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SPACE, TIME AND CAUSALITY IN MODERN PHYSICS AND ANCIENT INDIAN TRADITIONS

नासदासीन्नोसदासीत्तदानीं नासीद्रजो नो व्योमापरो यत्।
किमावरीवः कुहकस्यशर्मन्नंभः किमासीद्गहनं गभीरं ॥१॥
न मृत्युरासीदमृतं न तर्हि न रात्र्या। अह्न। आसीत्प्रकेतः।
आनीदवातं स्वधया तदेकं तस्माद्धन्यन्नपरः किंञ्चनास ॥२॥

B V SREEKANTAN AND SISIR ROY

Space, Time and Causality in Modern Physics and Ancient Indian Traditions

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FOREWORD

The birth of quantum theory in the twentieth century raised many epistemological and ontological issues regarding various concepts prevalent during the Newtonian era. For example, the authors critically analyze the ontological issues related to concepts of space, time and causality in the context of modern physics and those discussed in ancient Indian traditions. The quantum theory and general theory of relativity have shed a new light on the origin of physical universe. They discuss the most popular idea among physicists that a substratum (all pervading) called quantum vacuum whose fluctuations due to Heisenberg Uncertainty principle, give rise to the physical universe. During the process of the evolution of this physical universe, characteristics of various types of fields like Gravitational field, Electromagnetic field etc are being manifested out of the potentialities hidden in this substratum. Metaphorically this is similar to manifestation of "Saguna Brahma" from "Nirguna Brahma". They raise many thought provoking issues in the context of all pervading substratum (quantum vacuum) in comparison to concepts "Akasha" and "prana" in Vedanta and also the concept of "spanda" in Kashmiri Shaivism. They explain that when prana hits akasha, all the physical attributes emerge, the spanda or vibration being responsible for "creation". The present authors, however, point out that in case of quantum vacuum in the context of space-time is an integral part while in case of akasha there is no concept of space-time as such. Other concepts in modern physics which seem to be divergent with respect to such concepts considered by various schools of Indian philosophy are critically analyzed in this book. Some seem to be convergent also.

Most attractive part of this book is not only the critical analysis by the authors but also the presentation of a dialogue among the traditional Indian scholars from various Indian philosophical schools like Vedanta, Yoga, Buddhist, Kashmiri Shaivism and Jaina Philosophy and physicists on some of these issues. This dialog was part of an International Conference held in December 2015 at NIAS with patronization of TATA Trust. This book will inspire young minds in India and all over the world to look back into the rich heritage and contributions of India in domains of science. The reproduction of the enchanting discussions on the issue of reality, between great minds like Tagore and Einstein in the annexure projects a new perspective. Some important statements by eminent scientists and scholars add new dimension to the book. It is important for us to realize that science is never done and beyond quantum mechanism, synthetic biology etc., these are many windows and pathways yet to be discovered, experienced and harnessed in our quest of knowledge and applications.

One aspect that needs to be pointed out is the amazing power of the new instruments of the 20^{th} century that has added wealth of information on the universe. The methodology used by scientists is different from that used by wise spiritually inspired people in ancient India for

getting those concepts and forming a framework. Science is largely based on Empiricism which is different from Introspection though it is hard to deny the existence of sense data from outside world in the case of introspection also. Further coordination of the two methodologies, may help the present day scientists to have the benefits of insights from Ancient Indian wisdom. I am of the conviction that empiricism and introspection in synergy can be a pathway to find solutions to many a challenges facing the human kind and indeed earth ecosystems in our times. The challenges are unique with respect to opportunities and changes and it can be argued that solutions shall be based on paradigm changes. It is generally argued by some that no practical advantage can spring from studying the ancient wisdom. Series of arguments are put forward in the context of Greek traditions almost a century before by Schrödinger, which appear relevant to the present context of ancient Indian wisdom which at least appears to be two thousand years in age.

Most notable paragraphs on this debate end with: *Nearly our entire intellectual education originates from the Greeks. A thorough knowledge of these origins is the indispensible prerequisite for freeing ourselves from their overwhelming influence. To ignore the past is here not merely undesirable, but simply impossible.*

The book provides us a framework to think current and also differently like ancients with arguably a purpose to give closer and meaningful engagement of mind to think and act.

(Late)Prof. Baldev Raj
Former Director, National Institute of Advanced Studies, Bangalore

PREFACE

We, the authors of this book , one an experimental physicist and the other a theoretical physicist both interested in philosophy for a number of years, have explored all the information that is available on THE UNIVERSE in all its glory and in its nakedness, in its contents, structure, association with space and time , its birth and evolution , modality of emergence of matter in all its diversity, of variety of radiation , of unusual mind boggling phenomena like explosion of stars near and far., all this from the point of view of knowing what the ultimate reality, the basic fundamental substratum, behind this wonder of largest creation is ? : When was it created? and how and who created it? Of course We have not dared to ask Why?

In our efforts to unravel this mystery, we have adopted two different approaches. One is "Empiricism" which over a period of time has become the standarid and accepted method of science and the other is "Introspection" which was the method adopted by our ancients thousands of years ago - - sit and meditate registering in memory all the information gathered by their senses and processed by their mind after consultation and discussion with their peers and absorbing the esoteric inputs from the scriptures triggering their intuitions.

Immediately, the question naturally arises whether in the 21st. century with so much of information gathered with the help of sophisticated instruments like various type of telescopes and various particle detectors pointing to necessity of categorizing the vast universe into three classifications micro, macro and mega, not only in terms of size but more importantly in terms of variety and complexities as a function of time :

DOES IT MAKE SENSE TO RESORT TO ANCIENT METHODS FOR RESOLVING ANY ISSUES AT ALL ?

It is very difficult to answer this question in a straight forward manner. However, we wish to emphasize that there are some important issues in modern physics debated for more than a century now, that have also been discussed many centuries earlier by ancient Indian philosophers who followed the different methodology. We make an attempt in this book to find how far the two are convergent or parallel or are they completely contradictory.

Some of these debated issues in modern physics are discussed in Chapter II. A dialogue among eminent traditional scholars from various schools of Indian Philosophy and Physicists was arranged in a symposium on December 12, 2015 at NIAS to discuss the above mentioned issues of modern physics from different Indian philosophical perspectives. This dialogue forms the Appendix I.

It is worth mentioning that great minds like Schrodinger and Linde discussed the relevance of discussing the issues of modern science in the light of ancient wisdom – of course in their case , from Greek thoughts. We have presented the short related articles by Schroedinger in Appendix VI and by Linde in Appendix VII.. A large number of quotations relavant to the topics under discussion in this book from eminent Scientists and scholars from different countries specialized

in different disciplines are given in the Appendix IV..The conversation between the two Nobel Laureates Einstein and Rabindranath Tagore (Appendix II) is especially enlightening and provides the proper perspective for going through the various chapters of this book.All this clearly demonstrates that it is very essential to have a very open mind before drawing conclusions on the complementarity or diversity of the two methodologies.

In chapter III , entitled "Reality in Modern Physics", we show how some of the concepts like space, time, matter, energy, cause and effect, start off as intuitive ,innate concepts in our everyday life and with precise definition and quantification were rendered suitable for measurement and became classical concepts in science and enabled mathematical formulations and quantitative predictions and experimental verification. These concepts became Universal and played an important role in the advancement of science till the end of the 19th century. They were crucial concepts in the developments of fields like Dynamics, Acoustics, Electricity, Magnetism, Optics, Electromagnetism etc. However, with several new discoveries in the early part of the 20th.century ,with the advent of quantum theory and relativity for the explanation of the new observational results it became necessary to transform many of these basic concepts in a radical way. Some aspects of this transformation and their influence on the issues related to reality in physics in the three domains micro, macro and mega referred to above are discussed. The Big Bang Theory of creation and its relation to the newly discovered Dark Energy which overwhelms the possible true content of the energy of the Universe is also discussed. All this seems to point to the possibility that ultimate reality behind the universe is "Quantum Vacuum".

In chapter IV, under the title "Indian Philosophical Traditions", we give some more clarification on the Ancient Indian Standpoints on the issues discussed as part of the Panel Discussion presented in Annexure In the Indian philosophical tradition too, there are two categories: The Astika (Belief in God) and the other Nastika (No belief in God). We present the subtle but firm distinction between these different categories from the point of ultimate reality. The doyen and champion of the Advaita philosophy, Shankaracharya, while declaring that Reality = Brahman = Atman = Consciousness = I am Bramman= Everything , affirms that this is true only for the realized souls (transcended Maya),but for the ordinary man (who is immersed in Maya) shankara emphasizes "The world is real the way we experience it and God is the "Creator"" thus making a clear distinction between Normal and Transcendental points of view regarding ultimate reality .We present these different aspects from the Buddhist and Jain points of view also.

B V Sreekantan and Sisir Roy

Acknowledgements:

The authors are grateful to the (Late) Professor Baldev Raj Director of NIAS for his interest and appreciative support for this work and also for providing an appropriate Foreword for the book. It is heartening that the present Director Prof. Shailesh Nayak has continued similar support for this area of research.

The theme and contents of this book were inspired from a Dialogue on "*Modern Physics and Ancient Insightts on Reality –A dialogue across Traditions*" that was part of an International Conference on "*Consciousness, Cognition and Culture*" held at NIAS during December 2015. We would like to acknowledge the scholarly contributions from the panelists of the Dialogue The International conference was organized by the Consciousness Studies Group of NIAS under the leadership of Professor Sangeetha Menon. We are indebted to her for this lovely conference. We would like to thank Ms V B Mariyammal for undertaking the arduous task of typing and formatting the manuscript.

Chapter 1 Introduction

> *"I did feel a little uneasy, particularly since those lectures arose from my official duty as a professor of theoretical physics. ... need to explain (though I was myself not so thoroughly convinced of it) that in passing the time with narratives about Greek thinkers and with comments on their views I was not just following a recently acquired hobby of mine..... it was justified by the hope of some gain in understanding modern science and thus inter alia also modern physics".* *Heisenberg*

He emphasized that the endeavors of both scientists and metaphysicians to secure insight referred to the same object i.e. man and his world.

It is important to note that the methodologies followed by science and those followed by the ancients are radically different. Due to technological developments the scientists started to use more and more sophisticated instruments to probe the matter from larger scale to smaller and smaller scale and to happenings in more and more minute intervals of time. It is essentially a reductionist approach trying to understand the whole cosmos considering the smallest entities as building blocks. They have reached the ultimate reality called "Quantum Vacuum" necessarily endowed with "fluctuations" from which the whole universe was generated. This fluctuation is subject to Heisenberg uncertainty principle and operates over all space and time. According to the uncertainty relation between time and energy, enormous fluctuations of energy during very short duration of time can happen. Thus the universe manifests with all its attributes from quantum vacuum endowed with potentialities only. These potentialities through fluctuations lead to gross form of energies.

The oldest system among various schools of Indian Philosophy is generally acknowledged to be Samkhya [4] (enumeration or category) which consists of theoretical analysis that enumerates or categorizes the structure of reality. Infact, *Samkhya enumerates the component principles that make up the universe from "inside out" and from "subtle to gross". In a view it is rather similar to that of modern physics. Samkhya notes that reality involves a wide continuum of experience from subtle to gross, from invisible to visible, from unmanifest to manifest.*

On the other hand Sankara's Advaita system holds to a single innate reality (Brahman = consciousness = Everything) and Samkhya proposes dualism i.e. purusa (consciousness itself) and prakriti (material reality). These are essentially two innate and independent realities in Samkhya which should not be confused with the traditional western distinction of body and soul.

The concept of quantum vacuum as ultimate reality is different from the substratum "Akasha" in Vedanta. Since the quantum fields are present in Quantum vacuum, the very concept of space-time is valid in Quantum vacuum where as "Akasha" is to be considered as substratum of modern Space-time.

According to Vedanta (also Yoga) as soon as "prana" hits "Akasa", creation starts. Clearly much care is needed to compare the ultimate reality in modern physics with that in ancient Indian wisdom since in physics it is due to spontaneous fluctuation. Modern physics delineates many layers of reality from gross material objects (like everyday objects) to subtle objects like atoms, electrons, protons, neutrons ,leptons quarks and finally quantum fields. The importance of invisible components of matter like "virtual particles" is fundamental in physics since these entities exert influence on matter itself. Even the hitherto unidentified component of matter called " Dark Matter" [5] (which is though unidentified yet) plays an important role in modern cosmology.

The manifestation of the physical universe from the fluctuations of Quantum vacuum occurs without considering any other (other than quantum fluctuation) external agent or condition. It seems Quantum vacuum is a self-referential and self-organizing system. This immediately raises the question of the validity of principle of causality in modern physics since there is no separate cause and effect in occurrence of the fluctuation of vacuum. However, the principle of causality is considered to be the pillar of modern science!

Here, the insight from ancient wisdom may be helpful for a comprehensive view on causality and modern physics. It is generally considered that there exist four basic pre-Buddhist causal theories. They belong to both Vedic and non-Vedic traditions. They are classified as:

- **Self-causation**
  The basic assumption of this metaphysical postulate was that the cause and the effect are identical.

- **External causation**
  Which includes several theories
  - *Time (kala).*
  - *Creation by God (Isvarakrtaka).*
  - *Inherent nature (svabhava).*
  - *Action or behavior {karma).*
  - *Fate {niyati).*

- **Internal as well as external causation**
  This is the combination of first two theories.

- **Neither internal nor external causation**
  It denies any form of causation; only indeterminacy.

It is evident from the above four type of causal theories, the fluctuations of quantum vacuum belongs to the school of self-causation.

Again the principle of causality in microscopic domain needs a special attention. The statistical correlation is not always the causal relation. For example, in case of Einstein-Podolsky-Rosen arguments, though the two microscopic entities like electrons are correlated in entangled state, this correlation or relation is not causal. Scientists call it nonlocal correlation. This reminds us about the longstanding philosophical debate regarding the reality of relation as propounded by famous Buddhist scholar Dharmakirti and subsequently debated by many non-Buddhist Indian scholars.

Scientists discover the existence of the subtle matters like quarks using more and more sophisticated observational techniques. On the other hand the ancient Indian philosophers based their conclusions mainly on experience and perhaps in some cases on sensory data too. In science we use the methodology which we call "Empiricism" whereas ancient seers used what we call "Introspection". Now let us discuss the issues of Empiricism and Introspection.

According to Encyclopaedia Britannica :
empiricism in philosophy, the view that all concepts originate in experience, that all concepts are about or applicable to things that can be experienced, or that all rationally acceptable beliefs or propositions are justifiable or knowable only through experience. This broad definition accords with the derivation of the term empiricism from the ancient Greek word emperia, "experience".
Empiricism emphasizes the role of empirical evidence in the formation of ideas, over the notions of innate ideas or traditions.

What is Introspection? According to Stanford Encyclopaedia of Philosophy :
Introspection, as the term is used in contemporary philosophy of mind, is a means of learning about one's own currently ongoing, or perhaps very recently past, mental states or processes..... Introspection is a key concept in epistemology, since introspective knowledge is often thought to be particularly secure, maybe even immune to skeptical doubt.

Two kinds of experiences are generally considered: external (extraspection) and internal (introspection). The first one is considered to be uncertain, at best probable and the second is

completely certain. It essentially captures the Cartesian epistemology of experience. According to Hume's epistemology:
all experience- whether extraspective or introspective – based on sense data, which are the atoms of the mind. Sense data represent particular simple features of the world. Various mental procedures lead to the creation of even more complex ideas.

Debating the issue whether introspection is related to sense data or not, Adam Wiegner [6] an eminent Scholar of Polish Brand of Analytical Philosophy introduced new ideas regarding this issue:

- *introspection is the result of the interpretation of extraspection,*
- *all experience is subject to theoretical interpretation.*

Weigner's thesis on introspective data remains to this day an original way of going beyond the empiricist model of knowledge.

The issue on reality has been extensively discussed in Modern physics especially after the birth of quantum theory based on empirical knowledge. Various schools of Indian philosophy debated on the issue of reality for many centuries. We begin this book with elaborate discussion on reality and its various layers in modern physics. This is discussed in chapter II. The technological developments helped the scientists to understand the ontological issues in modern physics. The issues are not yet fully resolved. In this chapter we discuss the various layers of reality from empirical observations and the current status of standard theory of subtle entities. This helps us to discuss the epistemological issues associated to some of the unresolved issues related to various concepts like space, time, causality etc. in modern physics. It is discussed in Chapter III.
Here, an attempt has been made to critically analyze the claims of convergence between various concepts in modern physics and those discussed in our age old Indian traditions. We have identified several pertinent concepts that are relevant to this comparison in modern physics. We emphasize that our aim is not to discover the findings of modern physics in Vedanta or to show how modern physics can also be claimed as "spiritual".
The relevant unsolved issues and associated epistemological problems as discussed in Chapter III are discussed in Chapter IV in the context of various Indian philosophical schools. For example, the concept of quantum vacuum in modern cosmology and its ontological status is discussed in comparison to the concept of "Akasa" in Vedanta. The concept of quantum entanglement is shown to be a relation which is real in contrast to the unreality of relation by eminent Buddhist scholar Dharamakirti in his book "Sambandhapariksha". However, many other non-Buddhist Indian scholars like Bhartrahari, Utpaladeva and Pravacandra et al considered relation as real.

Some important remarks have been made on the methodology used in science in comparison to that in ancient Indian philosophical traditions. These are mentioned in the Chapter V.

It is worth mentioning that this book contains several appendices which are very important to the community both from science as well as from philosophy. The exchange of ideas in the form of dialogue in the spirit of ancient Indian philosophical schools which was arranged in National Institute of Advanced Studies , Bengaluru (in 2015) is put the appendix I. The historical dialogue on the issue of reality between great Indian poet Rabindranath Tagore and famous scientist Albert Einstein is reprinted in the appendix II. The idea of creation which is much relevant to modern cosmology was discussed by Indian sages many centuries before especially in the Hymns of Rgveda (known as Nasadiyasukta) is put in the appendix V. In essence, in this book we have discussed various concepts from Modern Physics from empiricist point of view and compared similar concepts from ancient Indian philosophy which are mainly based on introspective data.

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Chapter II: Reality in Modern Physics

Abstract

In this chapter, we briefly discuss how the crucial concepts like space, time, matter, energy, causality which evolved during the last four hundred years after the advent of modern physics in the 17th century. The experimental discoveries and the required theoretical formulations have led to a drastic transformation of these concepts particularly after the recognition with the new sophisticated instruments microscopes, telescopes, accelerators that the universe has three domains, the micro, macro and the middle and these concepts have to fit into the explanation of happenings in all the three domains. The Big Bang Theory of Creation triggered by the discovery of the expanding, accelerating universe and which needs for explanation findings in General Theory of Relativity, the creation of particle and anti-particles discovered in high energy physics experiments, the Dark Energy and Dark matter overwhelming the contents of the universe, in comparison to baryonic matter that has been discovered earlier have all been explained. How all this leads to one strong but, tentative conclusion that the ultimate reality is most likely the "quantum vacuum" which is a combination of various energy fields, endowed with specific properties.

Keywords: space, time, causality, Big Bang theory, General Theory of Relativity, Dark Energy, Dark matter

The scientific methodology is defined by the sequence: Observation/Experimentation followed by theoretical and mathematical formulation. This theoretical formulation is considered to be a viable physical theory if it has a predictability which can be verified by laboratory experiments. It has its origin around the beginning of the 17th century when the founders of modern science Des Cartes, Galileo, Kepler, Newton appeared on the scene in successive periods and tried to explain systematically various natural phenomena both qualitatively and quantitatively. The concepts of space, time, matter, motion causality, force, energy etc., were borrowed from everyday experience. The ideas of units and quantitative measurements had to be introduced. Most importantly, accurate measuring instruments had to be designed and constructed. The symbiosis of theory and experiment over the next three hundred years resulted in a satisfactory explanation of a variety of natural phenomena observed on the Earth and in the Sky. These phenomena got classified technically under the scientific disciplines: Dynamics, Heat, Light, Electricity and Magnetism, Astronomy, Acoustics. A variety of instruments were developed which led to discovery of new phenomena beyond what could be observed with the human sensors like the eye, ear etc. The simple experiments of Faraday, Oersted, in electricity and magnetism led to the formulation of the theory of Electromagnetic waves by Maxwell [1]. This entirely new unknown phenomenon was experimentally produced in the laboratory by Hertz [2].

The developments of this period established the supremacy of the scientific methodology in understanding the happenings in the external world and also in the development of wide variety of technologies that contributed to better living conditions to humanity. Newtonian Dynamics, Thermodynamics, Statistical mechanics, Electro-magnetic theory and Optics and Spectroscopy were the highlights of this period which came to be known as the Classical Physics period. Parallel developments in chemistry revealed that that all the matter in the world is made up of singly or in combination of some ninety two elements Hydrogen to Uranium. Spectroscopic measurements had revealed that each element had its own characteristic spectral lines. However there was no satisfactory explanation for the emission of spectral lines. Also the theory of the spectral distribution of black body radiation had indicated what came to be known as "ultraviolet catastrophe", which implied that the energy distribution as a function of wave length would increase at shorter and shorter wave lengths of radiation. Experiments had revealed that this was not so. Also in the last decade of the 19th century three major discoveries were made which could not be explained in the classical framework; discovery of Radioactivity, of X-Rays and the Electron.

It is worth mentioning that space,and time are considered to be independent of eachother in Newtonian paradigm. The Newtonian equation is a deterministic equation in the sense that if one knows the initial values precisely then the future behavior can be .determined with infinite precision. For example, if the position or velocity of a particle be known, then it is possible to determine the position and velocity at a later time. This modality of determinism and cause and effect relationship prevailed in the scientific arena for a long period. The development of modern physics i.e., advent of relativity and quantum theory shattered the idea of determinism and modified concepts of space, time and causality

One of the important results of Maxwell's electromagnetic theory was that the calculated value of the velocity of the electromagnetic wave is the same as the experimentally determined value of the velocity of light. This fact alone led to a bold assumption by Maxwell that light is an electromagnetic wave. Another interesting result pertaining to light discovered by Michelson and Morley [3] was that the velocity of light is independent of the motion of the observer or of the source of radiation. This observation contradicted the famous law of addition of velocities according to Newtonian dynamics. Einstein[4] resolved this dilemma in his newly introduced Special Theory of Relativity in 1905. In introducing special theory of relativity Einstein had to transform our conventional notions of space, time and also the concept of simultaneity in contrast to the classical Newtonian ideas which were completely in conformity with our normal everyday ideas. This is because according to the special theory there is no absolute frame of reference in which absolute space and time intervals can be defined. However there is one parameter that is independent of the relative velocities and that is the speed of light "c" which has to be regarded as a Universal constant.

In the Special Theory of Relativity a four dimensional Space-time world is considered instead of three dimensional space and one dimensional time separately as was done in classical physics. In four-dimensional world of Einstein, the space and time are not considered separately but they belong to same class (a category). The point in this four-dimensional world is identified with an event. In 1911 Einstein discovered General Theory of Relativity where the role of space-time raises lot of debate regarding the ontology of space time. Before Einstein scientists thought that space time or geometry was an abstract concept and directly not related to any physical phenomena. Various types of geometry were introduced by mathematicians .Einstein introduced the curved geometry (Riemannian geometry) to understand the physical phenomena like gravity. Here the characteristics of gravitational field is associated to the properties of geometry of space time. The geometry is considered to be non-Euclidean and the curvature gives rise to gravitational effects in the three dimensional space where all effects are observed.. This immediately raises debate regarding the ontology of space-time. In fact, the three main views on the nature of space and time are :

i. The container view
ii. The prime stuff
iii. The relational view

This has been discussed in details by one of the present authors (SR)[5] in one of his books. The birth of quantum theory raised lot of epistemological issues among the scientists and philosophers. The indeterminism associated with Heisenberg uncertainty relation leads us to a rethink about the principle of causality in microscopic domain. However, the Schrödinger equation which describes the behavior of microscopic objects is fully deterministic equation. If one fixes the wave function, associated to microscopic entity at initial time, then the wave function can be determined at any future time. So this is no problem in understanding the principle of causality. However, as soon as one wants to measure particular attributes the wave function collapses. The process of measurement creates probabilistic aspect and the collapse of the wave function is a causal and asymmetric process. The concept of indeterminism and probabilistic aspect in the microscopic domain has been debated for several decades.

Matter and Radiation in the Universe:

One of the most important constituent of the universe is "matter" which exists in three forms solid, liquid and gas. By the end of the 19th century, the chemists had established that all matter on earth consists singly or in combination of 92 elements, Hydrogen to Uranium. Spectroscopic analysis of the light from the stars had shown that the same elements were there in stars also. Only the relative proportions of the elements were different. The sun was predominantly rich in

hydrogen. The alpha particle scattering experiments of Rutherford early in the 20th century established that each atom had a central core (called later the nucleus) and after the discovery of the protons and neutrons it became clear that all the elements were constituted at the atomic level of just protons and neutrons and the difference between one element and another was just in the total number of protons and neutrons. The positive charge of the nucleus was compensated by the number of negatively charged electrons surrounding the nucleus. Bohr in his Quantum theory of the atom postulated that the electrons are revolving in quantized orbits around the nucleus and the number of electrons in the orbits is determined by the Pauli's exclusion principle. Bohr made the further assumption that the energy levels of the orbits are quantized and when an electron jumps from a higher orbit to a lower orbit with a vacancy, a photon of energy equivalent to the difference in the energy levels of the two obits was radiated. This mechanism accounted for the discreteness of the spectral lines and also led to the characteristic identity of the elements. This leads to the determination of the velocity of recession of the stars with respect to the earth, which in turn enabled the determination of the distance of the stars and other celestial objects.

The 20th century advances in particle physics have led to the idea that the protons and neutrons themselves are constituted of fractionally charged particles called "quarks". The proton is made of three quarks and the neutron of three different quarks. The Fermions and Bosons consist of various types of quarks as depicted in Fig. 1. The universe is also filled with small quantities of matter thrown out from the stars during explosions distributed all over space and also antimatter and cosmic ray nuclei. All these are also constituted of quarks. However a big surprise was in store in the mid-20th century when the necessity of postulating the existence of vast quantity of matter called "dark matter" [6] had to be postulated to account for the stability of galactic clusters. The identity of this matter is not known. What is known is that this matter is not the same baryonic matter that we are familiar with on the earth and in the stars. What is surprising is that dark matter overwhelms the quantity of normal matter by a factor of 5.

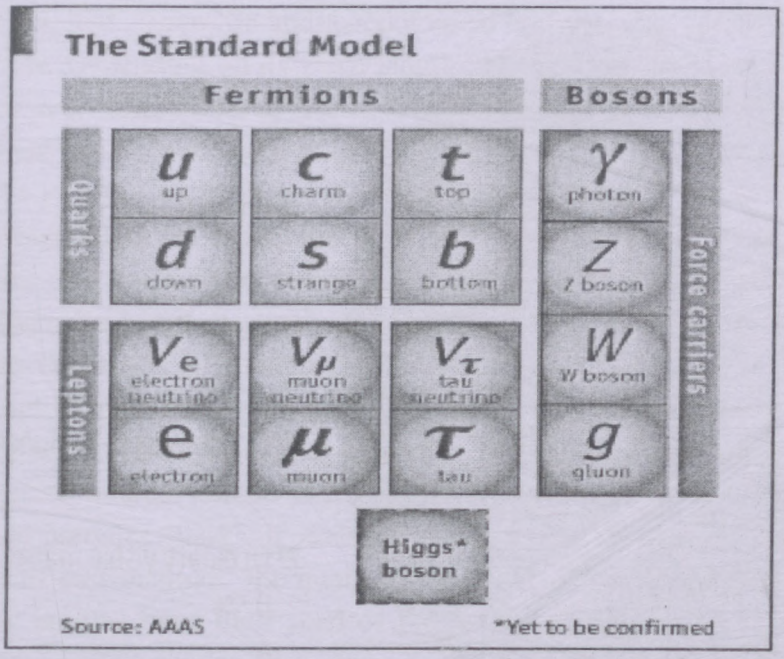

Figure 1

In addition to matter, the universe is filled also with radiations of various kinds: microwaves, radio-waves in other bands, (optical, infrared, ultraviolet, X-rays, Gamma rays, cosmic rays, neutrinos produced and thrown out into interstellar and intergalactic space by stars, neutron stars, black holes which are the seat of many types of high energy phenomena. While all this adds to the mass and energy of the universe, what is new and unexplained so far is the discovery in the last decade of the 20th century of Dark Energy" [7] which constitutes 95% of the total energy of the universe. These are diagrammatically shown in Figure 2 .The nature of this dark energy is still not known. An interesting feature of this energy is that it is gravitationally repelling thus causing the universe to expand more rapidly than

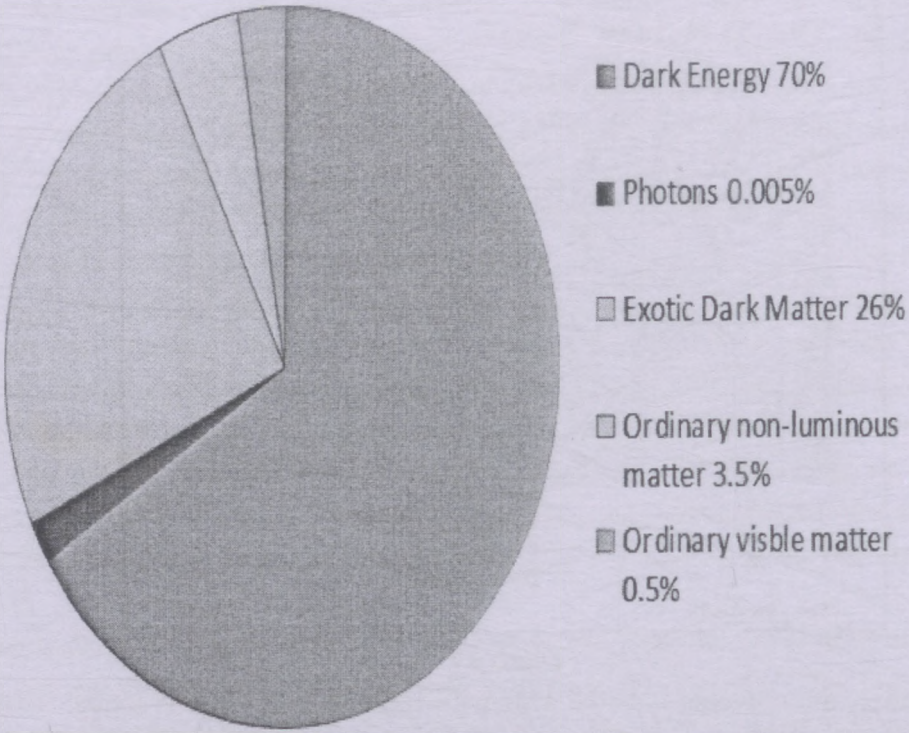

Figure2. Composition of the universe: Visible and invisible (2005). Dark Energy: ~2/3 of universe; Gravitationally repulsive; No one knows what it is made of. First Evidence : 1998- Supernovae observations; 2002 – Survey of 250,000 galaxies gravitational Lensing. Hubble Telescope, Wilkinson Microwave Background Anisotropy (WMAP); Sloan Digital sky Survey (SDSS)

Forces and Force Fields:

Newton introduced the idea of gravitational force acting between two masses, whose strength he defined as the product of the two masses divided by the square of the distance between them. The value of the proportionality constant G was later experimentally determined. Newton had no idea how this force was generated or how it was transmitted between the two masses. Faraday's experiment on magnetic induction and Oersted's experiment with an electric current led to the idea of electric and magnetic fields and led Maxwell to formulate his famous Electromagnetic field equations which was a major breakthrough in connecting electricity and magnetism and to the possibility of generating electromagnetic waves in the laboratory.

Maxwell's calculation of the velocity of the electromagnetic wave gave the surprising result that the value was the same as the velocity of light. This led Maxwell to make the bold assumption that light was an electromagnetic wave. Hertz [2] succeeded in producing electromagnetic waves in the laboratory around 1885. Since then the concept of electromagnetic wave has been one of the widely adopted concepts for explanation of a wide variety of physical phenomena and also

one of the vastly exploited scientific and technological tool for wide variety of research and for commercial purposes. Depending on its wave length, the electromagnetic wave can manifest as radio wave, microwave, infrared wave (heat), Optical wave (light), ultraviolet, x-ray, Gamma ray. Each one of these has its own realm of utility.

According to current ideas in quantum mechanics corresponding to every particle like the Electron, Proton etc., there is a wave present in all space and time. The square of the amplitude of the intensity of the wave gives the probability of the particle being present there. The subsequent developments of quantum theory lead us to abandon the idea of wave and particle. The concept of quantum field was introduced where there exists the concept of quanta of field. For example, the photon is considered to be quanta of electromagnetic field. Essentially we are having a description of various fields and their quanta. The fields corresponding to the various fundamental particles quarks, leptons etc, and the fields corresponding to all the bosons that have been identified constitute "the quantum mechanical vacuum". The observed properties of such elementary entities have their seed or potential in these vacuum fields. Quark-quark forces (strong force) inside particles like protons are mediated by particles called gluons, the weak forces responsible for spontaneous decay of particles like Pions, K-mesons etc are the vector bosons (W^+, W^-, W^0). The electromagnetic force is mediated by photons and the gravitational force by gravitons. There is yet another field called the Higgs field (the Higgs boson was discovered at the LHC Accelerator at CERN recently) which as we shall see later on is one of the first fields to be created immediately after the Big Bang explosion that started the creation of the universe.

The mass of every fundamental particle like quark arises from the interaction between the quark field and the Higgs field. Evidently the mass of the quark depends on the coupling constant between the quark field and the Higgs field and the value of this must be hidden in the vacuum field of the quark in some unknown form. It is interesting and important to point out here that when we just add the masses of the three quarks that constitute the Proton we do not get the value of the mass of the Proton. The rather large contributions of the relativistic mass due to the motion of the quarks and gluons have to be necessarily taken into account. The importance of Einstein's special relativity to particle physics is evident from this. One has still to account for origin of the other so called intrinsic properties of the particles namely electric charge, spin, parity etc., which need to be explained in this new approach of Vacuum Quantum Field theory. Some theorists have expressed the view that these properties are manifestations of the geometrical properties of space-time in higher dimensions. We are unable to design experiments in higher dimensions and have no direct access to what is happening in higher dimensions.

The question arises how and when all these fields come into existence and when all the constituents that we see as parts of the universe emerge? It is only in the 20th century that scientific answers to these questions were provided through the knowledge obtained in the fields of astronomy and high energy physics. The observations of the celestial objects with the 100" ad 200" telescopes at Mount Wilson and Mount Palomar in the early part of the 20th century by Hubble led to the discovery that what appeared to be patches of diffuse light with small telescopes were actually clusters of galaxies each with billions of stars and these clusters were moving away from each other. Further observations with spectroscopes revealed that the speed of recession increased as the distance between the galaxies increased. This result led Abbe Lemaitre to suggest that perhaps all the constituents of the universe were together at some time in the past and the universe might have arisen from the explosion of a single point. This remarkable event has come to be known as the Big Bang. The Big Bang scenario has been portrayed very beautifully as followed by John Bosllough [8] in his book "Mysteries of Time: Cosmology at the End of Innocence"

"Into the void so absolute as to mark any human concept of emptiness appeared a single point of raw potential and at the instant of creation. This point bearing all matter all dimension, all energy and all time, burst out spewing forth its contents. At the instant of origin all matter and all forces were indistinguishable from each other. As the universe expanded and cooled, matter and force split apart and then split again. Still in the first billionth of a second in its history, the universe continued to fragment. Soon all the constituents of matter-what we call quarks and leptons soon assumed separate identities, falling into separate classes that have been joined again. The single force propelling the cataclysm also became fragmented with new forces splitting away as quarks and leptons were formed, and the different particles became associated forever, with the new forces that were being created. Three of the fragmented forces are still at work inside the atoms. The most powerful of these is the strong force that binds the constituents of the nucleus together-the quarks that make the protons and the neutrons. One thousand times weaker is the electromagnetic force that keeps the electrons a type of leptons, orbiting around the nucleus. This force makes atom appear solid and is also responsible people for radio and light waves. Another hundred times less powerful: Is the weak force that causes radioactive decay by slowly breaking down neutrons in the atom in certain elements like Uranium, All forces are transmitted by Vector Bosons-force - carrying particles that exist for fraction of a second transmitting force in much the same way as energy would be transmitted between people in a rowing boat throwing a ball back and forth between them recoiling at each toss. Vector Bosons live just a fraction of a second while they impart the force. It is as if the ball between the boats disappeared after each catch. A vector boson called gluon is responsible for strong nuclear force and the photon a mass less particle for electromagnetism".

The Inflationary Phase of the Universe: the first moments of Creation:

The possible sequence of happenings associated with the Big Bang has been worked out by astrophysicists on the basis of developments in physics, astronomy and astrophysics in the 20th century as follows: The inflationary phase of the universe is depicted in Figure 3 and in various stages of the evaluation of the universe is shown in Figure 4.

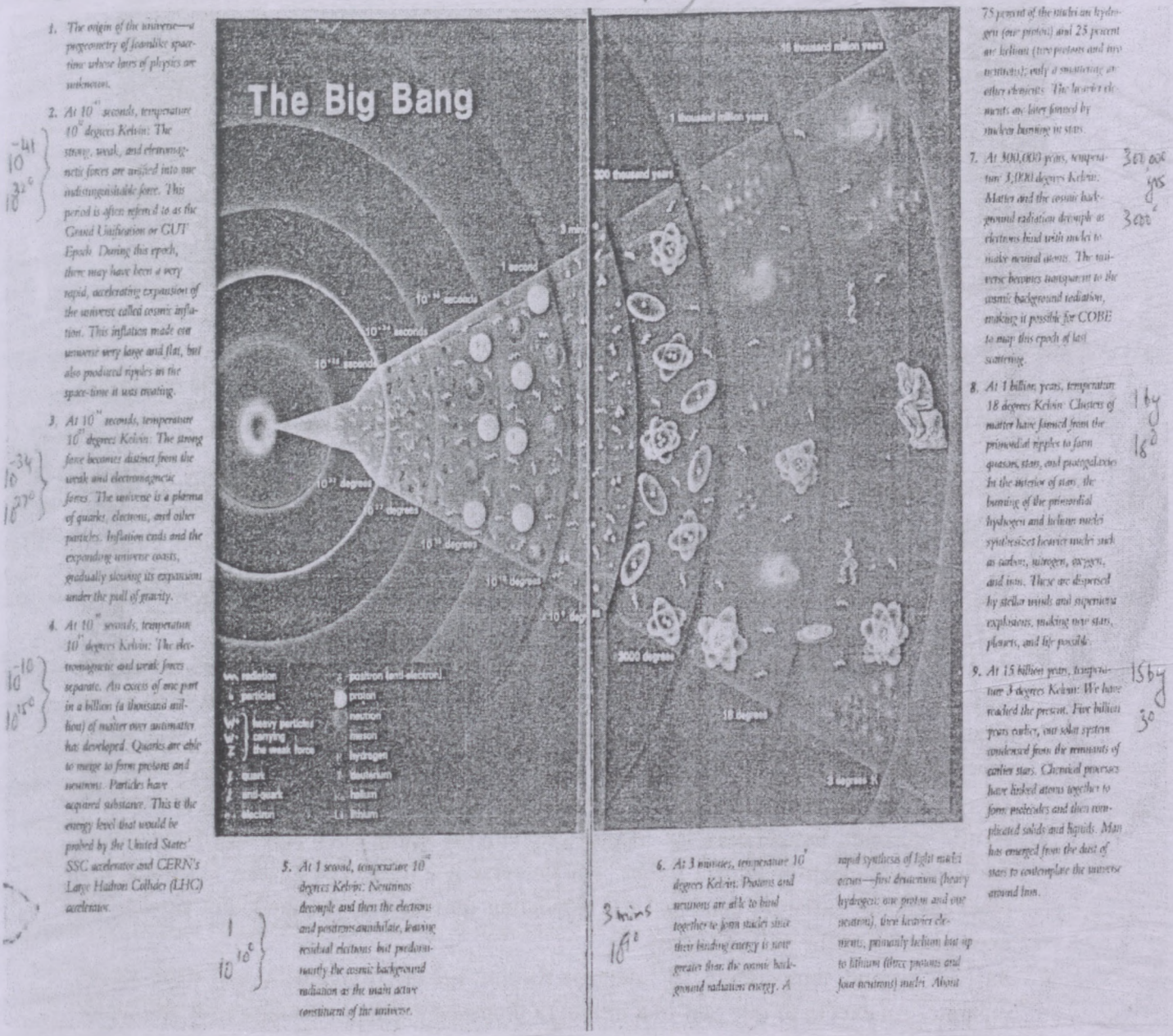

Figure3. http://www.universetoday.com/54756/what-is-the-big-bang-theory/. Big Bang to evolution of a pondering man – particle, chemical, biological evolution – over a period of 10-15 billion years (from Smoot and Davidson 1993)

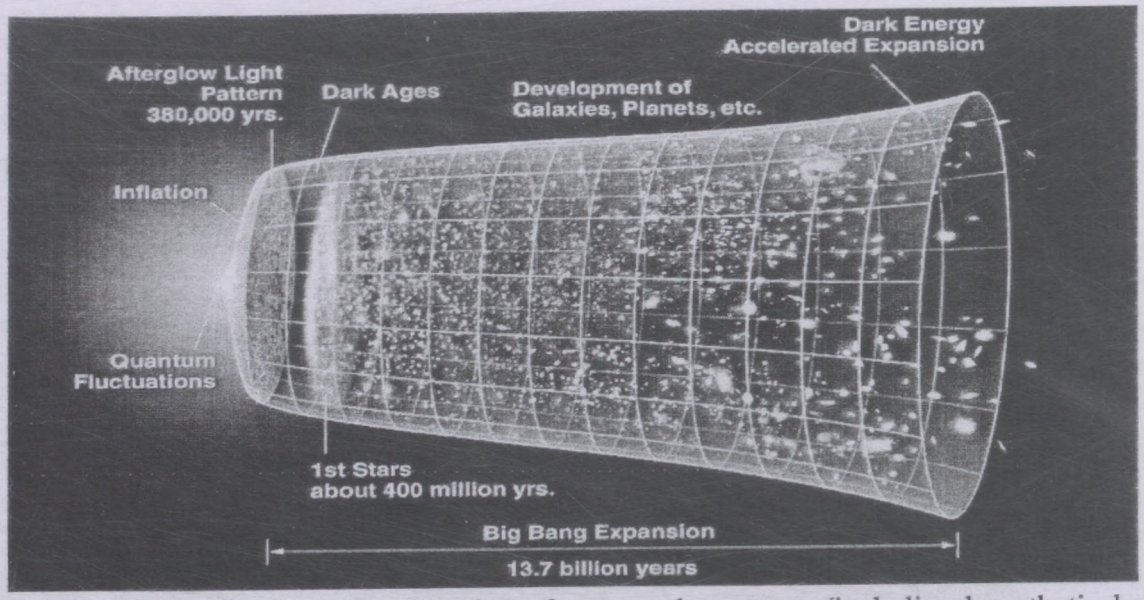

Figure 4. Timeline of the metric expansion of space, where space (including hypothetical non-observable portions of the universe) is represented at each time by the circular sections. On the left the dramatic expansion occurs in the inflationary epoch, and at the center the expansion accelerates (artist's concept; not to scale). https://en.wikipedia.org/wiki/Big_Bang.

The expanded version of the legends surrounding the figure which elaborate the physical aspect of the universe, are as follows :

1. The origin of the universe – a pregeometry of foam like space-time whose laws of physics are unknown.
2. At 10^{-43} seconds, temperature 10^{32} degrees Kelvin: the strong, weak, and electromagnetic forces are unified into one indistinguishable force. This period is often referred to as the Grand Unification or GUT epoch. During this epoch, there may have been a very rapid, accelerating expansion of the universe called cosmic inflation. This inflation made our universe very large and flat, but also produced ripples in the space-time it was creating.
3. At 10^{-34} seconds, temperature 10^{27} degrees Kelvin: the strong force becomes distinct from the weak and electromagnetic forces. The universe is a plasma of quarks, electrons, and other particles. Inflation ends and the expanding universe coasts, gradually slowing its expansion under the pull of gravity.
4. At 10^{-10} second, temperature 10^{15} degrees Kelvin: the electromagnetic and weak forces separate. An excess of one part in a billion (a thousand million) of matter over antimatter has developed. Quarks are able to merge to form protons and neutrons. Particles have acquired substance. This is the energy level that would be probed by the United States' SSC accelerator and CERN's Large Hardon Collider (LHC) accelerator.

5. At 1 second, temperature 10^{10} degrees Kelvin: Neutrinos decouple and then the electrons and positrons annihilate, leaving residual electrons but predominantly the cosmic background radiation as the main active constituent of the universe.
6. At 3 minutes, temperature 10^{9} degrees Kelvin: Protons and neutrons are able to bind together to form nuclei since their binding energy is now greater than the cosmic background radiation energy. A rapid synthesis of light nuclei occurs – first deuterium (heavy hydrogen: one proton and one neutron), then heavier elements, primarily helium but up to lithium (three protons and four neutrons) nuclei. About 75 percent of the nuclei are hydrogen (one proton) and 25 percent are helium (two protons and two neutrons): only a smattering are other elements. The heavier elements are later formed by nuclear burning in stars.
7. At 300,000 years, temperature 3,000 degrees Kelvin: Matter and the cosmic background radiation decouple as electrons bind with nuclei to make neutral atoms. The universe becomes transparent to the cosmic background radiation, making it possible for COBE to map this epoch of last scattering.
8. At 1 billion years, temperature 18 degrees Kelvin: Clusters of matter have formed from the primordial ripples to form quasars, stars, and protogalaxies, In the interior of stars, the burning of the primordial hydrogen and helium nuclei synthesizes heavier nuclei such as carbon, nitrogen, oxygen, and iron. These are dispersed by stellar winds and supernova explosions, making new stars, planets, and life possible.
9. At 15 billion years, temperature 3 degree Kelvin: We have reached the present. Five billion years earlier, our solar system condensed from the remnants of earlier stars. Chemical processes have linked atoms together to form molecules and then complicated solids and liquids. Man has emerged from the dust to stars of contemplate the universe around him.

It is evident from the above picture that the physical universe is manifested from the fluctuations of quantum vacuum. This quantum vacuum is a substratum with all kinds of potentialities for the manifestations of various characteristics of different forces like and weak field. Our previous discussions on quantum vacuum and concept of akasa in vedanta clearly indicate that these two substrata (ie., quantum vacuum in modern physics and akasa in Vedanta) are not the same. However, further research in this matter is necessary to get a comprehensive picture.

We have displayed in the chart on page (29) the connection and non-connection of different Indian philosophies? As can be seen, they can be classified under two categories: those dependent on the Vedas, the scriptures belonging to a period earlier than 1500 BC and those that do not owe allegiance to the Vedas. The Vedanta philosophy is directly based on the Upanishads which are the last parts of the Vedas. Buddha and Mahavira, the founders of Buddhism and Jainism belong to the period .600 BC which is also interestingly the period of Pythagoras, Lao Tse. Over the

hundreds of years that have passed, these original philosophical materials have been interpreted by many distinguished Scholars who have also engaged themselves in critique of the companion philosophies. Three eminent scholars Shankaracharya (788-820 AD) , Ramanujacharya (1017-1137AD) and Madhvacharya (1199-1278 AD) have interpreted the Upanishads and Brahma Sutrs and Bhagavad Gita and propounded three slightly different schools of Vedic philosophy known as. Advaita, Dvaita and Vishishtadvaita philosophies which differ from each other in respect of the relation between Brahman, Self and Reality. According to the Advaita philosophy of Shankara everything is Brahman .....Brahman, Soul and Reality are the same.

The Vishistadvata philosophy of Ramanuja , Brahman identified with God, Soul and the world are different but inseparable. There exists an underlying Oneness in these three real entities. Madhva expounded a theistic and dualistic interpretation of Vedantha. Around 800 AD another school of philosophy emerged in the region of Kashmir, known as Kashmiri shaivism which is in many respects similar to the Advata philosophy. Coming to more recent times, in the 19th and 20th centuries, with the advent of English language and becoming part of the Indian Educational system several interesting developments began to take place. Several scholars both from within India and also from abroad studied Indian philosophies and started writing articles and books in English .This helped in dissemination of the philosophies to a larger section of people with in the country and abroad. Prominent among the early writers is Max Muller a German who learnt Sanskrit. in Paris and migrated to England to translate the six volumes of Rigveda and few Upanishads that were in possession of the East India Company. It is said that Max Muller never visited India. Swami Vivekananda visited him in England when Max Muller was 73 years old and was so impressed with him that he has remarked " a soul that is everyday realizing it's Oneness with the universe." Another British Philologist Raphael Hurst (1898-1981) travelled extensively in. India , met several distinguished sanyasis like Ramana Maharshi, and wrote many books on several aspects of Indian Philosophy under the pen name Paul Brunton.

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Chapter III: Unresolved Issues Common to Physics and Philosophy

Abstract:

Over the past decades, following the revolutionary scientific contributions to the theory of Einstein's relativity and quantum physics many scholars both in India and outside have been inspired to seek parallels between world views of ancient philosophies like *Vedanta* and modern physics. Our aim is not to discover the findings of modern physics in Vedanta or to show how modern physics can also be claimed as "spiritual". On the contrary, an attempt has been made to critically analyze the claims of convergence between various concepts in modern physics and those discussed in our age old Indian traditions. We have identified several pertinent concepts that are relevant to this comparison in modern physics.

KEYWORDS: Quantum Vacuum, Modern Cosmology, Vedanta, Quantum Entanglement, Metaphysics of Relations, Buddhist View, Akasa. Ultimate Reality. Identity and Individuality, Quantum Fluctuations, Spanda.

We have identified some of the unresolved issues in modern physics. These issues are also discussed in various schools of Indian Philosophy as part of many conferences. We start with issue related to quantum vacuum.

Quantum Vacuum

Literally, "Vacuum" is simply defined as space devoid of any material entity and appears to be empty. However, the birth of Quantum theory and its extension as Quantum field theory (a theory of field like electromagnetic field is based on the principle of Quantum theory) and modern cosmology give rise to the introduction of a new concept of vacuum or substrate, known as "Quantum vacuum" [1,2,3] inherent with fluctuations.

Greeks called a vacuum by the adjective 'kenos', i.e., the "empty". The word originates from the Latin adjective *vacuus* for "vacant" or "void". Thus, vacuum is space, devoid of matter. According to Aristotle, *Nature abhors vacuum.* Early Greek speculations about vacuum in the works of Aristotle, Leucippus, Democritus and Epicurus are mainly concerned with the questions of ontological nature – something immutable on which the "world drama" is played and also actively participates in this universe? Since then, the concept of vacuum has attracted the

attention of large community of philosophers and scientists to study vacuum both as a theoretical concept and as an experimental entity. Newton identified vacuum more or less with absolute space, like a passive container in which bodies move with respect to each other. In various theories of nineteenth century physics, vacuum was considered to be just ether as an all pervading and subtle substance involved in transmission of light or electromagnetic waves. In the beginning of 20th century, experiments like those of Michelson-Morley [4] failed to detect the existence of ether. Based on this negative experimental result, Einstein formulated his Special Theory of Relativity [5] in 1905 ignoring the existence of ether. He assumed that light moves with a constant and maximum speed in vacuum (devoid of any matter or ether). So vacuum lost its substantiality. However, this is not the absolute space introduced by Newton. The formulation of General Theory of Relativity by Einstein in 1911, introduced the geometric interpretation of vacuum. Here, the gravitational field has been described in terms of the curvature in a four dimensional non-Euclidean geometry (Riemannian geometry), and vacuum got its ontological status closely connected to the gravitational field as proposed by Einstein.

In this picture, fields are considered as the internal characteristics of space-time which constitutes the physical vacuum. The introduction of quantum theory by Bohr and Einstein and the discovery of uncertainty relation by Heisenberg shed new light on the vacuum model. In quantum formalism, the energy of the zeroth state of a simple harmonic oscillator is shown to be non-zero. This zeroth state of the oscillator is known as the ground state. It has been explained by considering the Heisenberg uncertainty relation where the existence of fluctuations of zero-point energy in vacuum or empty space give rise to this non-zero value of the energy of the ground state. Now we have a model of physical vacuum or a substratum where there exists fluctuation of zero-point energy. The developments of quantum theory and its applications to various fields like electromagnetic field etc. led physicists to construct the model of vacuum called "Quantum Vacuum". Before going into the details of the structure of "Quantum Vacuum" let us classify the various models of vacuum in historical perspective based on Duquette [1] analysis:

1. *From Antiquity to Renaissance: a period of philosophical speculations about vacuum, concerned mainly with ontological arguments.*
2. *From Renaissance to 17th century: empirical evidence for the physical existence of vacuum and its integration in Galilean/Newtonian mechanics and Newton's Gravitation theory.*
3. *From 17th century to 1900s: reflections on vacuum as an "etheric" medium and rejection of ether theories with Einstein's Special Theory of Relativity (1905).*
4. *From 20th century onwards: formulation of General Theory of Relativity and Quantum physics (including Quantum Field Theory (QFT), in which the vacuum is endowed with some substantiality.*

5. *Modern Cosmology and Dark energy: concept of vacuum.*

The applications of quantum theory to classical electromagnetic fields led to the discovery of Quantum Field Theory (QFT) in late 1920. There exist several characteristics of fields (even for classical fields as described by Maxwell equations) which led to the introduction of field ontology instead of particle ontology. Field is an entity, continuous over whole space-time and has infinite degrees of freedom. It affirms the holistic nature of reality. First consistent framework of QFT was formulated in 1940-50 by three physicists Schwinger, Feynman and Tomonaga who shared Nobel Prize for this discovery. This theory is recognized as most successful fundamental theory of physics whose results have been verified in the laboratory experiments with very high degree of accuracy.

From the time of the inception of Quantum theory, the debate started among the pioneering personalities like, Schr□dinger, de Broglie, Heisenberg, Einstein, Bohr, Born and others regarding the dual wave or particle ontology. In quantum theory, a microscopic entity like electron or proton or photon behaves sometimes like a wave and sometimes like a particle and it has not been possible not to design a single experiment that demonstrates both the aspects particle and wave aspects simultaneously without any ambiguity. Schr□dinger and de Broglie had a more realistic interpretation of the wave function., Born is said to have been the advocate of particle ontology, Schr□dinger was considered to be a radical advocate of filed ontology:

"A realistic interpretation of the wave function usually implies a field ontology rather than a particle ontology. The field is distinct from the discrete, individual and impenetrable particle by its continuity, extension and the superimposability of its different portions. This is however true only of "classical" field ontologies (like Schr□dinger's) and not of quantum field ontologies in which the field displays some form of discreteness (Cao)". [6]

It is difficult to think of any kind of particle or wave ontology within the framework of non-relativistic quantum theory. Very recently, a new experiment has been performed where some authors [7] claim to detect both the particle and wave aspects in the same experiment. However, it needs to be repeated by others carefully before making any definite conclusion regarding the ontological status of quantum theory.

In regard to ontology of a physical theory, Cao [6], a philosopher of science defines it *as* "an irreducible conceptual element in the logical construction of reality [that] is concerned with a real existence, that is, with an autonomous existence without reference to anything external".

Within the framework of Cao [6], the quantum field is considered to be the best candidate for being the basic ontology of QFT [8]. In this framework, particles do not have eternal and independent existence but are epiphenomena of substantial quantum field. However, quantum filed ontology is different from classical field ontology. Within the framework of QFT, the

wavelike or field like and corpuscular aspects of radiation are considered as different manifestations of the same fundamental entity i.e. the quantum field.

By considering the field ontology within the framework of QFT, it helps us to conceive the nature of vacuum in a radically new manner. In Einstein's special theory of relativity, vacuum is considered as a state of nothingness with zero energy, zero charge, zero momentum etc. According to quantum theory, the vacuum has non-zero energy because of the existence of zero point fluctuations. However, within the framework of Quantum Field Theory, vacuum is a state though devoid of matter or radiation, yet full of fluctuations along with the imprints of attributes of various fields like electron field, photon field or Higgs Boson field. These attributes are charge, spin, polarizations, colour etc., and it is called Quantum vacuum.

Duquette [1] critically examined the convergence of ontological issues of QFT and Advaita Vedanta concepts such as "akasa", "Brahmana" and "avyakta". We examine these issues later in relation to the concept of "Alayavijnana" in Yogacara Buddhism. Before discussing the parallels, we will briefly discuss the emergence of the present universe and the role of quantum fluctuations in the substratum – quantum vacuum.

Modern Cosmology and Quantum Fluctuations:

In modern cosmology [9], the universe is assumed to emerge from the quantum fluctuations in the substratum. There exist concepts of "true" and "false" vacuums in modern cosmology. According to several scientists [10], the evolution of the universe started from a true vacuum with perfect symmetry which made a transition into our present vacuum state (called false vacuum) which may melt down again anytime. The release of energy due to breaking of symmetry may explain the origin of Big Bang . This is depicted in the following figure 5:

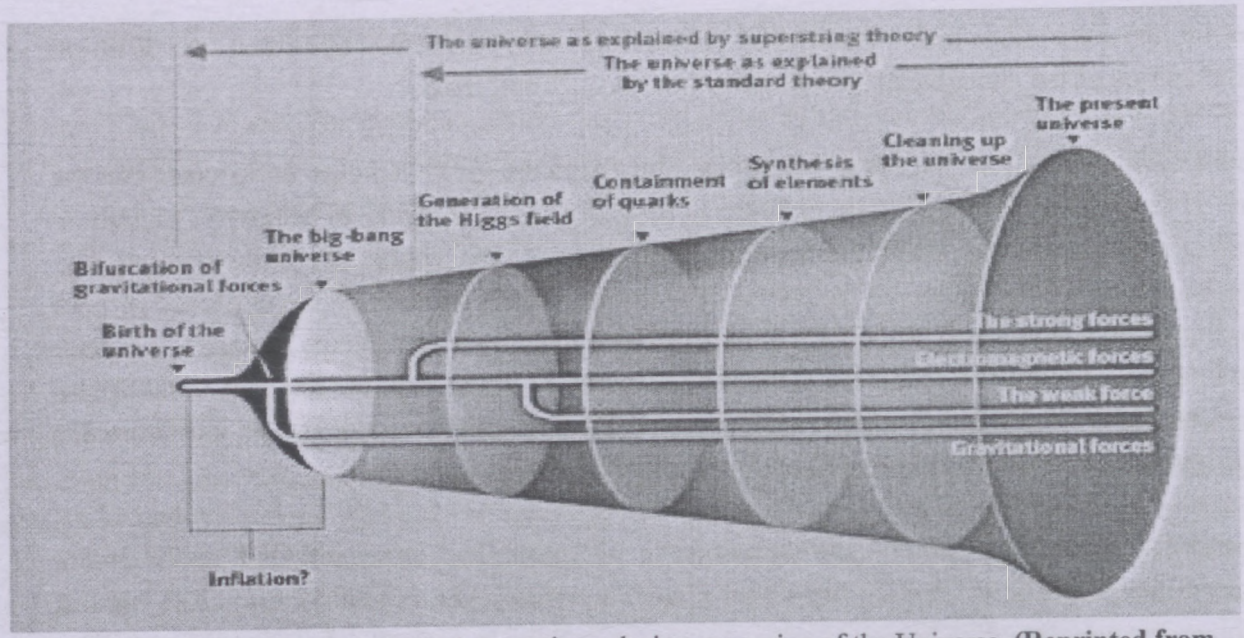

Figure 5. Vacuum has transformed many times during expansion of the Universe. **(Reprinted from Roman Pasechnik:** The Physical Vacuum: Where Particle Physics Meets Cosmology, Lund University).

The above picture clearly indicates that there is evolution of false vacuum. It raises the immediate question :*Is vacuum self tuning ?*
Extremely complicated structure of the Physical Vacuum exhibits intrinsic self-tuning properties for its parameters with very high degree of precision which gives rise to the structure formation in our Universe, and ultimately to the appearance of biological and intelligent systems (Anthropic Principle).
Genz [11] suggests,

"May be quantum mechanical fluctuations initiated not only the stuff our world was made of, prior to inflation but also space-time itself. Maybe the true vacuum, the true nothing, of philosophy and religion should be seen as a state wholly innocent of laws, space, and time. This state can be thought of as nothing but a collection of possibilities of what might be".

Identity and Individuality

The concepts of identity and individuality of objects have attracted lot of attention among physicists and philosophers in the twentieth century in the context of statistical distributions of counting of quantum entities like electrons, protons, neutrons etc in physical situations.

Identity and individuality have been discussed by philosophers for many centuries. It is generally considered that chairs, trees, rocks, people and many of the so-called 'everyday' objects we

encounter, can be regarded as individuals. The issue, then, is how this individuality is to be understood, or what constitutes the 'principle' of individuality. Leibniz states that no two distinct things exactly resemble each other. This is known as Leibniz law "The Identity of Indiscernible" which may mean that no two objects have exactly the same properties.

Recent work on the interpretation of quantum mechanics suggests that this principle of "Identity of Indiscernibles" fails in the quantum domain [17]. Let us try to elaborate first what is meant by identity and indistinguishability in the context of classical physics (for objects in everyday world or macroscopic world) as well as in quantum physics (for objects like electron, proton, photon etc. in microscopic world). By identity we mean a relation which exists between items, say "a" and "b", in a particular domain.

Now "item a" is said to be identical to "item b", symbolically written as 'a = b', which simply means that there are not two distinct items in reality , but only one, which may be named as either "a" or "b". Thus when we say "particles a and b" are identical, it implies that there are not two particles at all but only one.

By indistinguishability we mean a relation of identity which may exist between certain kinds of attributes of two or more individuals. In the context of physics, two or more particles are said to be indistinguishable if they share the same set of "intrinsic" "state-independent properties" such as 'rest mass", "charge", "spin" etc. Thus particles of the same species-- say having same charges (for example - electrons) are said to be indistinguishable. The conceptual distinction between individuality and distinguishability lies on the fact that the former relates to the individual taken on its own where as the latter concerns with the individual's relationship with others. From epistemological point of view, we become aware of something as an individual through distingushability. Ontologically, we go on to analyze that individuality either in the same terms or via some other conceptual principle. This is very well understood for macroscopic objects to which we have straightforward epistemic access. But it gives rise to the problems in case of microscopic objects like electrons, protons, photons etc. The simple reason is that the observable which we associate with everyday objects like chair, table etc or the epistemic grip to begin with for macroscopic objects posses a big challenge for microscopic objects.

Time, Causality and Consciousness:

The concept of time as discretized appears in physics, neuroscience and in certain schools of philosophy, although the atomicity of time is motivated differently. In our physical universe there exists the smallest duration of time and space called Planck time and Planck length, below which concepts of space, time and causality do not exist. The value of this smallest duration of

time depends on the values of the fundamental constants "c" the speed of the light, "G" gravitational constant and "h", Planck constant. They have fixed numerical values. At the level of Planck scale, space and time are discrete. One the other hand at the level of elementary entities like electrons, protons etc. as well as in our everyday life (called macroscopic level), space and time are continuous.

One of the challenging issues in the 21st century physics is how the continuum space time emerges from discrete structure. Again as time is discrete at the lowest level (Planck level), it raises serious issues related to the principle of causality i.e. cause and effect relationship below the Planck time limit.

In neuroscience, there exists "quanta of time" or "shortest time duration". Gamma oscillation (40--100) Hz is found to be dominant in wakeful as well in REM sleep states. A smallest duration of time in the millisecond range exists in the brain corresponding to Gamma oscillation. It plays an important role in conscious activities. One's experience is reported to be discontinuous-- a moment of consciousness arises, appears to dwell for an instant, and then vanishes, to be replaced by the next moment. Is this description of experience (the kind of description of actual human experience that we have been asking for) consonant or not consonant with descriptions that we get from neuroscience? The term "perceptual framing" has been extensively discussed in neuroscience and psychology which deals with sensorimotor rhythmicity and parsing. One of the most well-known phenomena studied in this literature is called "perceptual simultaneity" or "apparent motion." For example, if two light flashes are shown successively with an interval less than a period of 0.1- 0.2 seconds, they will be seen as simultaneous, or in apparent simultaneity. If the interval is slightly increased, the flashing lights will appear to be discrete.

The issue now arises of the simultaneity between events in the external world and the corresponding perception events in the internal cognitive space. The motion of an object in the external world within the "psychological atom of time" engenders a collapse of space and time events in its counter space in the internal world. Since the delay in conduction speeds along different axons and the integration time for individual neuronal elements in the circuit are both of the same order of magnitude as the temporal quanta, so in spite of such delays, the concept of simultaneity of the external event will be considered valid for functional space, i.e. as an operational of simultaneity is taken to be valid.. The brain is supposed to be an instrument having resolution power of 10-12 ms. Everything that falls within a frame will be treated by the subject as if it were within one time span, one "now".

Recent Magnetic and electric recordings from the human brain have revealed the existence of coherent oscillatory activity near 40 Hz. A magnetoencephalography (MEG) system was used by

Joliot et al. (1994)[18] to test whether the 40 Hz oscillatory activity relates to the temporal binding of sensory stimuli. The results showed that the 40 Hz oscillations not only relate to primary sensory processing, but also could reflect the temporal binding underlying cognition. Experimental results have shown that there exists a time interval of (10–14) ms (corresponding to the up trajectory of 40Hz oscillations) that is the minimum time required for the binding of event. This was proposed as the cognitive ''quantum of time''.

Quantum Entanglement and Metaphysics of Relations

The remarkable progress in modern physics in the twentieth century raises lot of interest on the metaphysical aspects of quantum theory. According to quantum theory the physical world is nonlocal. Einstein in his famous paper known as EPR (Einstein-Podolsky and Rosen, 1935) [20] considered a Gedanken experiment where the state of two quantum objects like electron, photon (i.e sub-atomic particles) is prepared in a manner such that when the state of one quantum object is measured, that of the other is instantaneously affected (no matter how far these objects are separated), but in the subtle way that the effect can be found out only in conjunction with knowledge of the action on the other particle. This "spooky action-at-a-distance" called "nonlocal". Quantum entanglement, is a property of a nonlocal quantum state. Objects in an entangled state are non-separable. This leads us to think of entanglement as a sort of holism. Holism is the thesis which claims that the whole is more than the sum of the parts.

The relation between the quantum objects making the whole contain the information about the relata (i.e. the individual quantum objects), though the relata do not necessarily need to have intrinsic properties. Intrinsic properties are those properties that a thing has, irrespective of whether or not there are other contingent things. All other qualitative properties are extrinsic or relational. So characterizing the entanglement in terms of non-separability for quantum systems is a metaphysical proposal and a matter of philosophical argumentation.

Quest for Ultimate Reality: Modern Physics and Ancient Wisdom

Both Scientists and Philosophers are trying to understand the ultimate reality. However, it is necessary to be clear first what is meant by "ultimate reality". In his book, T.R.V. Murti [26] asks: "If nothing can be predicated of the Absolute and no terms can be applied to it, how then do we continue to speak of it? How can it be cognized at all as the ultimately real?"

The anomaly is: "absolute" or ultimate reality (paramartha) is not delimited by any attributes, it is Unknowable or "anakshara", (inexpressible). Hence it cannot be the object of any Knowing. How then can it be cognized and attested to exist? In the drk-drshya-viveka approach (i.e., discrimination between the subjective seer and the objective seen), one adduces a hierarchy of higher level realities, such that any given level of reality is cognized by the next higher level. In Vedanta, the deepest level of reality indicated (but not reached in any finite number of inductive steps) by this method of induction is identified with the Self or Brahman. The above philosophical problem is then solved in Vedanta by the idea that "brahma-vit brahma-iva bhavati-" meaning, "the knower of brahman becomes brahman" himself/herself/itself (i.e., the ultimate knowing is by being one with That absolute). The ultimate truth cannot be known, but REALIZED.

In physics, we have an analogous situation where more general or fundamental theories replace restricted theories. For example, the discovery of General Theory of Relativity by Einstein changed the Newtonian paradigm. It does not imply the falsehood of Newtonian theory of Gravity. Einstein's framework is more general than the Newtonian one, which is of limited validity compared to the Einsteinian one. Both depict the same Reality however, but at different levels, with the Einsteinian perspective being deeper.

As another example, the discovery of quantum theory at the beginning of the twentieth century changed our understanding of reality. Quantum theory is considered to be valid at the level of elementary entities i.e. photon, electron etc known as the microscopic level, where the scale of length and time are different by orders of magnitude from that of everyday life. To understand the reality at everyday life (called the macroscopic level), Bohr introduced the principle of correspondence so that under certain limiting condition say in the limit of Planck's constant (h) tends to zero the behavior of every day or macroscopic objects can be explained within the paradigm of quantum theory. Similarly, scientists use the limiting procedure of the speed of light tending" to infinity in the theory of special relativity and get back to Newtonian framework.

In other words, such a limiting procedure allows us to traverse a parametrization of levels of reality. However, a careful analysis clearly demonstrates the inadequacy of these limiting procedures since the value of speed of light as well as that of Planck constant have been experimentally determined and have same values at all levels of reality. It is clear from the above analysis that scientists and philosophers both require a hierarchy of realities. However, their approach in the matter is complementary. Whereas Vedanta posits such an ultimate Reality from direct intuition, scientists approach the reality in a top-down fashion, from the macroscopic level to subatomic scale to the scale of strings and then to the ultimate level of physical universe called Planck scale (10^{-33} cms and 10^{-43} s).

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Chapter IV: Indian Philosophical Traditions

Abstract

Regarding several as yet unanswerable questions raised by physicists regarding some crucial aspects like origin of the universe, space, time, non-locality, quantum entanglement etc. within the frame work of modern science, the responses of the panel of Indian philosophers belonging to different schools, is presented in the annextrure I. These give a flavor of the character of Indian philosophies which are a mixture of both theistic and atheistic viewpoints. In this chapter we provide some more background to these ancient philosophies going as far back as 1500 BC. Clearly they fall into two groups : - (i) those that have allegiance to the Vedas, the scriptures dating book to 1500 BC and (ii) those which do not have their allegiance and belong to a period after 600 BC.

The first category called Asthika fall into two classes – those that are theistic of (believe in God). Among this class we have Vedantha, Kashmir Shaivisam and Yoga philosophies and among the second category we have Tarka, Sankhya, and Purva Mimamsa (Jaimini). Among Nastika philosophies we have Jainism, Buddhism, and the Charavaka which perhaps is the oldest purely materialist philosophy. Under Tarka we have Nyaya and Vaisesika and under Sankhya there are two groups theistic and atheistic.

The accepted source of knowledge (Pramanas) in India philosophy are Pratyaksha (perception), Anumana (inference), Apta vakya (Testiimony), Upamana (Comparison). Arthapatti (postulation), Anupalabdhi(non-cognition). The different philosophies accept different combination of the sources listed above. The conclusions regarding the ultimate reality reached by the different philosophies are also presented.

KEYWORDS: Vedanta, Kshmir Shaivisam, Yoga Philosophy, Buddhist Philosophy, Jaina View

We have already identified several as yet unanswerable questions raised by physicists on some crucial aspects like origin of the universe, space, time, non-locality, quantum entanglement etc. within the frame work of modern science. In this chapter, at first, we discuss briefly various phases of India traditions and then we investigate the parallels – convergence or divergence between the issues raised in Modern physics, those discussed within ancient Indian philosophical traditions.

Vedas to Vivekananda to Tagore

Among the ancient Indian philosophers [1] too we have radical materialists, pure spiritualists, some who require both spirit and matter. It all boils down to discerning what is primary – spirit or matter? And what is real? And what is illusory?

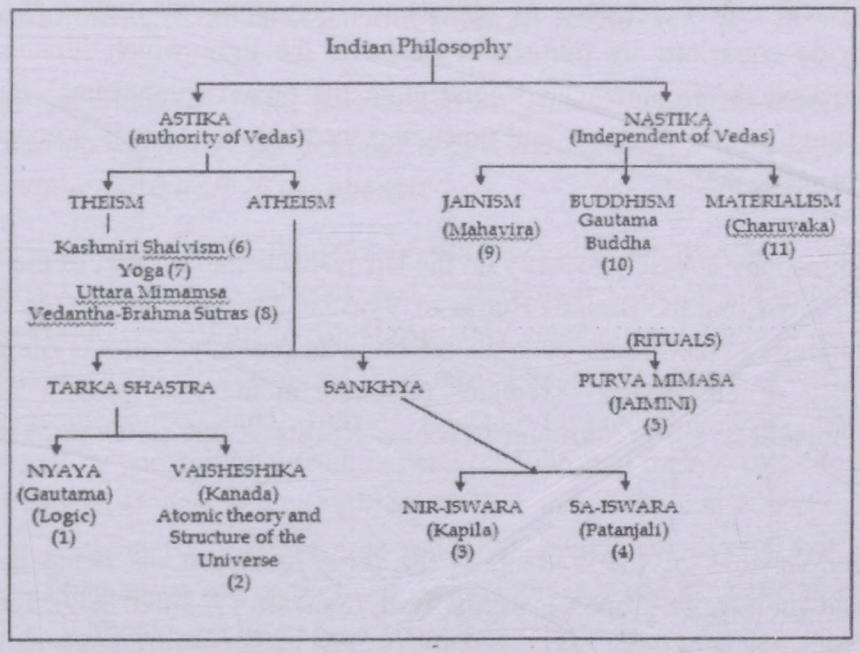
In Indian Philosophies there are two broad categories – those that owe either partial or full allegiance to "the Vedas" the scriptures and those that are independent of Vedas.

Those that subscribe in part or full to the Vedas are Vaisheshika of Kanada, Yoga of Patanjali, Mimamasa of Jaimini and Vedanta of Badarayana. The Charvaka of Brihaspati, Jainism of Mahaveera and Buddhism of Buddha do not concede the authority of the Vedas. Among the former the differences arise essentially in the interpretation of the Vedic utterances and also on the extent of dependence on post Vedic texts. We shall not go into the historical or developmental details of these various schools, but consider only the main insights from the point of view of comparing and contrasting them with the insights from western philosophies and of modern science.

The Carvaka philosophy is perhaps the earliest, atheistic material philosophy dating back to a period earlier than 600 BC. It totally denounces the authority of the Vedas. Perception (Pratyaksha) is the only means of knowledge that is accepted. What is not perceived, does not exist. Inference is totally rejected. Matter is the only reality. The basic constitutent elements of the world are earth, water, fire and air. Even Space or Akasa is not there because it is not directly perceived. It is only inferred. Intelligence is a modification of the four elements. There is no Soul since it is not directly experienced, but inferred. Consciousness arises from a mixture of these, so also thought.

Though there are some differences between Nyaya and Vaisesika systems of philosophy founded by Gautama and Kanada respectively in the 3rd century BC, for our purpose here we can treat them together. In Nyaya-Vaisesika system, diversity and not unity is at the root of the universe. Experience reveals nine entities which make up the universe. These are called 'dravyas'. Not all the 'dravyas' are materials. The four materials are earth, water, fire and air all of which are actually composed of "atoms" which are indivisible and have specific properties. 'Akasa' which is other constituent of the universe is partless and infinite and does not produce anything like the combinations of the 'dravyas' do. Space and Time are conceived as objective realities. They are

infinite and partless like 'Akasa'. In this scheme 'Akasa' stands for what fills the space – some ethereal substance which supports 'Sabda' or Sound(vibration).



Numbers 1 – 8 are orthodox systems owning allegiance to Vedas and Numbers; 9-11 are Heterodox systems – no allegiance to Vedas. (Vedas: Rig, Yajur, Sama, Atharva (Samhitas - Mannasa; Brahmanas – Rituals; Aranyakas – contemplatives). Upanishads: End portions of Aranyakas of each veda.) The accepted sources of knowledge (Pramanas) in Indian philosophies are Pratyaksha (Perception); Anumana (Inference); Apta Vakya (Testimony); Upamana (Comparison); Arthapatti (Postulation); Anupallabdhi (Non-cognition). Vedanta accepts all 1-8; Nayyayikas only 1-4; Sankhyas only 1-3; Vaiseshikas only 1-2; Buddhas only 1-2; Charvakas only the first.

The Sankhya philosophy founded by Kapila (6^{th}-5^{th} Century BC) is based on the concepts of Purusha and Prakriti, Purusha being pure consciousness without quality or character and is formless. The World of objects is a transformation of Prakriti. Prakriti has three qualities or Gunas such as Sattva (virtue), Rajas (passion) and Tamas (darkness). Combinations in different proportions of these decide the variety of objects in nature, including man. Prakriti is the ground condition for all creation in the universe. The three Gunas may also be equated with essence (Sattva), energy (Rajas) and mass (Tamas). According to Sankhya, 'Mahat' which is Sattva prominent evolves first from Prakriti from which the world, mental and physical is manifest. In Sankhya there is one 'purusha' for each soul. Patanjali's Yoga system is grafted on the Sankhya metaphysics. Purusha is the transcendental principle underlying all being and knowing. Purusha

cannot be perceived. It may be realized by personal development and practice of certain disciplines. Intellectually the presence of 'purusha' can be inferred from the manifest purposiveness of the universe. Thoughts and images of the world are physical, but more subtle. Like gross physical objects, images of objects are non-conscious unless they are felt, are experienced, made conscious by purusha. Purusha is the light which illuminates the mind. Patanjali emphasized the importance of controlling the breath (pranayama) for cleansing the body and achieving control of mind, and practicing meditation. There is no concept of God as Creator. Mind is subtle matter.

The Vedanta philosophy is based not only on the Upanishads, the last part of the Vedas, but also on the non-vedic texts like the Brahma Sutras of Vyasa and the Bhagavad Gita which is part of the epic Mahabharata. According to Vedanta, the ultimate and only reality is Brahman. Reality is described as "that which persists – remains the same in the past, present and future, both manifest and unmanifest; substratum and structure. Reality is like an Ocean and Creation like Waves.

There are many versions of the Vedanta – the three main schools being the Advaita, the Visistadvaita and the Dvaita proposed primarily by Sankara (788-820 AD), Ramanuja (1071-1137) and Madhvacharya (1199-1278) respectively. The essential difference between them lies in the relation between Brahman, Self and Reality.

Sankara addresses the problem from two distinct stand points or reference frames. One is the Vyavaharika (transactional) stand point – that of everyday experience of the lay person. The other is the Paramarthika (transcendental) standpoint- the Absolute reality which is the view point of those who are far more advanced spiritually. In the latter case, Sankara takes into account the experience of not merely the waking state, but also of the dream and deep sleep states and also the experiences of those who are given to advanced spiritual practices of Yoga and Meditation. In them in their proper perspective from a transcendental point of view (Adhyatmika Dristi), according to Sankara there is only ONE REALITY – that is BRAHMAN – and there is NOTHING ELSE.) (Ekameva Advayam Brahma). He gives relevant importance to the revelations from the scriptures.

It is relevant to point out the works of three most respected late 19^{th} and early 20^{th} century Indian intellectuals and philosophers namely Swami Vivekananda, the Nobel laureate Rabindranath Tagore and Aurobindo Ghosh. They are the individuals who had great familiarity with developments in other countries in arts, music, science, literature and philosophy at that point of time. It is interesting and significant that all the three had theistic leanings and supported Vedanta philosophy, particularly the Advaita philosophy. In this context, we also make reference to the conversation between Einstein and Tagore [2] on the question of Reality and also to the

views of the Nobel Laureate Erwin Schrodinger [3] on the Upanishads on the identity of the "I" and also of other scientists and philosophers.

Two Truths in Buddhism (Conventional and Ultimate Reality)

Buddhist scholar Nagarjuna [4] in his famous text Mūlamadhyamakārikā attributes two truths to Buddha *"the Dharma taught by the Buddha is precisely based on the two truths: a truth of mundane conventions and a truth of the ultimate".*

The doctrine of two truths lies in the core of Buddhist philosophy. One is conventional truth which involves our everyday experience and understanding the way the phenomenal world appears and functions. According to Buddhism this conventional truth is deceptive and this deception is called inherent existence and is identified as the root cause of sufferings. The truth about phenomena in conventional truth is inferred through cognition. The emptiness of phenomena asserted by conventional truth is perceived through the abstract construction and by the analysis of conceptual objects. The ultimate truth is the direct, non-conceptual perception of the emptiness of phenomena. Madhyamika school of Buddhism asserts that no independent phenomena exist. Phenomena are neither self-created nor self-enduring but arise in dependence on other conditions without a nature or essence of their own.

For example, in Newtonian physics, a concept called `inertia' was introduced; inertia of rest and inertia of motion. Newton's laws of motion assume that the object at rest will remain at rest or in motion will remain in motion unless affected by external forces. These properties are called inertia of rest and inertia of motion respectively. But the challenging issue is how inertia is being originated. Famous physicist philosopher Mach considered that this inertial property is related to the existence of other objects in the surroundings. This is popularly known as Mach's principle. Though Mach was influenced by positivist philosophers, this explanation is very much compatible with Buddhist concept of dependent origination or simply Nagarjuna idea of "praittyasamudpada."

The Buddhist attitude was very much rationalistic. Once Buddha said to his disciple Kaalamaas:

"This I have said to you, O Kaalamas, but you may accept it or not because it is a report, not because it is a tradition, not because it is not said in the past, not because it is given from (our) basket (or scripture, pitaka), not for the sake of discussion not the sake of careful consideration, nor for the sake of the forbearance with wrong views, nor because it appears to be suitable, ... but, if you yourselves understand that this is so meritorious and blameless, and when accepted, is for benefit and happiness. Then you may accept it".

In fact, the theories based on the reason and not on a person were prevalent and much discussed among thinkers before the advent of Buddha. In fact, Buddha refused to answer the following problems either in the affirmative or in the negative [5]

"Whether the world is eternal or the world is non-eternal; whether the world is finite or the world is infinite; whether the soul and the body are identical or they are different; whether soul exists after death or be does not exist after death, or whether the soulboth exists and does not exist after death. All these questions are not answerable".

Reality in Jain Philosophy

Jain school offers [6] an approach which is intermediary in between the extreme externalism of the Naiyayika and the equally extreme idealism of the Buddhist and Vedanta schools. Regarding reality and relational aspects a few critical points should be mentioned which contradict directly the different Hindu schools and Buddhist schools. Following Jaina philosophy, few points need to be mentioned as follows:

(i) The Jaina does not believe in the existence of absolutely simple entities. For example atoms present in a constellation of similar entities, which assume various patterns, have magnitudes determined by the internal compulsive laws and external pressure. In this manner, an infinity of relation is assumed internal and external, total and partial, mediate with the other phenomena of the universe. A real is, obviously, an independent existent but at the same time a network of relational forces, just like a knot into which the strands of such forces are woven.

(ii) Jaina school postulates the reality as a deliverance of the direct or objective experiences and as a result the relation are posited not merely as inferable but also as an indubitably perceptual.

Now we will study the various unresolved issues in modern physics with light of various schools of Indian Philosophy.

Parallels between Quantum vacuum and Akasa in Advaita Vedanta :

Drawing parallels between claims of different disciplines like modern physics and Advaita Vedanta may create various problems: lack of contextuality, problem of translation, language fallacy, oversimplification, ideological bias etc. Any such comparative study should take care of the methodological difficulties.

We compare on the one hand, the concept of Akasa as addressed in Indian Philosophy in Sankara's Vedanta and on the other the concept of Quantum vacuum as interpreted in modern physics. Some parallels may be drawn between Akasa and the luminiferous ether of classical physics. Probably, Swami Vivekananda suggested such correlation first, having become familiar with ether as a physical concept during his stay in the west and while meeting Lord Kelvin, von Helmholtz, William Thomson and Nikola Tesla. (Vivekananda died in (1902), just before the advent of quantum mechanics and relativity)
Duquette [7] made an extensive analysis regarding the parallels between the two concepts within various schools of Indian philosophy and wrote:
"We have seen that Upanisadic literature endows the word Akasa with various meanings. In some passages, Akasa is stated to be one of the five elements (mahabhutas), connected with hearing and sound. Elsewhere, it acquires a metaphysical meaning while being closely equated to the eternal **Brahman** and the innermost **Atman**".

As presented in the last section, there is clear indication that universe is created out of the fluctuations of quantum vacuum. This quantum vacuum is all pervading, self-tuning and self-referential. Moreover, this vacuum has some kind of memory in some form of imprints or seeds of various fields and their characteristics. On the other hand, according to Indian philosophy the spatial and material universe is created out of five elements: four of matter (fire, earth, air and water) and one of pure space or ether (the Akasa). The ether has two phases, subtle and gross. So to discuss parallels between Akasa and quantum vacuum, we need to understand the gross and subtle aspects of vacuum within quantum paradigm.

In Yoga Vasistha Ramayana [8], Vasistha used three words "cidakasa", "cittakasa" and "bhutakasa" in the context of the concept "akasa" and creation. If one takes literally meaning of akasa as "space", "cidakasa" means "consciousness – space, 'cittakasa "means mind-space and "bhutakasa" means the element space. Swami Vivekananda suggested a better translation of the word "akasa" as "dimension". Since, *"the same infinite consciousness is known as cidakasa, cittakasa and bhutakasa viewed from the spiritual, mental (conceptual) and physical dimension respectively."*

With respect to creation, Vasistha discussed with a metaphor. He talked about a holy man named "akasaja" (born out of space). In conversation of "Death" with "Yama" (who keeps the account of the karmas of all individuals).

Yama said: "O death, this holy man Akasaja was truly born of space and has no karma at all. He is as pure as space. Hence he has incurred no karma which can help you grasp him or devour him". Here, the concept of self-creation is introduced without having any Karmic deeds and hence no memory.

Quantum vacuum has been studied considering quantum field theory. Quantum fields are having infinite degrees of freedom and are continuous over all space-time. We call it as global existence. Here, quantum fields are defined over a space-time manifold endowed with Minkowskian structure. This is physical space-time where the special theory of relativity holds good. It means there is constrain on the speed of propagation where speed of light is considered to be constant and maximum. The metric of space-time is Minkowskian in nature. We should call it as gross aspect of vacuum or ether. But to make a comparison, one needs to understand the subtle aspect of the vacuum so as to compare with subtle aspect of ether. Duquette did not discuss these aspects and hence the comparison remains incomplete.

Recently one of the present authors (SR) along with mathematician Ralph Abraham [9] studied these aspects using rigorous mathematical structures which shed new light on the issue of subtle and gross aspect. The results have already been published in a book form. The main ideas are elaborated as follows:

The word Akasa is generally translated in english as ether. However, the concept of ether as a medium for the propagation of light is not the appropriate one in Indian philosophy. The concept of Akasa has the distinguishing quality of supporting sound in contrast to ether as that of light. In fact, to understand the concept of Akasa, one needs to understand the concept of "tattva". The Sanskrit word tattva consists of two syllables: tat and tva. "Tat" means that and "tva" means "ness" and hence the word tattva signifies "thatness". On further analysis, it signifies the essence which creates the feeling of existence. There is another Sanskrit word "bhuta" which is used synonymously with tattva. There are five elements or five different states known as pancha tattva or pancha mahabhuta associated with distinct vibratory motions which appear during the evolutionary process of manifestation from Parabrahman. The first evolutionary state is the Akasa tattva. It has the distinguishing quality of sound. If we want to use a word similar to ether for Akasa, it is better to use an adjective with ether as in the book by Abraham and Sisir Roy. According to physics, sound requires a physical medium for its propagation where as sound in ancient wisdom may just correspond to "vibratlon" of Akasa. The five tattvas can be classified as

- Akasa as soniferous ether
- tejas tattva as luminiferous ether
- vayu tattva as the tangiferous ether
- apas tatva as the gustiferous ether
- prithvi tatva as the odoriferous ether.

Evolution gives rise to light from sound and then to forms. The generation of light from sound has been discovered in twentieth century physics and the phenomenon is known as sonoluminescence.

On the gross level, the physical characteristics of these five tattvas or five mahabhutas can be described as:

- The characteristics of akasa are motion in all directions which are not agglomerated and also not obstructed
- Tejas corresponds to fire, i.e., going upward, burning, lighting, shining, destruction, power.
- The characteristics of vayu or fire are the movability and friction.
- Ap corresponds to water which characterize smoothness, softness, heaviness, coolness, purification, etc.
- Prithvi or the earth corresponds to form, stability, rigidity, support, etc.

According to Sankhya philosophy, atoms of the five mahabhutas combine together to form different substances. According to the different schools of Indian philosophy, matter can exist in three forms as tanmatras (i.e. sub-atomic stage), as anus, or the atoms of the mahabhutas. The tanmatras signify the potency of having the characteristics of akasa, fire, air earth, etc. Divergent views exist regarding the genesis of the tanmatras. Actually, they possess something more than the quantum of mass and energy; they possess the physical characteristics like penetrability, capability of radiation of heat, viscosity and cohesion. In addition to these capabilities they also possess the potentials of energies represented by sound, touch, colour, taste, and smell, but are devoid of any particular form. In this way, both animate and inanimate bodies and all forms are created out of the various combinations of these five elements or pancha mahabhutas.

Akasa is all pervading, just like the luminiferous ether described in physics. The vibrations of the elements which constitute sound associated with akasa are different from the vibrations which produce sound in everyday world and require a physical medium. These elements or tanmatras are very subtle but have the potentiality of creating the sound in the physical world under certain conditions. These subtle tattvas exist in the universe on four planes as follows:

- Physiological, corresponding to prana
- Mental, corresponding to manas
- Psychic corresponding to vijnana
- Spiritual corresponding to ananda

Again some of the secondary qualities of these tattva can be summarised as:

- Space: This is considered to be a quality of the akasa tattva. The vibration here may give rise to the statistical nature of space.
- Locomotion: A quality of vayu tattva, motion in all directions.
- Expansion: A quality of tejas tattva.
- Contraction: A quality of ap-tattva. The direction of this ether is considered to be the reverse direction of the ether associated to tejas tattva or agni tattva.
- Coherence resistance: A quality of the prithvi tattva. This is opposite to akasa tattva. Akasa tattva can give rise to locomotion where as prithvi tattva resists it. It is worth mentioning that Laszlo proposed an integral theory of everything and the importance of the akasic field in several of his recent monographs.

According to Advaita Vedanta, there exists an all-pervasive "plenum" called Akasa from which the entire universe has originated. In this tradition, the first element Bhutas are created which seems to be the primordial source of other physical elements. Recently, Panda (10) remarks that this concept resembles in many ways the quantum vacuum as described in Quantum Field Theory. However, most of the authors did not realise that the vacuum within the framework of Quantum Field Theory has specific structure of space-time which is nothing but the features of gross or physical space-time. So unless one constructs a substratum beyond this gross level – call it as subtle one, it is very difficult to make a useful comparison. As mentioned above, in their recent book Abraham and Roy have succeeded to construct such a subtle level from which one gets physical space-time or quantum vacuum and hence the comparison appears to be meaningful one. It is worth mentioning that this subtle vacuum has dynamic possibilities with fluctuations which give rise to the physical vacuum or gross one. According to Yoga Vasistha "akasa" is pure space without any "karmic seeds" (results of past actions). It is to be mentioned that one of the present authors (SR) discussed the nature of quantum vacuum and various ontological issues within Buddhist perspective.

The concept of Alayavijnana plays a central role in the development of Buddhist dialectical thought. Nagarjuna is considered to be the first Buddhist thinker to introduce a dialectical system as a means of developing progressive philosophical views. However, he never mentioned the term Alayavijnana. Asanga, the propounder of the Vijnanavada doctrine, wrote the first systematized theory of causation by the "ideation storehouse" or Alayavijnana. It is not clear from the text whether the storehouse consciousness should be considered as a universal source of individual consciousness or as a pluralistic principle per se performing at the bottom of each individual human mind. The text of Asanga considers aalya as the seat of pure subjectivity, out of which objectivity develops. However, the text does not imply any sort of ultimateness in the storehouse consciousness as such. Vasubandhu, brother of Asanga adhered to the doctrine as the basis of subjective consciousness and the source of all phenomenal multiplicity. In Lankavatara sutra aalay is compared with infinite ocean (Verdu)[11] on whose surface waves roll on permanently aroused by the winds of ignorance but the depth remain unmoved that is the aalay

body itself *"subsists uninterruptedly, quite free from fault of impermanence.... and thoroughly pure in its essential nature"*. Later development towards more ontological formulation, the sutra identifies the concept of aalay with the concept of Tathagatagarbha , the matrix or womb. The latter one is the most cherished Kegonian expressions. This designates the ultimate reality of Buddha nature itself or tathata or suchness. In 1974 Verdu [11] in his book on "Dialectical aspects in Buddhist thought" raises an important issue which is much relevant in the context of modern science. He wrote "The Lanka , however,, leaves a vital aspect of its doctrine shrouded in deep mystery. This is the question concerning the character and origin of the agency that stirs the waves of change upon the ocean of the garbha. This agency is metaphorically designated as the winds of ignorance. What principles are these winds related to ? What is the ontological status of this principle as primordial stimulator of the growth within the womb (garbha) of the aalay? Is it extrinsic to the garbha, in which case it is the latter is not ultimate or is it internal to the garbha, in which case it is the very source of error and of its subsequent evils?"

There exists striking similarity to the idea of creation of the universe by the fluctuations of quantum vacuum in modern cosmology. According to Heisenberg uncertainty principle, during a very short time period there will be enormous fluctuation of energy. These enormous energy fluctuations give rise to the birth of the universe. This quantum principle is considered as the fundamental principle existing at all levels ubiquitously. So the issue is whether this quantum principle is extrinsic to the quantum vacuum? The answer is no. The very concept of quantum vacuum is intimately related to this uncertainty principle. Indeed it is intrinsic to the quantum vacuum.

Let us now look into the solution of the enigma raised in the context of Tathagatagarbha by Yogacara Buddhists. A highly speculative scripture *Mahayanasraddotpada (Awakening of faith in Mahayana)* usually attributed to Asvaghosa offered an interesting solution to this enigma. Briefly speaking, Tathagatagarbha is considered as the universal flux or storehouse of all reality including both its samsara and nirvana aspects where as *alayavijnana* is considered as the storehouse of all knowledge. Phenomenologically if the enlightenment is the noetic aspect of the aalay, the tathagatagarbha is its ontic aspect. Edward Thomas[12] stated "*It becomes superfluous to ask whether this mind or store-consciousness(aalay) is universal or individual. It is conceived as the one reality beyond all differentiation.....This is Tathagatagarbha ..... in which all reality and difference is embraced*".

According to modern cosmology the universe arises in the process of "fluctuation of quantum vacuum", not out of "nothing" but out of a certain physical reality. This vacuum or ontologically speaking a substratum exists which is devoid of any matter but is full of activities or full of potentialities. These potentialities give rise to various attributes of the physical universe. For example, there exist four fundamental forces in physical universe – namely, the electromagnetic

force, gravitational force, strong nuclear force and weak force. These fundamental forces are associated with corresponding fields – like electromagnetic, gravitational fields etc. Each field has its own distinct characteristics. These characteristics are supposed to have arisen from some kind of imprints or seeds in "quantum vacuum" (via symmetry breaking). So these characteristics or attributes arise out of the fluctuation of the "quantum vacuum" with potentialities. Here, the scientists are yet to find the answer to the question of how the attributes of the physical universe arise out of "fluctuation of quantum vacuum with some seeds or potentialities" or a space-time endowed with fluctuation without having specific "attributes" of the various fields.

It is worth mentioning that though several concepts of vacuum like "true vacuum". "false vacuum" are proposed in modern cosmology, yet none of them is "nothingness" in the strict ontological sense of the word. In the context of these theses on the creation of the universe out of "nothingness", "tunneling out of nothingness" or "fluctuation of nothingness" are not purely scientific theses. Now even if one does not consider the concept of energy, mass, stress tensor as characteristics of nothingness but that of space-time (which we call dynamic geometry), then one should recognize the existence of a law of nature at the "very beginning" according to which"nothingness creates the world". Clearly, such a law would appear to go beyond any known physical laws, and presumably it is subject to causal laws that invoke some world of logic and mathematics, because we believe (almost religiously!) that an explanation of the origin of the universe cannot do without assumption of structure of rationality. This entails that, in understanding the question of the "beginning of universe" the involvement of philosophy is inevitable in the following sense. Cosmology as an empirical science is predicated on the structure and evolution of only a small observable part of the universe (like correctness of inflation), but not the universe as a whole – for example, we are not able to check the correctness of a rule for initial conditions from a scientific point of view. It is to be noted that extrapolations of local physics onto the whole observable Universe cannot do without cosmological principles, about which what we know is basically of a philosophical character. It immediately raises the pertinent question "Is the emptiness of quantum vacuum similar to the emptiness of Buddhist philosophy?" Or Brahman of Vedanta philosophy .?

Identity and Individuality

Reichenbach(13) realized the problem correctly. He suggested looking how these objects behave collectively and from that epistemic point of view came to some conclusion regarding the individuality. In practice, we examine the object itself with inferences based on the statistical behaviour of an ensemble or aggregate of such objects. For example, we consider the two electrons over two boxes or energy states. Classical objects which belong to the same species like chair may be indistinguishable in the above sense but they are considered to be distinct

individuals since they occupy different locations. Permutations of these objects give rise to a new complexion which is distinct from the un-permuted one. Here, the labelling individuals (say) with respect to position is possible. On the other hand, this type of permutations for quantum objects does not give rise to new complexion – simply because any such labelling is not possible for quantum objects. This was taken to imply that the objects had 'lost' their identity and was, in some sense, non-individuals. If the quantum objects are not considered similar to classical objects like gas molecules, table, chair, book, Leibniz's famous Principle of the Identity of Indiscernibles is in fact violated. The identity of indiscernibles is an ontological principle that states that there cannot be distinct objects or entities that have all their properties in common. That is, entities 'x' and 'y' are identical if every predicate possessed by 'x' is also possessed by 'y' and vice versa; to suppose two things indiscernible is to suppose the same thing under two names. It states that no two distinct things (such as snowflakes) can be exactly alike, but this is intended as a metaphysical principle rather than "an operational principle" of natural science. It is to be noted that the Pauli exclusion principle plays an important role in the understanding the arrangement of atoms in various structures of the objects in nature. For example, the arrangement of various elements in Periodic table for all the elements like Hydrogen Helium etc can be explained using Pauli's exclusion principle. According to this principle, no two Fermions like electrons (identical with respect to all their properties like, mass, charge, spin etc) can occupy the same state with same spin state. On the other hand, the particle we call Boson like photons can occupy the same state all at a time. The elementary particles or entities in nature are broadly divided into two categories according to their property called spin – either Boson (honouring Indian scientist S.N. Bose) or Fermion (honouring Italian scientist Enrico Fermi). This behaviour of fermions or bosons has given rise to new debate regarding the identity and individuality of the particles at the quantum domain. The individuality and identity have been discussed widely in Indian Philosophy. Sankhya Yoga verse in Bhagavad Gita claims that the analytical knowledge gives the description of the nature of individual and individuality. The primary importance of the individual is established by the Vedic statement "AHAM BRAHMASMI" which describes the true identity of the individual as that of Ultimate Reality known as Brahman.

Time, Causality and Consciousness

In Indian philosophy, the concepts of "instant or kshana" as well as "atomic unit of time" have been extensively discussed in Yoga, Sankhya as well as in Jain Philosophy. Moreover, controversies exist in Buddhist doctrine of momentariness ("kshanika vaada"). In Sankhya philosophy the problem of time coincides with the problem of change. The pattern of conceiving change in this system with reference to underlying substratum called prakriti is different from that of Buddhist conception of change. They postulate two principles – Purusha and Prakriti – as

ultimate and ontologically independent of one another as highly important for the study of time and consciousness. There exist internal differences regarding the doctrine of momentariness within Buddhist tradition. A dialectical analysis of the problem of time has been discussed in Nagarjuna's "Madhyamika Karika" (kalapariksa) which has been further elaborated by Chandrakirti. The aim was to expose the untenability not only of any idea of time as unitary and absolute, but also of the notion of the reality of time as instant

In Yoga philosophy the ideas of "kshana' and "karma" i.e. moment/instant and sequence have been discussed in Yoga Sutra III. In the commentary of Vyasa it is said "just as the atom is the minimal limit of matter, so the moment is the minimal duration taken by an atom to change its position". Moreover, Yoga advocates the discrete view of time. The atomic concept of time has been extensively discussed in Jaina text (Pancastikayasara) where time-atoms are distinct and can never be mixed up. This is brought out by saying that "kala" has one "pradesha" only i.e. the time-atoms can never be combined. This indicates the difference between the atoms of space, matter, etc from that of time. To an Advaitin, the reality of time as a separate ontological category is considered to be wholly superfluous.

The metaphysics of relations has been extensively discussed by various schools of Indian philosophy including Buddhist and Jaina. It is clear from the above analysis that Quantum Entanglement can be thought of as relations having the following characteristics:

1. This kind of relation is not causal.
2. It is beyond space-time description.
3. The relation contains the information about the relata.
4. The relation has intrinsic property.
5. The relatum (i.e., single object) does not have intrinsic properties but has propensity of being entangled (elaborated in Pauli exclusion principle)
6. Some quantum entities can be entangled although quantum theory can describe some entities which are not entangled (product states).
7. Since this relation is a causal and beyond space-time description, is it a mental construct.
8. The concept of entanglement can be used to produce teleportation of quantum objects which can be produced even in the laboratory. So, the entanglement is real.

Western Perspective (Scientific Perspective):

According to western perspectives, the world consists of independent individual things that are embedded in space-time. These things are stated as individuals because

1. They have a spatio-temporal location.
2. They are a subject of the prediction of properties each.

3. There are some qualitative properties by means of which each of these things is distinguished from all others (at least the spatio-temporal location is such a property)

Aristotle assumed that there is a plurality of individual things (substances), characterized by intrinsic properties (forms) each. Esfeld [14], on the other hand, claimed that quantum entanglement may be considered as relation containing the information about the relata and there is no need to consider the intrinsic properties of the relata as claimed within the domain of western perspectives. Recently, structural realism has drawn much attention to the scientific community where the concept of structure refers to some set of relations between the things or entities that they relate, called *the relata*. People have used the term "structural realism" to describe different approaches to the nature of the relation between things and relations. These differences all seem to be variants of three basic possibilities:

- only relations without relata.
- relations, in which the things are primary and their relation is secondary.
- relations, in which the relation is primary while the things are secondary.

Indian Perspective:

The nature and ontological status of relation has been widely discussed by various schools of Indian philosophy. Before going into the details of their analysis, one need to discuss the basic question: **what is a relation?** A relation connects one entity with other entity and the basic characteristic of a relation is that it rests on two entities (**dvisthah sambandhah**). This means: when it is observed that many individuals form one class, the relation (inherence) subsists in both the class and the individuals. Symbolically speaking, a relation between object **a** and object **b** is **aRb**.

Now, the next question: Is the relation real?

- "No" is the answer by idealists i.e., Buddhists and Advaitins.
- "Yes" is the response from realists who are conventionally identified as Nyaya-Vaisesikas , the Mimamsakas and Jains and other pluralists.

In fact, the idealists consider the entire world as the creation of mind and so, any revelation out of our experiences is to be termed as relation and invariably imaginary entity. The proponents of this view i.e., Buddhists introduced the role of the mind, connected to things inherently with language. The idealists, also, advance their argument further by introducing the role of projection of the mind on the appearance of the existence of mind.

Nyaya-Vasesikas, Mimamsakas and other pluralists are the proponents of realist view. In the language of realists, say Nyaya-Vaisesikas, the determinate cognition (savikalpaka-jnana) takes the vital role in which a structure of qualifier-qualified type is revealed and consequently this structure is not possible without the involvement of an entity called Relation.

Dharmakīrti's view: Dharmakirti, a Buddhist scholar of around 7th century and one of the founders of Buddhist logic discussed the metaphysics of relations in great depth. In one of his seven of valid cognition (**Sambandhapariksa**), Dharmakirti made an extensive study in his seven treatises on analysis of relations. His arguments can be briefly summarized in the following way:

Sambandha or Relations (**R**) are of two types: **paratantra** (dependent) and **rupaslesa** (close connection).

Again *dependency* can be of two types: **nispannayoh** and **anispannayoh.** He claimed that dependency is not considered as relation since it is already nispanna .
He raised the next issue whether mixing or amalgamation between two things **(rupaslesa)** is a relation or not.

In case of mixing or amalgamation two cases arise:

- If the two things are distinct, then how they can be mixed up or amalgamated? So mixing or amalgamation cannot be a relation.
- If the two things are identical then how a relation can be established since the relation must be defined between two distinct things? So mixing or amalgamation is not a relation.

Symbolically speaking: If **a** and**b** are distinct, then how can we say they are related? Now if **a** and**b** are identical then either **a** or **b** or **R** exists and there is nothing like **aRb**. So **R** is not a reality.
Suppose, the relation is considered only as imagination which connects **a** and**b**. Depending on this imagination whether one can think of **kriyakaraka-sambandha**, This is also not possible since there is no relation of any "karaka" with verb "kriya" and everything is momentary. So **kriyakarakasambandha (cause and effect relation)** cannot be considered as a relation between **a** and**b.**

Now, **Cause and effect** relation is considered to be one of the pillars in modern physics. It is pointed out in **Sambandha Pariksha** that cause and effect relation is not a "relation" in the sense that cause and effect cannot exist at the same instant of time. So the relation is not a reality. Now even if we consider that **R** exists in case of cause and effect in a sequence not in the sense of

simultaneity, then either **R** exists in cause and not in the effect or the vice versa. In such case, then, how a relation exists either without **b** or **a** respectively?

Again, if **R** does not exist in the cause or the effect, then how **R** produces the effect in **b** or vice versa?

The relation plays an important role in generating the cognition. According to realists, the ontological reality of relation must be considered to acquire an expressible cognition. However, idealists can do away with a relation and Dharmakirti was in **b**of idealism. Since Dharmakirti wants to establish idealism of the type of Yogacara philosophy, he has no other alternatives left than to deny all relations on the basis of which realists will explain a qualified cognition. The assumption of the realists that cognition is also produced by the external object cannot be accepted by the idealists. Let us, now, discuss the views of realists.

Realist View: Realists cannot portray the reality of this universe iwithout accepting that the relations appearing in the qualified cognition are as real as the relata. **Navya Nyayas** have researched in detail and classified various types of relation which can be summarized and classified as follows:

1. **Samyoga** and **Samavaya**: **aRb** where **R** is considered to be a distinct entity from **a** and**b**. Here, the "contact" and "inherence" can be considered as particular type of relation**Svarupa** : If **R** is neither contact nor inherence. A causal relation implies: **R**is the property of being a cause **or** the property of being an effect. For example : Pitr-putra bhava , guru-sisya bhava etc.

2. **Navya Naiyayikas** use the word **visesanata** for **svarupa**and divided "visesanata" into two types as **daisika visesanata** and **kalika visesanata**.
3. **Paryapti** : Here, the relation is called **Paryapti-sambandha** in Navya-Nyaya. This can be expressed over and above the inherence-relation. It is used to explain a cognition in which vyasajya-padartha appears existing simultaneously in more than one locus.

4. **Kalika sambandha** or Temporal Relation which is **svarupa-sambandha** and also known as "**kalika visesanata**".

The analysis of realist school clearly indicates that the relation is as real as the relata in the context of qualified cognition. Dharmakirti refuted the arguments of the realists regarding the reality of cause and effect relation since relation presumes the existence of the relata simultaneously.

Recently, it has been argued by Ghosh that Nyaya [15] could justify in favour of admitting relation as real in the following sense. Firstly, the relation is exposed in terms of language and the reality is beyond the net of language. It is further argued.

The Nyaya could forward the following justification in favour of admitting relation. First, relations are disclosed in language and the real escapes the net of language. If so, is it not a sort of inconsistency on Dharmakirti's part to argue for unreality at the level of ontology by making a linguistic statement?

The Jaina view:

Jaina school, with the usual reconciliatory metaphysical standpoint offers an approach which is intermediary between the extreme externalism of the Naiyayika and the equally extreme idealism of the Buddhist and Vedanta schools. Regarding reality and relational aspects a few critical points should be mentioned which contradicts directly with the different Hindu schools and Budhhist schools. Following Jaina philosophy, few points need to be mentioned as follows:

The Jaina does not believe in the existence of absolutely simple entities. A real, say, even an atom ,is considered as a star, present in a constellation of similar entities, which assumes various patterns, have magnitudes, determined by the internal compulsive laws and external and internal pressures. In this manner, infinity of relation is assumed, internal and external, total and partial, immediate and mediate with the other phenomena of the universe. A real is, obviously, an independent existent but at the same time, a complex focus or network of relational forces, just like a knot into which the strands of such forces are woven.

Jaina school postulates the reality as a deliverance of the direct or objective experience and as a result, the relation are posited not merely as inferable, but also as an indubitably perceptual. According to Buddhists, the basis for admissibility of relation is not possible due to lack of serviceability (upakaritva, arthakriyakaritva) attributed to relation. But Jainas [25] established the fact about how the relational element is a constituent factor in making up objects. For example, if the atoms producing an object say pitcher are discrete entities as Buddhist maintain, then simply the aggregates of the atoms will not produce pitcher. In modern science one needs concept of cohesion to produce such an object. Jaina scholars emphasized that the atoms are capable of being connected to become a concrete object. The Jaina looks upon the relation resulting from the combination of the relata in it as something unique (jatyantara) in comparison with the combining relata.

Regarding "paratantra sambandha"as discussed by Dharmakirti, Pravachandra[16] remarked that essential nature of "paratantrya" is unification of the relata not mere "dependent" as observed by Buddhist. Accordingly, Jaina view of relation, it is an identity of differents or different terms.
In view of this perspective of Jaina view we will discuss the reality of Quantum entanglement as a relation in modern physics.

Discussion on Reality of Quantum Entanglement and Jaina view

Whatever entanglement may exactly be, it is a relation among subatomic or quantum systems. It is not necessary that the states of quantum systems are entangled. In the famous paper of Einstein (known as EPR) a state of two subatomic entities are prepared by a measurement procedure : for example a singlet state of two electrons is prepared so that even when the electrons are far apart thereafter, the correlation exists hence called non-local correlation. A singlet state is formed because of Pauli's exclusion principle. This principle says that no two electrons can occupy the same state with same spins states. So the two electrons may be a particular state with their spins having different directions like if one in up direction along plus z-direction and then the other one along the minus z-direction.

It is now clear that the entangled state of two electrons is not merely as aggregate of two sub-atomic entities; but one needs to consider the restriction imposed by Pauli's exclusion principle. So this is a kind of relation where we need to consider the "propensity of the relata" to form a relation called "quantum entanglement" in contrast to Buddhist view of mere dependency as emphasized by Jain scholar Pravachandra[25]. Moreover, this singlet state of two electrons remains invariant under permutation or exchange of the position of two electrons though the two electrons are in different spin states in this state. This is similar to the concept of identity of differents as discussed by Pravachandra in the context of "paratantra sambandha".

Quest for Ultimate Reality: Modern Physics and Ancient Wisdom

In physics it is meaningful to define "degrees of reality" based on the observation process for acquiring knowledge. To realize the various levels of reality we use different mathematical symbols and methods. It is worth mentioning that after a long "manipulations of symbolic process" (generally known as "mathematical calculation") or in the process of deep thinking, scientists also experience a transcendence, something which gives rise to a completely new description of reality. At this stage, the physicist faces a kind of experience of the "wise" as in case of experiencing "ultimate reality" in ancient awakening of wisdom. This seems to be first person experience similar to that in various schools of Indian philosophy which under goes by

the name 'Realization' which is transcendental. Thus, it would not be incorrect to say that physicist's approach is not entirely unlike the Vedantin's bottom-up approach!

Some schools in our ancient wisdom (for example Yoga, Tantra etc) also emphasize the use of techniques and methods in search of the Ultimate Reality. They also use various symbols and geometric diagrams to understand the Ultimate Reality. Philosophy asks "Why this existence?", while Science asks "How this existence?" The moment you ask the "how" question, mechanism and technique become important.

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Chapter V: Summary and Conclusions

Concepts of identity, individuality, entanglement and non-locality:

The Reductionist method followed by science over the last four hundred years, since the time of Newton has finally led to the following sequence: of one of the constituents of the universe: i.e. mater: matter elements, hydrogen to uranium,compounds, molecules, atoms, protons, neutrons, electrons, quarks and gluons. Metaphysical concepts like non-locality and quantum entanglements are introduced to understand the behaviours of elementary entities like electron, proton, neutron etc. Further developments have revealed that it is necessary to make the assumption that the fundamental particles are essentially manifestation of Quantum fields of energy endowed with special properties corresponding to the manifested particles. In fact, in order to understand some of the properties of particles like charge it is necessary to consider happenings in more than four dimensions. The above mentioned elementary entities in this physical universe can be classified into two broad groups depending on their "intrinsic" properties like spin. The one group is known as "Fermion" which consists of entities having spin one half or odd-integral of one half. Electron, Proton,etc fall in this category. The other group known as "Boson consists of entities having spin zero or one or integral multiple of one. The corresponding rules of counting of these entities belonging to "Fermions" and "Boson" have been discovered namely "Fermi" statistics and "Bose" statistics. However, this rule of countingis different from that for everyday objects. This feature gives rise to new debate regarding the "identity" and"individuality" of the elementary entities. Two elementary entities like two electrons having the same spin value, same mass and same charge being treated as "identical particles".

However, when they are in entangled state, like in EPR situation, the measurement of spin of one electron in one direction say positive direction of z-axis, the spin of the other electron will be in negative direction of z-axis. If one measures the spin of the first electron be in positive x-axis, the spin of the second electron will be in negative direction of x-axis. So the electrons in an entangled state may have arbitrary spin states. Consequently the electrons lose their *identity* in an *entangled* state. We have thus a situation in microscopic domain where one think of identity and difference as equal elements in reality (quantum reality).

The electrons in entangled state are connected quantum mechanically (the two electrons are tied by a single quantum wave equation), which is different from connectedness for everybody objects or classical objects. This connection in microscopic domain is known as nonlocal connection. Of course, the concept of *non-locality* is a metaphysical concept. The concept of connectedness is supremely important in any inquiry into the nature of reality and knowledge.

Concept of Non-locality and Relations

We have already mentioned that the concept of non-locality is a fundamental aspect of quantum theory. Here, the quantum correlation or simply a relation exists between the quantum objects which is absent in classical domain. So the philosophy of relation is extremely important in an inquiry into the nature of reality in microscopic domain or more specifically in the context of "quantum reality".

Ultimate Reality – Quantum Fields

Scientists are interested in the ultimate reality of the universe which has two distinct components – the phenomenal world revealed to us through the development of more and more sensitive instruments. The mental world consists of thoughts, feelings, sensations etc. revealed by our minds. In our attempts to understand the phenomenal world (or physical world) we recognize the four concepts namely matter, space, time and causality. We usually follow top-down approach starting from larger objects like Galaxy, Quasar, planet, star, sun etc. to the smaller objects like molecule, atom, electron, proton, quark etc. The advancement of quantum theory leads us to formulate the framework of Quantum Field like electromagnetic field in a comprehensive manner. As of today, the universe consists of the fields like electromagnetic, Gravitational, Weak and Strong field which are universal and it is their mutual interactions that are responsible for all the phenomena.

Origin or the Universe

The most important question is: How did this Quantum Vacuum with the energy fields arise? How did Space and Time arise? There are two views on this question of origin. One view is that it has been like this for an infinitely long time and we will never know the answer. The other view is that the universe was born 13.8 billion years ago according to what has come to be known as the Big Bang theory (Details in Chapter 1). The steady state universe is not popular since it does not give a definite answer. The Nasadiya-sukta of Rig Veda gives a speculative account of what could have been the scenario {if we can call it scenario) before the sudden creation of the universe when neither space, nor time nor matter was there'. The Sukta is given in Appendix I. It depicts how helpless we o in this matter.

Among the schools of Indian philosophy that we have discussed in this book, it is only the Jain Philosophy that is similar to the Steady State theory in science which does not give importance to the beginning or end of the universe. The other essentially Vedanthic philosophies , the Advaita, the Yoga and the Kashmiri Shaiva philosophies believe in a Creator and of origin and end of the Universe . According to these philosophies the universe that we are living was

created 4.52 billion years and has passed through many cycles of the four Yugas the Satya, Treta, Dwapara and Kali yugas of approximately 5000 years each at the end of which the whole universe dissolves and restarts after an unspecified period of rest or inactivity. We are presently in the Kali Yuga phase of one of the cycles. Interestingly, according to the vedanthic philosophies, the creator himself is the universe... In Advaita philosophy the Creator is known as Brahman, and in Kashmiri philosophy, he is known as Shiva and in Yoga philosophy as Consciousness, space, time and matter over the entire universe are all nothing but the manifestations of the creator. In Buddhist philosophy the universe manifests itself from fluctuations of Shunyata or Empty Space in extremely short time intervals (Kshnika).

Also in all Indian philosophies , there could be many universes besides the one in which we are and these could be in different stages of evolution. The Vedanta philosophies, talk of creation as having started from a Bindu (point) which exploded (Spanda) that caused the expansion of the universe. The force responsible for this was identified as Prana. The four Mahavakyas of Upanishads identify. consciousness = Bramman = Atman (soul) = universe = I . Which may be Summarised as "Everything is Brahman" ....Essentially Oneness. These ideas on the creator and creation by ancient Indian philosophers are based on introspection in higher mental states which could be achieved through meditation and other mental exercises. Perhaps they could transcend the limitations of the ordinary human mind, which is limited to perception only in three dimensions of space and one dimension of forward moving time.

Dimensionality of Space-Time and Experiments

It is worth mentioning that in special theory of relativity Einstein introduced the concept of four-dimensional space-time for consistent description of the physical phenomena. However, all the experiments are designed in three dimensional spatial world or in one dimensional temporal world. On the other hand Indian rishis, siddha, purushas could transcend the limitations of dimensionality in their meditative states. Some attempts have been done to describe the physical Universe in higher dimensional space (higher than four dimensions). This may help to formulate a comprehensive framework for the quantum vacuum or the substratum so that the various attributes of various fields will emerge from the fluctuation of this substratum. This substratum of quantum vacuum is full of potentialities out of which all these attributes arise.

This concept of quantum vacuum as the ultimate reality is not exactly similar to the concept of "akasha" in Advaita Vedanta. In case of "akasha", when "prana" perturbs, all the physical attributes arise – even space, time etc. On the other hand, one needs the concept of well defined space-time to describe quantum vacuum because quantum fields need well defined space-time for their support. Scientists are attempting to go further down the hill so that even notion of space-time can be built up from more primitive notions – popularly known as pre-geometric

notions. Abraham and Roy introduced a spatial networks starting from a set of isolated bindu or points associated with quantum fluctuations which give rise to a continuum space-time with well defined structure. Here, each entity is interconnected may be due to the existence of "non-locality"- one of the fundamental tenets of quantum theory. It is to be mentioned that Penrose and Smolin introduced a spin network from which they tried to understand the structure of space-time in everyday scale. Moreover, it is to be noted that the concept of "spanda" in Kashmiri Shaivism is introduced in order to understand the creation of various physical attributes. Again "spanda" should not be confused with the conventional notion of "vibration of sound" since one needs physical medium for the propagation of vibration of sound. According to Indian philosophy there was "sound" in the beginning and then comes light etc. It is usually thought that there exists a ether like medium but characterized as "soniferous ether" and then comes "luminiferous ether" in the next stage. In Kashmir Shaivism "spanda" or "vibration" is introduced in the beginning and no concept of space , time were there. So the concept of "spanda"is different from the "fluctuation of quantum vacuum" or the fluctuation of the substratum since there exists well defined space-time structure in this substratum. This is due to the fact the all types of quantum fields need support of well defined space-time structure and quantum vacuum is full of these quantum fields.

These considerations arise when we can talk of "ultimate reality" in modern physics similar to that considered by various schools of Indian philosophy. In the context of quantum field theory prominent scholar Cao defined the ontology of a physical theory: "as an irreducible conceptual element in the logical construction of reality [that] is concerned with a real existence, that is, with an autonomous existence without reference to anything external". In this sense quantum vacuum may be considered as ultimately reality in the physical universe. Each school of Indian philosophy acknowledges an Ultimate Reality that is eternal and unchanging.

Prominent Jaina scholar Padmarajiah adopted fivefold classification as guiding principle to understand the nature of reality in Indian philosophy. This classification includes almost any school of Indian philosophy. This fivefold classification can be described as:

- The philosophy of Identity or Being.
- The philosophy of difference or Becoming.
- The philosophy of identity –in-difference where, identity-in-difference as the ultimate reality considering identity as more primary than difference.
- The philosophy of subordinating Identity to Difference.
- The philosophy which considers identity and difference as equal elements in reality.

The issue of connectedness was briefly described by Padmarajiah in the following manner:

I. Whether it is an independent entity alongside the various things of the universe or

II. a mental construction imposed on a disjoint heap of reality of the human mind or
III. something which is objective, without being an entity and an experience, which is not merely subjective.

It raises the important point whether the connectedness or relation is objective or mental construct or a structural manifestation of Identity-Difference in reality?Various schools like Vedanta (Advaita) fall in the first category i.e. school of identity while Buddhism belongs to the 2nd one i.e. school of difference. The third category includes Sankhya, Bhedaveda and Visistaadvaitavada. The Vaisesika and Dvaita (Madhva) fall in the fourth category while Jainism. In the fifth or last one. The above classifications help us to find some fundamental concepts in modern physics as strikingly similar to those found in traditional Indian philosophy.
A description of ultimate reality is given in Rig Veda where a metaphor of a golden egg or Hiranyagarbha is considered to be the source of all existing beings and worlds:

At first was neither Being nor Nonbeing.
There was not air nor yet sky beyond.
What was its wrapping? Where? In whose protection?
Was Water there, unfathomable and deep?
There was no death then, nor yet deathlessness;
Of night or day there was not any sign.
The One breathed without breath, by its own impulse.
Other than that was nothing else at all.
Darkness was there, all wrapped around by darkness,
And all was Water indiscriminate. Then
That which was hidden by the void, that One, emerging,
Stirring, through the power of ardor (tapas), came to be. (Rig Veda 10,129)

It is to be noted that two important aspects are mentioned here as:

1) *Primordial water produced the One; and*
2) *the whole process was realized by the power of tapas.*

Oneness

This idea opens the way towards the notion of One (a primordial matrix that encapsulates all existence) and also toward asceticism, seen as a cosmic creative energy through which the unmanifested becomes manifested. It also points out an important aspect i.e. aspect of impersonal reality against personal beings and the origin is traced back to this primordial

impersonal entity. In Upanishads, the Ultimate Reality is Brahman which is at the origin of any physical, moral or spiritual activity. It is depicted beautifully in Vedic Hymns:

"As the spider moves along the thread, as small sparks come forth from the fire, even so from this Self [Brahman] come forth all breaths, all worlds, all divinities, all beings. (Brihadaranyaka Upanishad 2,1,20)."

In Buddhist philosophy there are two major schools: Theravada Buddhism and Mahayana Buddhism. According to Theravada school there is neither personal god nor a spiritual or material substance that exists by itself as Ultimate Reality. What we see is a product of transitory factors of existence, which depend functionally upon each other.
Buddha said:
"The world exists because of causal actions, all things are produced by causal actions and all beings are governed and bound by causal actions. They are fixed like the rolling wheel of a cart, fixed by the pin of its axle shaft. (Sutta-Nipata 654)"

The Ultimate Reality is nothing but a transcendent truth, which governs the universe and human life. According to Mahayana Buddhism, Ultimate Reality is also an ultimate truth, the truth of emptiness. Teachings of great Scholar Nagarjuna claim that each substance loses its Intrinsic existence or svabhava at the level of Ultimate reality. The doctrine of emptiness affirms that the world is to be seen as a web of interdependent phenomena having no intrinsic attribute. However, they considered two truths : conventional truth and ultimate truth. The svabhava or intrinsic nature of the object is supposed to exist at the level of conventional everyday level but does not exist at ultimate level. There is another important aspect of quantum vacuum considered as 'ultimate reality" in modern Cosmology which needs to be elaborated and be compared with Ancient Indian wisdom. In the Substratum or quantum vacuum no such attributes of various fields like electromagnetic field, Gravitational field etc are considered explicitly. They are considered to remain there in the form of seeds or potentialities. The challenging issue is how these potentialities give rise to physical attributes in the phenomenal world created out of the fluctuations. Modern cosmology is not in a position to give the answer for this issue. It is like how Saguna Brahman comes from Nirguna Braham. Anirvachaniya means a thousand answers given cannot explain in terms of known.
However, this kind of issue was discussed in Indian philosophy. Shankara tried to settle the relation of the Absolute Brahman (Nirguna Brahman - the One without any definable characteristics) with the origin of the world by proclaiming two distinct points of view: the absolute (*paramarthika*) and the relative (*vyavaharika*). In an absolute sense, Brahman is above any duality and external relation; nothing real exists outside him. But from our empirical and relative point of view, Brahman is the cause of the universe we know. In fact there is no real

causality; illusory sight of Brahman. Here, the universe is only a phenomenal appearance (*vivarta-vada*) of Brahman and not his transformation (*parinama-vada*).

In Trantra (possibly have no Vedic origin) the Ultimate reality is the god Shiva together with his divine consort Shakti, form a state of primordial unity and unmanifestation that corresponds in the Advaita Vedanta to Nirguna Brahman. The world and the human beings came into existence through the dissociation of the primordial unity of Shiva and Shakti :

Out of the combining of the spirit, that is Shiva, with matter, that is Shakti, and by the interaction of one on the another, all creatures were born.

Appendix I: Dialogue between Physicists and Indian Philosophers

In the context of the unresolved issues common to physics and philosophy, a half a day Symposium was organised at end of an International Conference held at NIAS on 12 December 2015 .The symposium was essentially in the form of a dialogue between scientists and philosophers. The audio recording of this symposium was made and the following are the transcripts from voice recording.

Introduction

The following, eminent scholars representing different schools of Indian philosophy participated as panelists in the symposium.

(1) Swami Atmapriyananda,Vice Chancellor, Vivekananda University, Belur
(2) Geshe Dorji Damdul, Director, Tibet House, New Delhi
(3) Dr. Madhu Khanna, Visiting Professor, Jamia Milia University, New Delhi
(4) Prof. NN Bhandari, Emeritus Professor, PRL, Ahmedabad
(5) Prof. R G Bhat, Vice Chancellor, SVYASA, Bangalore.

Prof. Sisir Roy (Physicist) led the discussion and Prof. B V Sreekantan (physicist) chaired the session and Prof. Shivanand Kanavi (physicist) moderated the floor participation.

Prof. Sisir Roy :

(i) **Quantum Vacuum & Origin of the Universe and Sunyata**

Let us raise the question whether the problem of the origin of the world continues to evade philosophers and theologians and passes completely to the realm of science, physics, astronomy and cosmology? Or whether science by itself also is not able to solve the problem. In the later case one would have to acknowledge that metaphysics, philosophy of nature and epistemology, provide important premises, assumptions and thoughts in principle for the solution. There exists several conceptions regarding the origin of the universe: Out of "nothing" or out of "vacuum"? In Christian theology and European philosophy supernatural concepts of creation out of nothing, required reference to God? Albert Einstein discovered a rigorous framework called The General Theory of Relativity where the origin and the structure of the universe were discussed in a

comprehensive manner. Stephen Hawking proposed that matter, time and space arise out of nothing and therefore at the beginning of the world is also, the
beginning of time. However, since General Theory of Relativity cannot suggest any mechanism of transition from the state of nothingness to the state of existence of the universe, the conceptions of creation out of nothing needed to adduce quantum principle. According to the recent formulation of cosmology, that is the origin and structure of the universe, the universe originated from the fluctuations of the quantum vacuum. Vacuum in modern physics is supposed to be devoid of any matter. However ,a Whirlpool of activities in the substratum suffuse with energy according to quantum theory is operative. According to Heisenberg's Uncertainty Principle,of energy and time, it is possible to have enormous fluctuations of energy during a very short duration of time and these fluctuations of energy will give rise to the fluctuation of Quantum Vacuum popularly known as Quantum fluctuations which in turn give birth to the physical universe. It is worth mentioning, that Heisenberg's Uncertainty principle is assumed to be valid for all space and time. From a philosophical perspective, there are two conceptions here; (i) those which assume that the universe aroses from nothingness and (ii) those which lead to the conclusion that the universe originated from a certain poorer physical reality namely Quantum vacuum or space-time endowed with fluctuations.

In the latter case, that is as per modern cosmology, the universe arises in the process of fluctuations of quantum vacuum, not out of nothing but out of certain physical reality. The vacuum or ontologically speaking, a substratum exists devoid of any matter but cooler activity or potentiality and these potentialities give rise to various attributes of the physical universe. For example there exist four fundamental forces in nature, electromagnetic force, gravitational force, strong nuclear force and weak force and these fundamental forces are assumed to be the result of corresponding fields like electromagnetic, gravitational field etc. And each field has its distinct characteristics. These characteristics are supposed to be some kind of imprints or sheaths in quantum vacuum. So these characteristics or attributes arise out of the fluctuations of the quantum vacuum and potentiality. Here scientists need to answer how attributes of the physical universe arise out of the fluctuations of the quantum vacuum, where seed or potentiality is in space time endowed with fluctuation without having any specific attributes of the various fields. It is possible that underlying space-time, as a substratum may have a large number of dimensions, then simply transforms into four dimensional one. The large number of dimensions, more than four dimensions in the underlying substratum may help us to understand the mechanism in a very effective way in the physical universe. It immediately raises the challenging issue why space-time is endowed with four dimension in the manifested universe. Einstein introduced the concept of four dimensions in his Special Theory of Relativity to envisage the observer independent reality. It is amazing to know that whenever we like to measure or observe we can do only in three dimensional world of space and one dimensional world of time. It is projection of four dimensional world on to three dimensional one, we perceive and measure. It is

not possible to make any observation in four dimensional world where actually the physical action is. It is like acting in a higher dimensional world and observing in a lower dimensional world. It is worth mentioning, though several concepts of vacuum like true vacuum - false vacuum are proposed in modern cosmology; some of them is `nothingness' in the strict ontological sense of the word. In the context of the issue, of creation of the universe out of nothingness, tunneling to nothingness or fluctuation of nothingness is not merely scientific thesis. Not even one considers the concepts of energy, mass, space ,time, as the characteristic of nothingness but that of space-time, where we should recognize the laws of nature at the very beginning according to which 'nothingness creates the world'. In Kant it is assumed the existence of something called the world of logic and mathematics and explanation of the origin of the universe, cannot do without assumption of the structure of rationality. In understanding the question of the beginning of the universe, the involvement of philosophy is inevitable in the following sense. Cosmology as an empirical science is involved in the structure and volition of 'known, un-observable' part of the universe like correctness of inflation and not the universe as a whole. For example, we are not able to get the correct initial conditions from scientific point of view. It is to be noted that extrapolation of local physics into the whole observable universe is done without any guiding principle which are basically of having philosophical character.

So what are the philosophical guiding questions for
"Is the emptiness of Quantum Vacuum, similar to the emptiness of the Buddhist philosophy or Akash in Vedanta?"

In Vedantic tradition the concept of space from Nirguna Brahma, attributes from the attributeless reality or potentiality in emptiness or Shunyata in Buddhist philosophy, may shed insight in understanding the manifestation of the attributes of the physical universe out of the fluctuations of the underlying physical substratum known as Quantum Vacuum. Is the fluctuation similar to Spanda in Kashmiri Shaivism?

Now we are inviting our panelists to give their insights from their traditions.

Swami Atmapriyananda(Vedantic Traditions):
I am supposed to represent the Vedantic tradition, which I probably do. I am very amused about this number five. In Vedanata and Samkya, we have Panchapranas, the five pranas, Panchakarmendriya, Panchagnanendriya, Panchatanmatra, Panchamahabhootas. So we have five panelists, five questions and five minutes given Pto each of them. What is the full meaning of five.So basically what I say is based on the discussion of this question by Swami Vivekananda, I was deeply influenced by 0qSwami Vivekananda's observations summarized for the Westerner philosophers. In the Samkyan cosmology, the idea of Akasha is something very interesting. Swami Vivekananda says that, the entire universe is composed of two materials, one of which is

called ***Akasha***. Akasha perhaps is very similar to the Ether, the omnipresent Ether, with all pervading existence, everything that is in the form of matter resolves into Akasha at the end of day. What is the power by which this Akasha is manufactured into the universe? There is another principle which is called ***Prana***. This Akasha is infinite, omnipresent material, this Prana is infinite,omnipresent manifesting power. At the beginning and the end of the cycle, everything becomes Akasha and all the forces of the universe resolve back into Prana. This is the cycle. Out of this Prana is evolved everything we call energy, everything we call force. The Prana is manifested as motion, Prana is gravitation, magnetism and even the wave currents, the motions of the body, thought forces and so on. Sum total of all the forces in the universe, mental and physical, are resolved back into the original state, is called ***Prana***. Swami Vivekananda even quotes from the ***Nasadiya Sukta*** **(see Appendix 1)** which is one of the earliest attempts of the human mind to understand the mystery of this creation, of this universe ., the origin of the entire structure which we see. ***It asks when there was neither ought nor nought, when darkness was covering darkness, what existed then?Then Akasha existed without motion.*** So the theory is the Akasha existed without motion, *still* and the Prana was existing as the energy in the potential state, for some reason which we do not know how, there is a vibration of this Prana in the Akasha. When Prana vibrates in the Akasha, then all matter is produced. So this is the theory which Vedanta posits from the Samkyan cosmology and Vivekananda goes on to say, a person who has controlled the Prana has controlled the body and all the bodies that exist and the Prana generalized manifestation of force. And the technique of Pranayama in Yoga about which our Porf. Bhat will speak in detail. This is a technique by which you can have Prana under control. Vivekananda concludes by saying, that, if I can bring myself into a quick vibration of the Prana to the highest cells of Prana, the material of which the whole universe is composed, the fulcrum of Prana, then we differ only in the state of vibration, if I bring myself to the highest state of vibration then different states of consciousness in which I will look at the universe as emerging from Akasha to the vibration of Prana. This highest state of vibration is included in one word in Yoga, which we call ***Samadhi***. All the states of high vibration, super conscious vibrations of the mind, are grouped in that one word Samadhi. The noble states of Samadhi give us the visions of these beings and the higher guides of Samadhi are when we see the real structure of the universe, the principle behind it, we see the material of the whole universe and the world of these greater beings are composed and one lump of clay being known, all other clay in the universe becomes known. So this is the question that is asked in the Upanishads, ***'What is that by knowing which, everyhting can be known?'*** ***"kasmin nu bhagavo vijñāte sarvam ida vijñātam bhavati iti.***'which the modern science is now asking through String Theory, the modern science is asking the question, 'How nature can be so established, it has two different sets of rules for the microcosm and the macrocosm? Is it possible to have one particular theory by which the entire universal phenomenon can be explained, both in the micro level and in the macro level? And as you know, the answer to this question, is eluding us and the search for the ***Holy Grail*** is still on.

Mdhu Khanna (Kashmiri Shaivism)

Modern physics believes that the universe originates from the void, technically described as the fluctuations of Quantum Vacum. This is the condition of the universe which is devoid of all matter but full of potential energy where there is enormous fluctuation. It is, this fluctuation of Quantum Vacum that gives rise to the physical world. I see parallels of this view in the ontology of Kashmir Shaivism. The most important philosophical axiom is that there is one universal consciousness, called *cit*. This one essence is the substratum that permeates the macro and micro levels of creation. This singular universal principle is called Anuttara, the Unsurpassable One, Param Prakasha, the Effulgent light. Theologically this Absolute principle is variously described as Shiva and Shakti, the male and female principles; Svatantrya or 'Freedom', Spanda or 'Vibration', Urmi or 'Wave of Awareness'. Shiva is the single all-inclusive Transcendent essence who is the concentration of infinite powers, namely, *cit-shakti* or the unconditioned power of self awareness or Universal 'I' hood (*purnahanta*); Ananda – Shakti or the Power of Bliss, eternal plenitude, identical with his power of unbounded freedom called *svatantrya*, or his cognitive energy *samvid-Shakti* to savour his unimpeded freedom to ever satiate his desire to create the universe. The first, is the Power of Will (*Iccha-shakti*), the irresistible creative impulse, called *spandan*, vibration, or *sphurana*. The next is his Power of Cognition (*Jnana-shakti*) which empowers Shiva to perceive plurality within its unity. The next is the Power of Action (*Kriya-shakti*) through which Shiva can assume any form of phenomenal existence from the very subtle to the concrete.

In the pre creative state of the universe Parama Shiva is identified with the ontological *Shunya*, preceding all worldly manifestation. Shiva is *Shunyata* or the abode of void, of supreme consciousness. As such it is supportless, of undifferentiated nature, which both expands all the categories from the potentiality of plenitude and dissolves the universe into itself. The Shaivites believe that both fullness, plenitude and voidness or emptiness are both integral to one another. There is only *cit*, as Shiva, the cognizer, the *atman* or the real self is identical with the Absolute. The *atman* is neither the body as the Charvaka's claim, nor *prana* as the Vedicist's claim; nor is it the category of *buddhi* as held by the Yogacara Buddhists; nor *shunya*, as claimed by the Madhyamika Buddhists. It is simply a partless form of consciousness which may be described as *Shiva-vyoman*, a void called Shiva, beyond *pramana*, where there is no duality (Shiva-sutra 1.1.). Creation takes place in three stages. In the first stage Shiva's potential power Shakti, activates the quiescent state of the void and there is the splitting of the seed (*bija/ bindu*) of creation by the force of desire. *Shunya* modifies into Shiva and Shakti, the two in one. This is the seed state of creation. The transformation of original unity takes place through Shiva's three energies of will, knowledge and action. In the second stage, Shiva's infinite powers get contracted and Shiva through his energetic power, Shakti divides and veils the immensity of creation which begins to give rise to microcosmic consciousness or psychical tattvas (*Kanchukas*) that obscure one's

perception of wholeness. In the third stage, the external projection and expansion gives rise to the multiple world of diversity projecting its 24 gross categories of the material world. What is important to note is that *cit* or consciousness extends in the form of gross matter as there is no existence of objects apart from consciousness. Therefore, the world is, in reality, pure consciousness. The plurality of objects we see in phenomena are known by the same consciousness. Consciousness in its gross form may be seen as parts, but these parts inhere wholeness of consciousness and, indeed the whole is made up of parts all the levels of creation are an expansion of the one, at the stereological level when the aspiring yogi experiences the identity with the universe as consciousness, she is described as entering the expanded state of awareness of the great void of *mahashunya*. So, the notion of *shunya* in this tradition encapsulates both, the macrocosm and the microcosm.

Sisir Roy: We are listening Shunyata and Akasha, maybe, I will ask Geshe Dorji Damdul to elaborate from Buddhist point of view.

Geshe Dorji Damdul(Buddhism): First in the canonical texts there is a mention of ***what*** is known as the whole cosmic evolution in four phases. One is the vacuum state, the formation state, then abiding state and the dissolution state. So these are the four phases that we keep within mind. Vacuum State, Formation State, Abiding State and the Dissolution State – dissolution or destruction. At the moment the universe is going through the 'abiding state' and at the same time, keep in mind that when I say these four phases are just confined to, it is not confined to the entire universe that's not true. In the Buddhist context there is what is known as the "whole universe" is something which we *cannot really comprehend fully*. B
What we call as, galaxy in simple terms in modern physics, is only a part of the universe. Like that, the universe is divided into smaller factions, so one of which, could be in the phase of one, of the four phases, say the formation phase and the other part of the universe could be in the destruction phase, still others could be in the vacuum phase and the others in the abiding phase. It is just like say there are some waves coming going up, some waves going down and all together is just zero. It is not zero, it is everything there but then we have to confine within the realms of evolutional universe. It is not that the whole universe as such but a small fraction of the universe, say, the universe which is visible to our eyes at this moment, visible to the science, so just these four cases. At the moment in the case of the universe we live in, we are in the phase of the abiding, abiding phase, which means that we flourish and human beings are formed all these things. This experience of abiding in the universe, is preceded by the formation of the universe, evolution, formation. So this formation of the universe, if you try to look at the Big Bang Theory, it is very much in line with that. Bing Bang, say initially all the singularity, it simply burst, it exploded and then slowly it further expanded. Initially all the singularity, it simply burst, it exploded and then slowly it burst into so many small factions and solar system is one of them. And the solar system in the sense is the sun, our sun and the sun also bursts and it got into 9

pieces or 8 pieces, so which makes the planets. So that everything cooled down. And then everything started to rise. So that is the formation phase. Then very interesting question. If it is exactly in line with the Big Bang Theory, his Holiness the Dalai Lama, his style of everything, any philosophy, any concept, is very skeptical and at the same time very rational. So he would argue, say, while there are different versions of the universes within Buddhism and of course other one of which is there is Mount Meru in the center and four corners on th side and His Holiness says this is a disaster. This concept, although it may be said in one section of the Buddhist philosophy, it is a disaster; it totally goes against the reality, which is observable reality. If the Mount Meru exists why not its shadow been seen. The fact that it's shadow is not seen and the fact that now we see the truth of the solar system with the sun in the centre and the nine planets or eight planets. so from there can we say that this part although it is said in the Buddhist literature, but this is not true. We don't have to accept things blindly, which contradicts reality we have to abandon that. So this is the courage of His Holiness The Dalai Lama. Then a question arises, if we are in the state of abiding of the universe which we experience, then the formation is, we can go back to the Big Bang Theory, to the big bang time. So now how the big bang thing came into being, this is the question, this singularity, how it exploded this comes into being. This explosion came into being, the question is whether single Bing Bang or multiple Big Bang. This is another question. This is being debated, hotly among the physicists. So Buddhism accepts the multiple Big Bang, because for a single Bing Bang, then the question is asked by Stephen Hawking himself. How does this intense energy, the singularity, how does it know, I have intense energy, I cannot bear it anymore. How does the energy know that? Without knowing it, how can it explode? So in the first place, why it should explode, even if there is too much energy, why not contain it? These are all the questions which remains unsolved by the physicists. So now, from the Buddhist point of view, this is also known as say; National Institute of Advanced Studies this TATA, his vision, I should support the education system of India, I should really support the highest standard of education in India. So National Institute of Advanced Studies should come into being. And may be the collaborators they were supporters, they were the brains with him. These ideas, they are the intention; this intention was responsible for making this huge massive structure, very beautiful massive structure, come into being. So now this energy…how this singularity comes into this big explosion is determined by the intention. Now what intention? Don't take it abstractly, intention of the beings..not as a universal cosmic being..no..no.. we are individual beings..say if I am hungry, if I am sick, then all others are happy, then I have to go to hospital myself. This is my individual being, that's it. So there's at the same time what's known as the collective motivation, collective intention, meaning all these individual beings come together, they decide, let's say have an NIAS, so this not a cosmic but individual beings, they come together, they came over the idea let's have this Institute, it's so important, I really support you Mr.Tata. Then everybody came into being. So this is known as the collective…it's not one with joints or the cosmos, the consciousness or the intention. Individual intentions, they come in unanimously, they come in consensus, they come together

and this is known as the collective intention. Likewise all those beings who have to party, partake in this solar system, planet earth and partake say the milky way galaxy, how many of such solar systems, even science cannot explore at this moment. According to Buddhist tradition it is mentioned that, this solar system is not confined to just one small solar system, it's numerously there in this same Milkyway galaxy. So all these things, their intention, collectively created as an intention to explode as a singularity and which is responsible for in creating this universe. Then there is question. So if it just started by this singularity, what's the material like? So in Buddhists there is Shri Kalachara Tanta there is what's known as Space Particles. Space particles. Infact a world renowned physicist David during one of my meetings with him, he was asking me .oh..very interesting topic known as, Space particles, in Buddhist cosmology. So what's it like. He was so interested in it. So that part will be very interesting as to what triggers or what is the basic material for the singularity from the Buddhist point of view. And then there many other things. I will stop here.

Sisir Roy: Now we listen to Prof. Bhandari fro Jain perspective.

Prof. Narendra Bhandari :I would like to present the Jaina view of what are the answers to these questions. But before I go into it is important to see what is the Jaina framework within which we can answer these questions. You see Jainism has a well developed structure and theory and framework. So I will bring out first a few points before we come to the question of the origin of the universe. The first thing Jainism propounds is that all questions cannot be answered in 'yes' and 'no'. So it can be 'yes' or it can be 'no', it can be either or it can be neither or it can be indescribable. So there are seven possibilities and Mahaveera who introduced this concept of ***Syadvad*** some 2600 years ago told his monks, 'So now you have taken a oath to tell the truth. So please to every answer attest a contextualtiy, because no answer is complete and no answer is correct, unless it is given in the proper context. So here I see lot of, everybody is interested in searching the ultimate Truthy, so we should always mention the context, that is what Jainism says. The second point is perspectivism, the perspective, the frame of mind with which you see a thing. So everything is partially correct only, not completely true, depends on the perspective with which this answer is being given. Now the main point is every substance, everything has two aspects according to Jainism, one is the '*substantial aspect'* and the other is the '*mode*'. The 'substantial aspect' is eternal. Eternal means it is not created nor is it destroyed, but it goes through a change. And the mode is one which is created, which is changing, which is persistent through change and which is destroyed. And the example is the body, you see all the cells are created and die every minute, but some substance remains. So when we talk of anything we should see through substantial point of view and from the modal point of view. The mode will be created, will be persistent for a while and will be destroyed. Whereas the substantial is eternal and continuous as it is. Now Jainism, the Jain philosophy, strongly believes in law of conservation. **It does not agree with many of the ideas given here that you can create**

something out of nothing. That is impossible. In the very beginning, when they gave a lot of thought to cosmology they said that everything is conserved and they have proposed six substances which are essence. You know I said that everything has a substance and a mode, so anything 'x' is equal to 's+m'. Now what is the substantive? If you analyze it, then ultimately you will find six substances, out of which, everything is made. One is of course ***Akasha***, but that Akasha is not the one out of which the universe is made. It is only a void which gives you place to exist. The other is **Paramanu,** that is out of which the whole material universe, the physical universe is made. The third is **Atman,** the soul or Jiva out of which the lifeforms are made. So you cannot have materialistic origin of life. Jainism is strictly against it. And you cannot produce one from the other. So you cannot produce matter from soul or soul from matter and then there are two other substances, one is called Adharmastikäy and the other is called Dharmastikay. These are supposed to be agents of motion and rest, and we will come it to later on. The last one is **time**, but time whether it is substance or not, there are multiple views and we will discuss when the question of time comes. So finally the universe will boil down to these six substances and time. The other important point to remember about Jainism is, that science believes that there is something known about a thing and something unknown. As we study, the unknown is converted into known and eventually a scientist will hope that everything will be known. But Jainism is quite different in this concept. It says there is something known, something unknown and something unknowable by sensory organs, because they believe that sensory organs and mind are imperfect. They are always under training. You can train them and have a much better mind, better equipped mind; science comes under this because it is an instrument of mind. So you cannot know everything by sensory organs or by mind or by science so there is a thing which is indescribable which can only be experienced. So these are few points I thought first I will bring them out before we come to the main question of how the universe originated. For one thing different from some other schools. The Jains believe the universe is real, it is not a Maya or it is not an illusion and not something which is just apparent. It is real and the Jain universe is actually a multiverse or you can say it is a tri-verse made of three kind of universes, one in which we live – the ***Manushyalok***, the heaven and the hell and it is always in triplets and there may be many such triplets as such and there is a structure and all that. But everything in the universe is conserved. All these six substances I said are conserved. There is you know. I was thinking when this proposal of Shunyavad in Buddhism it is given lot of importance, **how you can create the physical universe out of nothing?**

So the only way, because everything is not written in the language we are accustomed to, you can always have the freedom of interpretation. Then you come to Paramanu, out of which the whole universe is made.. so what is Paramanu? They have discussed it at length about Paramanu, about its velocity, about its vibrations, about its motion..but two things are relevant here. **One is that Paramanu is massless and the other is that Paramanu has no dimensions**. That can be a concept of Shunya ..it is nothing actually, it has no mass, it has no size. At the same time it is

mentioned that one Paramanu can occupy one unit of space ..they believe it as a unit space.. they call it ***Pradesha*** , a unit time, they call ***Kalanu.*** A unit matter they call ***Paramanu***. One to infinite Paramanus, can be accommodated in a unit space. It is like Bosons as we know in Physics. So Paramanu is nothing but a Boson. Of course this concept is there since the beginning. The only way you can produce the universe out of Paramanu and Paramanu is actually nothing, because it has no dimension and no mass. Now universe has a substantial existence, a substance and a mode. According to Jainism the universe is changing every instant. You do anything, you put one stone from one place to another, the state of universe has changed. So changing that s=x+m the mode is changing every minute, but 's' is something which persists. So what I would like to say is that I don't know how I can make out of Quantum Vacuum. The only possibility is the Quantum Vacuum is the substrate out of which the universe is formed and dissolves again. Then it will be eternal, you can form the universe and dissolve it and that is the only way it can be accommodated. I would like to say that the Jaina universe requires the six substances, each one is eternal, it is more or less sometimes likened to Steady State theory. It is eternal, it cannot be destroyed ..it persists through.. it will exists for all time and I just try to give you some way in which can be produced from ***Paramanu*** which can be equated to Shunya or it can be..it is a multiverse …which can be created and destroyed ..but some plenum or some substrate continues to exist forever.

Sisir Roy: Ok. Thank You. Let's now listen to Yoga view by Prof. Ramachandraji

A***Dr. Ramachandra Bhat (Yoga Philosophy):*** My basic concept about Yoga, it is purely spiritually rooted. It is not so called popular yoga as it is popularly defined and projected. When we take up very important subject domain as cosmology, there are many schools of thought, apparently talking in different tones and tunes, but, they address one important thing which is the root for this appearing world that is ***supra-clinical consciousness***. Consciousness where all those schools of thoughts, whether it is Veda based, Upanishad based or non-based, all have this very comprehensive concept about cosmology. All those different schools of thoughts have the same question to address. This very statement we come across in the Mandalas, Rig Veda, Nasadiya Sukta. Even that guiding consciousness, whether that can also understand this subtlety of the origin of this wonderful world, this is again a question. That's how the Vedic Rishis have this type of statement everywhere. But all different schools, even the Vedas, the Samhitas, the Brahmanas and in turn Upanishads, there we see that quest for unearthing this subtly, mystery of this universe. So for me ***Kathopanishad*** is the main reference, Akara Grantha, for yoga. What is there about cosmology? That's what I have to ponder over. Here I have to present that. Yoga is not that yoga, it just limited to some popular ***granthas***, but for me all ten mandalas of Rig Veda, they are the source books for yoga, with special reference to Kathopanishad, that is ***Atma Yoga***, because Rishi proclaims it, Adhyatma Yoga. ***Adhyatma Yoga*** has got all these wider areas to address. Otherwise if you take this popular yoga, it is only now, it has become so much physical. No. It is vedantic source yoga, what I am projecting, it is spiritually rooted. There cosmological

hints are projected; so Katopanishad tells, you know dialogue between Yama and Nachiketa. Nachiketa has got wonderful young mind, so he represents so called modern young mind also that's why he has got so many questions..he wants to unearth the reality … he wants to unfold the mystery of this universe .. so he got that question. …. What is beyond time, what is beyond place, what is beyond everything, what is that? If I know that one, then I can understand what is the root cause of this wonderful universe.

That's what his submission, young mind's submission. Answer is like this (Sanskrit verse (1)). That's how this unearthing process goes from gross to subtle, gross to subtlest, that is consciousness. Consciousness is the root. The same reality is projected in different languages,

Chandyoga says it is *subtle, subtle* and some other upanishad says it is *Chit,Chit* and ***Taittareeya Upanishad*** says it is *Ananda*. But it is *Sat,Chit, Ananda*. Non-dualistic one, that is the root cause for this wonderful universe. That's what *Aruni*, the daialog between *Aruni* and *Svethakethu,* in the sixth chapter of Chandogya Upanishad says. So in all these contexts we arrive at some conclusion that it is very very mysterious, but at the same tune, it is beyond mind, beyond time and space. OK. But it is there. It is Sat. It is not so Shunya. It is not so much void or something or what we say. And words are different. Actually Shunya, that very word also it is not something, which just leads to *nihilism* .There that's where many times interpretation goes somewhere it is beyond that one. But nihilism all these different words are used that's why confusions are created..but it is again addressed into the same ***Sachidananda,*** that's the root cause for the whole world. That's where all Upanishads come together. It's not Upanishads come together, all different schools of thought also. That's what great Kashmir Advaita says only terminologies differ but concept is one and the same. So it is only words that are different, so in that context it is *'supra clinical consciousness'* . Supra clinical word, it has to be properly understood. When we start understanding the reality, it is difficult to go beyond mind and our Buddhi. It binds, that's the binding factor. That's why we so called modern scientists we leave it to so called clinical analysis. This clinical analysis is based on probing and probing. It has its own limitations that we have to understand first of all, now scientific fraternity is coming to that level. With all humbleness, all great scholars, they have come to that one. So I remember, there were 13 scholars sitting and 13 scientists sitting, we were in the 1989 in Shankarmutt where all great scientists were there, coming from different states. One great scientist, Visiting Professor to this Institute and he told ..we have many gross root level understanding like our tongue, it has its own function, our ear it has its own function .. it is called perception. But we know that tongue has its centre at brain level, that brain also it is very much dependent upon some other illuminating factor. What is that? Again we go on searching and searching beyond tongue and brain, beyond brain and again we go to mind, beyond mind there is something we call it as soul, beyond soul what is that, ultimately we arrive at consciousness, which is not clinically proved, not possible clinically now. Right now we, our scientists, science have not developed to that

level. That's why it is supra-clinical. But it is consciousness. So in this particular theory of cosmology different schools of thoughts Jainism, Buddhism all other schools of thoughts also come together. That's what .. (Sanskrit verse(2)).

The only different terminologies words are used but concept are one and the same.. so there we have to arrive at that conclusion, so it is Upanishadic, yogic concept of cosmology that is …(Sanskrit verse(3)).

That is the ultimate climaxical thing, that is the reality .. that reality we call it sometime Shunya, sometimes Sachhidananda sometimes Shiva or Vishnu or so many different terminologies followed used by different schools of thoughts ..but that's where we have to end. End in the sense it is only again start of our journey, there again we have to start, because *Nyayayika* says that how we go..one after one how we go.. (Sanskrit verse)..subject, object, subject we think later on, first we take objectivity..from objectivity our journey starts ..then it ends at subjectivity .. so*indriya*, then *artha, manaha,* then *Buddhi* then again it is consciousness, Atma. In Nyayayika schools of cosmology also we arrive at that conclusion…so my submission is to think more and more about consciousness and more and more research is needed to be there that is so much of a vast area where we have so many unanswered questions again ..Yadyapi.. Upanishads are there to answer our questions, but Upanishads again they are Upanishads ... meaning of Upanishads is it is secret and sacred. That's why this unearthing process in probing and probing must start.

Identity and Individuality

Sisir Roy :. The concepts of identity and individuality have attained lots of interest in Physicists and Philosophers in the 20th century since the Statistics of counting quantum entities like electrons, protons etc. revealed anomalies. Identity and Individuality has been discussed also by philosophers for many centuries. It is generally beleived that chairs, trees, rocks, people and many of the so called everyday objects we encounter can be regarded as individuals. The issue then how this individuality is to be understood or what constitute principle of individuality. Leibnitz stated, 'No two distinct things exaclty resemble each other.' This is known as 'Leibnitz Law'. The identity is indiscernible which may mean that no two objects have exactly the same property. Recent works on the interpretation of Quantum Mechanics this principle of identity fails in the quantum domain.

Metaphysicians are investigating the issue of identity with the question of what exactly identity means for something to be identical to itself. In the context of time, the issue of identity arises regarding its meaning for something to be itself across two moments in time. How one accounts for this? Then one asks what our criteria ought to be for determining identity? Moreover, how the reality of identity interfaces with linguistic expressions?

From metaphysical point of view, one considers the issue not only for everyday objects or the objects in the microscopic world but it has far reaching implications on issues like mind-body problem, personal identity etc. Identity is considered one of the most fundamental concepts in metaphysics. Otavio Bueno put forward several reasons why this is so fundamental. It can be stated as:

(a) Identity is pre-supposed in every conceptual system: without identity, it is unclear that any conceptual system can be formulated.
(b) Identity is required to characterize an individual: nothing can be individual unless it has well-specified identity conditions.
(c) Identity cannot be defined: even in systems that allegedly have the resources to define identity.
(d) Identity is required for quantification: the intelligibility of quantification pre-supposes the identity of the objects that are quantified over.

Various metaphysical topics were debated in traditional Indian philosophy. Two most important topics were causation and the nature of self. The traditional Indian theories of causation are classified by reference to the question of whether the effect is made of the cause. Accordingly there exist two principal theories of causation:

(a) The identity theory (satkaaryavaada) where the effect is identical with the cause, a manifestation of what is potential in the cause. This is Samkhya-Yoga view. Advita Vedanta holds a view which is considered a variant of the identity theory.
(b) Non-identity theory (asatkaaryavaada) denies that the effect pre-exists in its cause and claims instead that effect is altogether new identity. Both Buddhists and Nyaaya-Vaisesika are usually classified as non-identity theories but differ in the details.

Indian theories of self are traditionally also divided into two broad classes:

(a) Aatmavadins: who explain personal identity by reference to an enduring substantial self.
(b) Anaatmavadins: who deny the existence of such self instead taking a model view of reality.

So what's the question? The guiding questions for dialog in physics, both in classical as well as in quantum domain are the following:

Properties like charge, spin etc considered to be intrinsic property of the object.
In philosophy especially in Madhyamika philosophy in Buddhism no such concept of intrinsic properties exists in contrast to the Vedantic ideas. So what are the views on Identity and Individuality of the objects according to various traditions?

Athmapriayananda : With reference to the Vedantic point of view, the 'Individual' is the 'I'. And how does 'I' come about is the question that has been discussed in the Vedanta elaborately. The answer that they have found is that 'I' is the spurious notion that arises when consciousness comes in contact with matter. The *'Jadagranthi'* the knot which ties on the one hand with *'Jada'* is pure matter, the other consciousness is the *'Chaitanya'* so because of Jadagranthis there is a spurious notion of 'I' and this 'I' has no specific locus. Suppose you are asked, 'Are you well?'

'Oh, I am not so well' . 'What's happened to you ?' you say, 'I am not well'. The tooth is not well and therefore you say 'I am not well' That means you identify yourself with your teeth. Then if you say 'I am not well' because my mind is not well, you are upset or something. So the 'I' identifies itself as the body, the senses, the mind and with the intellect and so on. So there is no specific locus for this 'I'. So this 'I' question has been repeatedly asked. What is this individual? What is this individuality? and how the identity? Now, with the question of Identity. I am very fond of football. So playing football, I break my leg. I have a very important matter to attend after two days. I am in the hospital, resting, I can't play the game and I am very upset about it. I suddenly shouted 'GOAL'. Somebody asked what happened to him? Ah! I scored a goal in my dream. I scored a goal in dream is wrong because I am now with the fractured leg but I feel identical with the person who scored the goal. The Doctor comes and gives this sedative and then I go to sleep. But in deep sleep the experiences of my waking state and my dreaming state are completely negated. So which is the real 'I'? But I feel the 'I' is identical with the waking, the dreaming and the deep sleep states. There is a 'Super I' which is called 'Avasthathreya Sakshi' which witness all these and participates in the experiences of all these three states and that it is the experience of the one and the same person. So individuality is therefore is a spurious notion when the 'Supreme I' or the 'Atman' or the 'Brahman' they call it by any name The 'Supreme I' which operates through three modes of individuals – the waking, the dreaming and the deep sleep and this 'Witness I' which is a non-participatory supreme ego, but allows the participation of the three modes in three states of existence. There is a very interesting anecdote from Swami Vivekananda's life. There was a French actress. Her name was Hema Kalve. She was a great celebrity in those days. Just as all celebrities are, she was very upset , very unhappy, extremely frustrated and almost contemplating ending her life. Somebody told her that there is this great Indian Yogi in Paris and you can go and meet him. He perhaps may help you. She made an appointment with him and went to meet him. Swami Vivekananda did not even look at her. What a terrible atmosphere? 'Calm Down, Calm Down'. She sat down. Vivekanada started talking about some of the deepest secrets of her life which she had not shared with anybody in her life. She was flabbergasted. She was confused. This is magic or mesmerism. Tell me what are you doing to me. How did you know all this? Did anybody talk to you about me? Swami Vivekananda smiled and said, "Is it necessary? I can read you like an open book." Then Swamy Vivekananda gave her a different idea of 'Individuality'.He told her, 'You are not an individual. The Vedantic view of the individuality . You are not the individual, you are the

universal, imagining yourself to be an individual encased in this little body and mind. Don't throw all these great experiences. You are the Universal. Go back to your Universality to recover your indviduality'. So the Vedantic idea is, 'we can be individuals only when we realize ourselves as the Universal'.That was a little too much for that lady. She found that individuality was just vanishing. She cried out, 'Swamiji, what are you doing to me? I am losing myself. I can't take it anymore.' Then Swamy Vivekananda smiled and told her , 'A water drop was falling into the ocean. The drop was crying bitterly. The ocean asked the drop, 'Why are you crying my child?' 'Oh, now I am going to lose my individuality as the drop'. The ocean smiled and said, 'But child, you are not losing your individuality as the water drop. You are regaining your individuality of the ocean. You were the ocean . You were one with the billion and trillion sisters and brothers who are water drops like you who went up the sky and coming back to regain their individuality.' Real individuality according to Vedanta is the Universality which manifests wrongly as the individuality and we feel that we are individuals cut out from the Universal. Once we reunite with the Universal, we realize that the Universal nature is the real nature of the Individual is re-established.

Geshe Dorji Damdul : This topic individuality and identity is a very important topic. The topic is 'Individuality and Identity'. Let's say we look at this beautiful plant and then what emotional reactions come to your mind. So we are talking about the individuality of the plant or the whatever. So when we react to the object, when we interact with the object .. then we say it is a very pleasant, it's a very nice plant. So what happens is this. The object is there, the plant is the object, your mind is the subject and the interaction between the two gives you a sense of feeling. Now if you see the same plant through a microscope, you will just see the molecules and none of these molecules are beautiful as this plant. So now what we are doing, we see the same object in a different way, then the question arises, 'What is the real identity of this object? Whether this is the one which gives you the sense appeal or whether the one which gives you the sense of what the real identity of this object is. Ok so from this we come to one thing which we need to know so well and very important so that how the object exists, 'Whether it is the plant or whether it is the molecules? Which of the two?' So it entirely depends on how you perceive that. With the naked eye you see that it is a plant and it's true that it is a plant but with your microscopic eye sight you see that it is just a bunch of molecules which is also true. Both are true. So these are the two realities. Now from this what we come to know is that what's objective reality is here? It is all perception. Now Arya Nagarjuna who commented on Buddha Sakyamuni's teaching that from the object side, nothing really exists, everything exists only through **'Dependant Origination'**. By dependance on the perceiving mind, things come into being. From this point of view now we come to know that, 'What's the objective reality?' Or what is the ontological reality? So there we keep in mind two things. 'Are you a strict philosopher, a strict scientist or who likes to enjoy the world. If you like to enjoy the world. Ok. I am part of the world.So from that point of view this is a plant. So this big plant is dependant on your eye-sight which is the

world as it is to your eyes now. Ok. From this we see that what's there is as individuality for example even with this plant there is individuality that is a plant or with the molecules as molecules so forth. Now from this point of view so "Bhava" or the absence of 'Svabhava'. It doesn't mean say, the fire never goes cold. Whether it's undeniable nature is hot. Hotness is the undeniable nature of the fire. Had it not been hot, it had not been fire. So as long there is something called fire it is always hot. As long as you are a being, you have a sense of happiness, a sense of being. So these are the very intrinsic strictly from the Buddhist point of view particulalry when you go deep into the philosphy and even this understanding of the intrinsic ..there are so many variables to be aware of. So subtlest version of what is objectivity. What is Objective Reality ? Absence of Objectivity is the objective reality of the phenomenon. So this is, this is philosophical so what I am saying is that when the objective existence is rejected is purely subjective . At the same time it does not reject that the say the atoms are in the nature of particle and atoms are in the nature of energy. This is not rejected. As long as something is matter it should be either physical matter or energy, is not rejected. As long as it is fire, it should be hot. And as a electron, it should have spin – upspin, downspin. These are undeniable facts. So we should distinguish between the intrinsic quality and the undeniable quality. So the undeniable quality, they determine what the object is. So that's not rejected.

Madhu Khanna: Identity arises when Shiva's unimpeded powers (*svatantrya*) that is infinite is contracted by his own self-veiling power, *maya-shakti* and assumes limited knowledge and limited forms. This act is known as *svarupa-gopana*, veiling of his essential nature, a stage of involution into the successive stages of inconscient matter. Individuality is brought about through the self-contraction (*atmasamkoca*) of Shiva's triplicate energy. Ignorance of one's true nature is brought about through the three forms of impurities: *Anava*, considering oneself to be limited; *Mayayi*, is caused by the contraction of Shiva's omniscience and gives rise to limited knowledge; *Karma-mala*, is the limiting condition brought by the residual traces of actions. On account of this the conditioned phenomenal self considers itself to be separated from Supreme 'I' consciousness. This is well explained in the aphorism: Shiva embodied in the body is Jiva; unembodied he is Supreme Shiva.

Prof Narendra Bhandari : It is a tricky question but we can approach it from that everything has a substance and a 'mode'. According to Jainism the identity is because of the 'mode' and it is changing all the time and the individuality, the substrate or the basis is a thing. I will explain it…from two points of view. Take for example the Universe and it is made of Paramanu as I explained. Now you can have infinite number of Paramanus in the unit space. Now their 'identity' is similar, but still they are 'individual'. So the identity is lost but, as you go to pure and pure state the individuality still remains and the same is true of the 'soul'. The identity in terms of different Shiva, or it is me or it is you. This comes because of the 'impurity' or the 'karmas'. Once they are shed, all source becomes identical, but they still remain individual

because they have two properties, two faculties, which still operate in the pure state. One is to know and one is to see – GYAN and DARSHAN – as they say. So although all souls are identical, they are individual because they are at a different state of 'seeing' and 'knowing' at a particular moment. So, the identity as I said x=s+m, identity is because of m, the *paryay* which keep on changing all the time but being so sure we still identify it as a persistent, whereas individuality or the substrate of that due to the substantial phase which is eternal and doesn't change.

Dr. Ramachandra G Bhat: Individual identity and individual difference is defined on the basis of Triguni Vyavasthayini Yoga – Satva, Rajas and Tamas. It is very much elaborated in the 16 th and 17 th chapter of Bhagavad Gita twelve aspects are separately projected.
Satva based *yagna* , *satva* based *shradda*, *satva* based *karma,satva* based *karyakarta*, *satva* based *Gnana*, satva based.. like that. Likwewise *Rajas* based, *Tamas* based. But according to Vyasamuni Bhashya on the *Yogasutra* we can classify individuals as Chitta, Moodha, Vikshipta, Ekagra, Niruddha. When *Rajas* will be prominent, Tamas is supporting, mind becomes boiling. When *Thamas* is predominant then docile, mind becomes docile. When it is sometimes *Sathvik*, sometimes *Thamasik*, some-times *Rajasik*, it is *Vikshipta* depending upon the conditioning factors of inside. When it comes to *ekagra* level, Sattva will be predominant and all these two will be subsidiary so that mind becomes one pointed, man gets that sublimated condition at his emotional level. That is what very important. Emotional sublimations. When that climax of this is achieved , when man crosses that bondage of Triguna uVyavastha and even tries to go beyond and attain that *Gunatheetha* there man goes to that purest form of mind, very transparent condition of the mind that is called *Nirudha* condition where *Samadhi Sthithi* becomes very much…very close to Him(or him). That is the climax of achievement. That's how this identity, individual identity and its expansion of individuality all these are defined on the basis of *Triguna Vyavastha*.

Time, Causality and Consciousness

The concept of time as discretized appear in physics, neuroscience and certain schools of philosophy, although the atomicity of time is motivated differently.

In physics: in our physical universe there exists the smallest duration of time and space called Planck time and Planck length, below which concept of space , time and causality do not exist. The value of this smallest duration of time depends on the values of the fundamental constants like the "c" the speed of the light, "G" gravitational constant and "h", Planck constant. They have fixed numerical values. At the level of Planck scale, space and time are discrete. On the other hand at the level of elementary entities like electrons, protons etc. as well as in our everyday life (called macroscopic level), space and time are continuous.

One of the challenging issues in the 21st century physics is how the continuum space time emerges from discrete structure or causality arises. Again as time is discrete at the lowest level (Planck level), it raises serious issue related to the principle of causality i.e. cause and effect relationship below the Planck time limit.

In neuroscience: There exist "quanta of time" or "shortest time duration" in modern neuroscience. Gamma oscillation (40--100) Hz is found to be dominant in wakeful as well in REM sleep. A smallest duration of time in the millisecond range exists in the brain corresponding to gamma oscillation. It plays an important role in conscious activities.

One's experience is reported to be discontinuous-- a moment of consciousness arises, appears to dwell for an instant, and then vanishes, to be replaced by the next moment. Is this description of experience (the kind of description of actual human experience that we have been asking for) consonant or not consonant with descriptions that we get from neuroscience?
The term "perceptual framing" has been extensively discussed in neuroscience and psychology which deals with sensorimotor rhythmicity and parsing. One of the most well known phenomena studied in this literature is called "perceptual simultaneity" or "apparent motion." For example, if two lights are shown successively with an interval less than a period of 0.1-0.2 seconds, they will be seen as simultaneous, or in apparent simultaneity. If the interval is slightly increased, the flashing lights will appear to be in rapid motion.

The issue now arises of the correspondence of simultaneity between events in the external world and the corresponding perception events in the internal cognitive space. The motion of an object in the external world within the "psychological atom of time" engenders a collapse of space and time events in its counter space in the internal world. Since the delay in conduction speeds along different axons and the integration time for individual neuronal elements in the circuit are both of the same order of magnitude as the temporal quanta, so in spite of such delays, the concept of simultaneity of the external event will be considered valid for functional space, i.e. as an operational definition of simultaneity is taken to be valid.. The brain is supposed to be an instrument having resolution power of 10-12 ms. Everything that falls within a frame will be treated by the subject as if it were within one time span, one "now".

Recent Magnetic and electric recordings from the human brain have revealed the existence of coherent oscillatory activity near 40 Hz. A magneto-encephalography (MEG) system was used by Joliot et al. (1994) to test whether the 40 Hz oscillatory activity relates to the temporal binding of sensory stimuli. The results showed that the 40 Hz oscillations not only relate to primary sensory processing, but also could reflect the temporal binding underlying cognition. Experimental results have shown that there exists a time interval of 10–14 ms (corresponding to

the up trajectory of 40Hz oscillations) that is the minimum time required for the binding of event. This was proposed as the cognitive ''quantum of time''.

Time and Consciousness have been extensively discussed by various schools of Indian philosophy. For example in Shankara philosophy, problem of time coincides with the problem of change. The pattern of conceiving changes in this system with reference to underlying substratum called *'Prakriti'*, is different from the Buddhist concept of change. The postulate of two principles *Purush* and *Prakiriti* that ultimate and ontologically independent of one another is highly important for study of time and consciousness. In Yoga philosophy ideas of the moment or instance and sequence have been discussed in Yoga Sutra 3 in the commentary of the Vyasa it is said, 'Just as a atom is minimal limit of matter, so the moment is the minimal duration taken by atom to change its positions. Moreover, Yoga advocates the doctrine, the discrete view of time the atomic concept of time have been extensively discussed in joint text where the time atoms are distinct and can never be reached out. This is brought out by saying that kaala had time atom can never be combined. This indicates difference between atoms of space, matter and from that of time. There exist internal differences regarding the doctrine of 'momentariness' which is Buddhist tradition. The direct analysis of the problem of time had been discussed in the Nagarjuna's Moolamadhaymika which had been further elaborated by Chandrakirthi. The aim of the untenability of not only of any idea of time and unitary and absolute whatever from the notion of the reality of time and in Advaita the reality of time as ontological category is considered to be wholly superfluous. The ontology of space-time, the nature of the cause and effect relationship has been studied by various Indian schools for many centuries. But now the question is, 'What are the views on the smallest unit of time, the duration and as well as instant, I mean, the idea of smallest unit of time or atomist unit of time in comparison to *Kshana* of time and also the ontology of space and time from various traditions.

Athmapriayananda : Space - Time are one unit. And causality obviously follows time. Because causality means before and after. That which goes before is the cause and that which comes later is the effect. Before and later are obviously temporal concepts. Now the fundamental question which has been discussed in philosophy, particularly in the Vedantic philosophy, there is only one substance which appears as many and is the appearance as real. Now how does the one become many? There are several points of view.

The "One" suddenly thought that I should become the many. That is the view that some of the Upanishads have mentioned. He was feeling very lonely, he said 'Let me become many'. Then the question is asked, 'Why he suddenly felt lonely and became many and create all these problems? We would be very very happy – alone and then we chose to get companions and then now we are restless to communicate with them with all kinds of Whatsapps and Twitters and bring in all the problems of the world. So the one become the many, the one point of view which

is being rejected, the One becomes the many rules space, time and causation. Space, time and causation is what is known as Relativity or *Maya*. And the One and the Absolute projected through the prism of space, time and causation becomes the Many. Then the question is asked, "Is it possible to have a state of consciousness in which time and space completely vanish? And this will survive before death. After death you don't know what is going to happen to you. Then Vedanta says, "Why don't you look at human experience?" Vedanta is a philosophy which doesn't philosophize. It is not metaphysics, it is not philosophy, it is not religion. It is just a simple analysis of your daily experience and asking simple questions about the experience and coming out with very profound answers. One is, "I passed through certain states of experience.. This can't be wiped away because they are my experiences which is the waking state when I used to see all the view. Then when I dream, my experience is completely different". The waking state experience is contradicted by the dream experience and both of these by deep sleep experience in which I feel no time, no space, no causation and I come back again of course. Therefore it is possible to have a state of consciousness in which space, time and causation completely vanish Now the question is asked, is it possible to simulate that experience when you are actually awake, not when you are sleeping? These questions have been asked and in recent times I can think of Maharshi Mahesh Yogi for example who talked about the Transcendental Meditation which very simply perhaps would mean 'induce sleep when being awake' which most of us did it for the last few days here, so that you are relaxed. Then all your lack of relaxation comes to you when it comes to space, time and causation. When space, time and causation goes away you are absolutely in a state of pure relaxation. So the technique is, even when you are awake, temporarily for a few seconds suspend your consciousness as it were and lapse into deep state of sleep and then from which you gain energy and come back. Jiddu Krishnamurthy for example used to say about psychological time and chronological time. The chronological is provided by the clock which the organizers always look at and the panelists don't. You have to go by the clock and you have the psychological time which doesn't obey the clock and the psychological time transcends the chronological time. Psychological time is memory. So you store memory in that and that memory guides you to certain paths which are not actually revealed by reality. Now, what I was trying to say was, that in the state of deep sleep which some of the Upanishads infact equate with Samadhi, space and time actually vanish. So it is possible to have a state of consciousness in which space, time and causation actually vanish. So well, what is the difference between Samadhi and deep sleep that have been discussed. The conclusion of Vedanta is that space, time and causation are essential to consciousness. They come into consciousness to project the relative world and it is possible to have a state of awareness in which space, time and causation could be transcended. In the state of transcendence, space, time and consciousness are actually subsumed into something which is higher. Infact the Lord himself the supreme reality has been described as Mahakaala. In the Bhagavad Geeta in the 11th chapter, when Arjuna was terribly frightened seeing the Vishwaroopa, the universal form, Who are you? I can't really place. Who are you? Where are

you? He said, "I am the supreme kaala." So Shiva, I just end with this imagery, 'Time flows as we know from the past to the present and into the future. So we have, you know the light cone with the infinite past and the infinite future and 'now', 'here-now' is just a point. So Shiva is pictured as holding the point, the *Damaru,* and then manipulating the past and the present. If you can arrest time in the present, now you are in a state of consciousness, in which you transcend space - time.

Sisir Roy : We know that there is the great Buddhist scholar Nagarjuna. There is a chapter called Kalapariksha in Moolamadhayamikakarika. Here he has extensively discussed concept of time. So let's listen from Geshe Damdul.

Geshe Dorji Damdul :Ok. In Buddhist philosophy everything that exists, everything that exists you can think of in this universe, you can divide into two. Composite phenomenon and non-composite phenomenon. Composite meaning which is composed of particles, which is composed of momentary segments of the mind, these are known as composite phenomenon. On the otherhand we have non-composite phenomenon, say, the Akasha – the space. The space is of two kinds. One is the composite space and the other is the non-composite space. So the non-composite space and other things fall into the category of non-composite phenomenon. Now the composite phenomena, because they are composite they are under the fabric of causation.. This is one of the topic. Now within this causation, within cause-effect relationship again there are two kinds – natural cause-effect relationship and cause-effect relationship determined by the 'mental intention. For example you plant a flower and after two- three days it whithers and dies. There is a natural cause-effect relationship. Whereas you keep this bottle here and there is a earthquake and the bottle falls. This bottle will not come back. But then with my intention, I can bring it back. So that's known as cause-effect, the bottle coming back is the result because of my intention plus the bottle being there on the floor. So combined together it becomes a cause-effect conjoined with the intention. That intention becomes a part of the consciousness in the Buddhist psychology. So consciousness is a 'English' word. Infact the Indian philosophical traditions like Buddhism, Jainism,Vedanta, I don't think they have the full legitimacy to say that consciousness means this, that It is a English word and we have to check with the English linguists. Anyway in a loose sense Buddhists would equate consciousness and the mind. According to Buddhism or the Buddhist school of thought it is divided into four, four schools of thought. The first is in a progressive way , progressively more advanced way. The first two schools believe in the particles moment of time, partless temporal time, temporal segment. Whereas the other two schools, they in a large nice way they do accept this. In a very direct way they reject this. For example there is mention of what is known as how the brain in this translation, how the brain requires a spatio model time to see the phenomenon. As of that time would be atom of time in this particular context, in the context of how the brain perceives the object. Whereas time per se, it is much much subtler than that. For example, the standard unit of time, I think was established

by the science, physics, on the basis of one atom of Caesium, if I am not wrong. This is based on what I studied. So why Caesium was selected as because it changes very stable as compared to others. It is not intrinsically reliable change, even there the change is there, but the change is so minimal.So now that minimal change, change connotes time, so that minimal change is much much less than the milli-seconds so that way that time is much shorter than the time spent given as the time say to perceive an object. Ok. I will stop here.

Madhu Khanna: The notion of time, causality and consciousness has three significant dimensions in Shaivite metaphysics. There is no such thing for a Shaiva as absolute statis or absolute dynamism. The point of statis is inherent in the active emergent state of the divine. On the other it is the innate nature of the active Shakti to resolve into a state of rest (*visranti*). The Absolute reveals its divine splendour (*nijavibhava*) through the twin act of creation.

The activity of Shiva and Shakti, in world creation is not divided by time or in space but is the foundation of all sequentially identifiable special (*desakrama*) and temporal manifestations (*kalakrama*) This idea is expressed in the following verse: Vibration (*spandana*) or pulsation of consciousness means sublet movement. It is subtle [in the sense that] although it moves, it moves not, it manifests as motion/vibration. The light of consciousness is identical with manifestation yet it appears to [be separate]. That which is immobile, is associated with the variegated manifestation, which manifests [as all forms of movement, temporal and special] *Isvarapratyabhijna – vimarsini*, 1, pp. 208-209.

There are no distinct Cosmic Processes. All the phases of creation are interlocked. The cosmic process consists of a cyclic series of creations and emanation or expansions (*srshti, prasara*) and involutions or contractions, (*samhara, samkoca*), preservation (*sthiti*) being an intermediary state, that follow one another. Shiva and Shakti are eternally engaged in all the phases of emanation and involution simultaneously and yet perform them separately. The first form of activity can be broken down into a sequential order (*Krama*) in time and space. The second order is the non-sequential activity (*akramika*) that is inherent in the absolute.

All entities in the universe are spontaneously emanated from consciousness, in a way that the primal source of the emitted categories (*tattvas*) remains *unchanged.* We have to understand that the principles of change and changelessness operate in ontological causation. No change takes place in the nature of the absolute because the effect (*parinama*) is a real transmutation. Ontological creation reverberates between change and changelessness. The Shaivites believe in the notion of *dharma parinama*, meaning, that the form, texture and quality of entities undergoes changed but not its essential nature.

Prof Sisir Roy: We know that in Physics we have the smallest unit of time called Plank Time which is ten to the power of minus forty three seconds and also there is a quanta of time of smallest duration of time, associated with the Gamma region of the brain. We know that the atomic concept of time has been extensively discussed in Jain philosophy. So let's listen what Jain philosophy says.

Narendra Bhandari : Well all these thre, Consciousness, Time and Causality are the very core of Jainism. So let me try to present what the Jain philosophy says about it. Let me take first the case of time. So as mentioned in the introductory summary we can approach this problem from what we call 'Stand point' or 'Nayavad'. So there is an absolute way of looking at it and there is a practical way of looking at it. So absolute is ***Nischaynanyaya*** and practical is ***Vyavaharnyaya*** . But there are many other Nyayas. But I am going to take just these two to explain about time. So time according to Jainism is made of ***Kalanu*** and ***Kalanu*** is a smallest unit of time .It is defined as the time taken by one ***Paramanu*** to go from one space point to another. So space point is defined as ***Pradesha*** and ***Paramanu*** moves with various velocities, they have given large range of velocities, but when it moves from slowest point..slowest velocity, from one ***Pradesha*** to another, that time taken is defined as***Samay,*** the smallest unit of time is equivalent to Kalanu. So that's ***Nischaynay.***And it is supposed to be, I mean they have not given the absolute one, is smaller than Plank time. So, I am surprised how we can reconcile Physics with this. It's much smaller than the Physics time. But they unlike Physics which only describe motion and sequence of events to time, time has four functions – one is a function of becoming, another is transformation, the third is motion and the fourth is sequence of events. So these four phenomenon are described as the effect of time. Now what happens as I told in the beginning there are these substances, the Akash, the soul, the Pudgul the matter, Paramanu, Dharmasthikay and so on. So time, the absolute time, I am not talking about the practical time, we have to distinguish it from the practical time. The absolute time intrinsically works on all these ..when it acts on soul, it gives the phenomenon of becoming. See compared to Physics which only deals with material part, Jainism deals with living as well as non-living. So becoming is an effect of time on soul , transformation is the effect of time on matter on Paramanu, motion is the effect of time on ***Dharamasthikay*** and sequence of events is the effect of time on Akash. This is how it is defined. So time is not really an independent substance as others are, but it becomes a part of them. I can't say it is embedded in other substances but it affects, the absolute time affects all these other substances, continuously affects without any external agency. So that is called the Nischaykal or what you call the Absolute Time. In practice, the absolute time is too small to measure or see or see it separate, so it becomes a 'time continuum'. So continuum of time is due to the practical perspective of time. Now as I said the universe is made of these six substances which are co-existing as well as co-extensive with the universe and it is immersed in a infinite ***Alokakash***, the ***Lokakash*** that is the universe is immersed in an infinite **Alokakash** . So inside we have all these six substances but outside we have only time and space. So 'time and

space' go together, 'time and matter' go together, 'time and soul' go together, 'time and Dharmasthikay' go together and they effect..that's how time is understood. Coming to consciousness. Actually much has been said about the consciousness in the last few days, but the Jain point of view is entirely different. Brain is not the seat of consciousness, body is not the seat of consciousness. Consciousness is everywhere. We talk of it as a field, a Bodhi field they call it . If you assume, I don't know how to prove it or not, but if you assume that there is a conscious field all over the universe then many phenomenon can be explained, like what they talk about in consciousness about the 'hard problem' or the 'binding problem' all the information is united by the brain. Because it is already there and the laws of this field, this Chidakasha, what Dr. Roy calls it, Chidakasha are different from the physical universe. So everything is now instantaneously, information can flow in one Samay or one Kalam, from one end of the Universe to the other and so on, such things are defined. So the consciousness, there is another point here I want to make. There is nothing like imperfect or levels of consciousness and so on in Jainism. Consciousness is perfect always. Brain is a tool of consciousness. And animal has a poorer tool or whatever so that you don't manifest it fully so it is the other way round, consciousness is perfect, it knows everything, it can see everything, but it uses various tools to manifest itself so our sense organs are imperfect, our mind is imperfect,our brain is imperfect, we don't realize it fully. So it is this way they define the consciousness. So it has infinite knowledge, always has, whether we can realize or not. It has infinite *Darshan*, infinite potency, infinite bliss, I mean several other infinite. I think about 47 are elaborated. I will not go into all of them. So it is not that consciousness appears spontaneously once you have a complicated neural network or something. I just heard about these ideas, but it is the consciousness is always there, uses the neural network as a instrument to visualize things and so on . So the causality, the causality as you know in Physics is a very fundamental thing. There is no effect without a cause and there is no cause which has no effect. But in Jainism the scope is little wider. They also include the living beings. That is where it is called the 'Karma Shastra' or 'Karma'. So this nothing, because of this causality there is no chance or coincidences or luck or God or anything. All this is not there. It is pure and simple law. And there are these laws which are defined.

Anyway before I finish, the causality actually collapses in one Kalanu, in one Samay. This causality requires past, present and future. Because any action you take now it may have effect in future. So unless the future is there, in one unit time the causality doesn't exist. That's how it is defined. But in practical way there is always a concept. So Time in Jainism is not a construct of mind as you say. Actually it brings out very fundamental changes in everything else. The Samay is the Kalanu is how much it is, it is always a question of debate. But as I said is much smaller than the Planks Time. But they go upto very systematically, as they make tables upto *Avalika* which is '2 into ten to minus four seconds' and then they don't give it anywhere the unit of Samay quantitatively. They say there is innumerable Samay in one Avalika. So that it shows it is not a fixed amount, it keeps on changing..and maybe it has something to do with the

Special Theory of Relativity, that you can't define unit time in a practical way. Ok as far as Quantum Entanglement is…

Prof. B V Sreekantan **:** For Einstein who started this revolution at the beginning of last century, it became necessary to combine space and time into one concept. Without that one cannot understand the constancy of the velocity of light. The most important experimental observation is that the velocity of light is independent of the motion of the observer or of the source. So space and time now fused into a concept called 'Space-Time'. We can think and do experiments only in three dimensions of space and one dimension of forward moving time. According to this theory, all actions take place in this four dimensional continuum. We can only experience the three dimensional projection of these with a separated time. A consequence of this relativity is that the rate of flow of time is not the same everywhere and depends on the gravitational field at different locations.

Prof Sisir Roy : Thank You. We know that in Yoga philosophy they practice, 'breathing practices'. So maybe, 'breathing practices and meditation', the atomic concept of time or instant are closely related.

Prof. Narendra Bhandari : Concept of time, space and causations are defined in terms of psychological binding factors in Yoga. Yoga tells us to go beyond all these. As long as we are conditioned and limited by these factors it is difficult because while defining all these factors we take up philosophy like Sankhya. Sankhya and Yoga both go hand in hand while defining all these things. So mind is the main factor here and going beyond mind, 'Ananya Bhava' is the culmination of achievements. In this context we have to study the concept of time, but according to Pathanjali it is ***Nirvichara Vaishardhya***. That is the word he uses for gaining ***Uttamdhara Prajna.*** This ***Prajna*** which is the climax of psychological achievements, where time plays in all these conditioning factors never have their own role to play. That condition he tells ***Adhyatma Prasada,*** it is what makes man go to that ***Uttamdhara.*** This entire world is to be understood. It is a very much accumulative concept of Prakriti . As long as we are bound by Prakriti it is very difficult to go beyond mind so that concept of mind, time and causations – cause and effect theory , they are all conditioned by this mental condition. So conditioned mind, pre-occupied mind causes, it makes time bending, not releasing. But Sankhya and Yoga take us to that level where mind must be a releasing factor for that we have to go out of these clutches, the shell. Infact, ***Prathiniyata Desha Kala Nimitta Kriya Phalashaya***, whatever happens here, in this Samsara, everywhere it is time play cause and effect, ***Nimitta*** and activities and ultimate intended results. These all five factors will be there. As long as we are enslaved to these five it is very difficult to go beyond but ultimate aim of Yoga is to go beyond that. That is why we have to go beyond these clutches. That is the main concept to ***Prakriti Tattva and Manastattva.***

Quantum Entanglement and Metaphysics of Relations

Prof Sisir Roy : Einstein along with his collaborators Podolsky and Rosen published a very controversial paper, normally called the 'EPR paper in which they considered a kind of thought experiment where the states of two quantum objects like pair of electrons or any other elementary particle are initially quantum correlated in such a way that when the state of one quantum object is altered the other will instantaneously change its state to exactly the opposite of its partner, no matter how far they have separated. And it is already experimentally verified by Aspect et al in France. Gisin et al in Switzerland verified this Quantum Correlations or what is called Non-Locality holds for more than even 12 km separation. Quantum Entanglement is a property of such a quantum state.

This leads us to think that entanglement or the joint state of two elementary entities contains more information than its parts . One can consider the intrinsic property of the quantum whole or quantum entanglement even if the parts do not have intrinsic properties.

Atmapriyananda: It is claimed that Vedanta solved, this kind of entanglement long ago. Infact, Swami Vivekananda in 1887 when he gave his famous lecture in Madras, talked about this I don't know whether he was really aware of any such discovery at that time. His exact statements are the following: He says I need not tell you, graduates of the Madras Presidency, that Physics has proved that even materially we are one. According to vedantic idea that there is a huge ocean of magnet what they call the field, we are talking about the field and the idea of Akasha. Vedanta recognizes three types of Akasha. One is ***Mahakasha*** in which objects are supposed to be existing. Einstein has said that objects don't exist in space. Infact, objects modify space. So in a sense space and objects, space-time and matter are one continuum as we know now. And the second is the ***Chittakasha*** in which thoughts reside. The thoughts residing in the space in what we call mind or whatever which we experience in the dream state. And the other is the ***Chidakasha*** ,which is consciousness space, which is beyond the state of deep sleep and beyond. Now the idea is that even materially whole of us are interconnected through the Mahakasha. One simple example with which we can now immediately understand is the Internet and the mobile phones which we use. The moment you send a signal, you send a message, you send an SMS, or you send an email, you upload it some cosmic server and it is downloaded somewhere. Anybody can download it provided he knows the correct password, the password is the mantra of the particular person which he doesn't like to disclose to anybody else. So every thought of yours is actually uploaded in the cosmic mind, we call it the ***Hiranyagarba*** . So vedanta has three layers, one is the cosmic material infinite which is called the ***Viraat***, the second is the ***Hiranyagarbha*** which is at the mental level which is the 'cosmic mind'. The third is the ***Iswara*** which is at the level of the spirit. So physically we are one, intellectually-mentally we are one and spiritually we are one. So the oneness which is percolating the famous Vedantic equation of the ***Atma Brahma***

Eikya which is called the ***Maha Vaakya,*** the individual self is identical with the Supreme Self. According to Vedanta it actually percolates through two levels, one is the physical level as the individual which is called the ***Vaishvanara*** being identical with the Viraat which is the cosmic. At the intellectual level, the mental level, the ***Thejassobhava*** is identical with the ***Hiranyagarbha or Mahat*** of the Sankhyan philosophy and ***Pragya*** being identical with the Eashwara at the spiritual level. So the idea is the microcosmic and macrocosmic are two manifestations of the same reality and therefore there is only one reality which manifests as the microcosm and macrocosm. I just end this with experience Swami Vivekananda himself had at Almora. He records it in his diary. He says "today I got the solution to one of the greatest problems of my life and that is the identity of microcosm and macrocosm. I actually saw the entire universe in an atom." In that sense, the sense of inter-connectedness of the entire body at the physical level at the mental level and the spiritual level. This interconnectedness is a corollary of the oneness of existence, of the solidarity of the universe which is one of the most fundamental doctrines on which the entire Vedanta rests being the 'Mahavakyas', the great saying ***Tattvamasi, Aham Brahmasmi, Pragnanam Brahma*** etc.

Prof Sisir Roy : We know that the great Buddhist scholar Dharmakirti discussed about the reality of relations in his book **Sambandha Pariksha** or Philosophy of relations. This gave rise to lot of debate among scholars of different Indian traditions. Let me invite Geshe Dorji Damdul about Dharmakirti's view.

Geshe Dorji Damdul : Relation in Buddhist logic is of two kinds. Sequential relation and concurrent relation.Sequential and Concurrent. Their relationship is established into these two. Sequential relation connotes 'cause and effect' – how the effects are related to causes. This is sequential relation. Then the other one is concurrent or simultaneous relation which means when I say I am thirsty. Let me have a glass of water. I lift this glass of water. It's my hand that is lifting it. So this hand is not me, I am related to this hand. So these two are simultaneous. These are not causal. So these are known as simultaneous relation. Okay. In this connection then a question arises where this phenomenon is, known as the relation. Where is it? Say when the hand lifts this up – the relation is it in hand or is it with myself. This is the question asked. So likewise as Prof. rightly described that there is so much of debate going between Buddhist logicians and the Nyayik also the Vaisheshiks and the Jain logicians and so forth. So very interesting discussion which is happening which I briefly touch. The various logicians. Say when we look at a beautiful flower or let me change the example, when you look at the forest. The same forest can be seen in two ways – one when you go into the forest, you will not see the forest, you will see the individual trees, when you go out of the forest, then you will see the forest, you will not see the individual trees. So when you look at the hairs here. you don't see the individual hairs, you will all the hair that is their, the bunch. So what is the relationship between the individual hairs and the bunch of hairs, individual trees and the forest, what is the

relationship.So these two are not sequentially related. These two are concurrently related. These two are simultaneously related. Now the question is, 'Where is this relation? This phenomenon known as relation, where does it exist. Does it exist as substance or what? Then the opponents of Acharya Dharmakirti, they all proposed a concept of something called substance. So this relation is something called substance which exist on all parts of the strands of the hairs or on all trees. This relation as a substance exists. Then Acharya Dharmakirti is saying that this relation if you tease apart, if you separate, if you don't distance these trees more, more and more ..then what happens to the relation if it exists as a substance, so then you will see that even the concept of a forest disappears, then where is that phenomenon known as relation if it is a substance. So this argument Dharmakriti came out with a very strong argument that this concept of relation, it exists not from the object as a substance it exists as a imputational phenomenon. So phenomenon exists in two ways. One as a substance from the object and the other from the subject. So it is a subjective existence. Because it is a subjective existence you will not find on the object as a substance. And another interesting topic raised here is the Quantum Entanglement. This is amazing concept. Infact say although it sounds very simple, if I gave the example that sounds simple but if you look for the complexity of the mechanism then it is a very challenging for us. Say for example let's say there is only one plant in this universe which is right there outside this hall. It is only one tree. Then if I say is it that the farthest tree or the nearer tree, it makes no sense. The moment you plant another tree in this universe, next to India Gate, then the moment I say 'Oh this is the nearer tree', 'The one here'. Then the moment the other tree is introduced simultaneously this tree becomes the nearer tree. So something is changed there, no changes happens to this tree, but simply because something else is introduced very far away from here, then simultaneously what is here is also becomes something different. So this is something like Quantum Entanglement. So this concept is well explained in Buddhism and now the question is how do you describe the mechanism, how do we account for this mechanism again on the basis of understanding how things come into being, not necessarily from the object. From the object it remains the same tree, yesterday, today it is the same tree, but it's only when you bring in the subjective involvement then the phenomenon of Quantum Entanglement ,relativity all these phenomenon come into being.

Narendra Bhandari: From the Jain perspective, everything in the Universe is related inseparable, cannot exist in isolation and is inter-dependent. I can only quote one Sutra for the living beings that ***'Parasparopotho Graho Jeevana'*** All Life is interconnected, interdependent and so on. And the same thing in the Acharank Bhashyam they say, '*If you know one, you know all'*. Now you can know one without knowing all? So that is the kind of entanglement – everything is related or dependent or you can say entangled with each other. Jainism as such believes in the relationship and it is real, but in a relative way, it changes in various perspectives and so on. It is not absolute and what is said is that, when the relationship is very deep then the relationship and the data – they merge in each other. That's how it is defined. So what I want to

say is that in the absolute sense the perspective is different, but in the relative sense Jainism believes that everything material and non-material, living and non-living are all very intimately related. So it is a very basic foundation of our existence.

Madhu Khanna : Science tells us that the world is a complex web of relationships, even the tiniest subatomic particles cannot be seen in isolation from one another, as the tiniest entity is interconnected with one another; 'entangled' with a complex network of events. Something very similar is conceived by the Shaivites. Many Shaiva scriptures are in the form of a dialogue between Shiva and Shakti which is the hall mark of several Tantric texts. In one text Devi asks Shiva: "How does Anuttara (The Unsurpassable Consciousness) bring about the identity between the empirical "I" consciousness (*Aham*), and the perfect – consciousness of Shiva so that one acquires sameness with Universal Power (=Khercari)? Shiva states: Anuttara is twofold manifestation: (I) as *Akasha – Shunya* and as *Khecari.* Non Referential Consciousness. All referential consciousness and existential phenomena is a concretization of consciousness."

The Shaivites have a very definitive concept of relationship between the categories of creation. Every entity of the universe is interconnected with everything. As the saying goes: *Sarvamsarvatmakam*: "Everything is interrelated with everything else". Creation is held by an internal dynamism of elements, which is intrinsic to itself. The universe is an orderly system whose structure and function is governed by the contraction and expansion of consciousness, which form the substratum. The second major principle is the complementarity between the male and female principles, Shiva and his cognitive power, Shakti. This complementarity is expressed symbolically in the image of the seed of creation, the *bindu* which is half white, representing, Shiva and half red, representing the Shakti principle. This complementarity is beautifully explained through the Nyayika concept of *avinabhava-sambandha* or the concept of inseparable relation. According to them, *sambandha* is of various types. I am speaking to you and we are relating to one another in a conversation. This is, indeed, a form of *sambandha* but, one in which the two entities are separate. I touch this table, this too is an act of *sambandha.* But such forms of relation is not the relation they are speaking about, where two entities just come together casually and may remain separate. The notion *avinabhava-sambandha* means that it is an inseparable entanglement of relationship between two entities. And this relationship is explained through metaphors such as moon and the moon rays, fire and its heat, etc. In other words the two in the one, cannot exist without the other. The Third aspect of inseparable entanglement refers to the relationship between parts and the whole which I spoke about earlier. Lastly, the immanence of consciousness into matter is Real as its source. The primal vibration and the unitive pulse of creation, its transformation into diversity is Real, the entities remain Real counterparts of the whole as consciousness. They are not to be looked upon as an illusion of *maya* but only as contracted states of the plenitude of *cit*.

At the end, I have to say that science must utilize the ontological immanence found within Religions and in the ancient philosophy expounded in Kashmir Shaivism. We need a new vision of Reality where science and religion can co-exist. I am reminded what Fritjof Capra said: "Science does not need religion; religion does not need science but humans need both."

Ramachandra Bhat: We have to take Samkhya philosophy to answer the question raised here. Samkhya philosophy and Yoga, they go hand in hand. They are mystic in nature. So Purusha is Purusha and Prakriti got all the roles to play while performing in this material world, in this physical and relative world. Here we have orderly relations and this very relation, it moves from subtle to gross level. That's how,

'Prakriteh Mahan Tatah Alamakara
Tasmat Ganah cha Sodasakah Tasmat api
Sodasakat Pancha-bhyah Pancha bhutani.'

That's how Isvara Krishna in his ***Samkyakarika*** tells how this world gets its tangible form, gross form. That we have to take for addressing many questions raised here. Main understanding here it is, very much dualistic, Chaitanya is Chaitanya and the other one is Jada Jagath. So that's how we have to understand this animate and inanimate – these two things we have to understand. That's how the realistic understanding of gross and subtle world we can go for. Main thing is, it is ***Sattva*** . Sattva concept is very important. Because Sankya philosophy tells everything which is experiential. Experiential understanding and existential reality – these two go hand in hand. These two terminology we have to understand, if we understand we can answer this relative world how it functions and how it has its own role to play in individual life also. That much I can share related to this particular point.

INTERACTION WITH AUDIENCE:

Prof Sisir Roy: Now I am giving my microphone to my colleague Shivanand Kanavi to moderate the discussion session. And it will be for around 40 minutes.

Prof. Shivanand Kanavi: This session is basically for the floor. So you are welcome to ask questions to any particular participant, any particular panelist or if you want to make a comment, kindly keep it very brief. Because I am sure there a lot of people with lot of questions. And bear with me if I interrupt your comments and so on if I find them too long. Please identify yourself.
(Unknown person) I am a clinical psychologist from Spain. My question is for all the members who are there. How do you say about the ***Ashtavakra Geetha*** ?

Ramachandra Bhat : Vedanta centered question it is. ***Ashtavakra Geetha*** is mainly dedicated for Advaitic understanding. Not realistic understanding. It is for that one. So ***Jivatma*** and ***Paramatma***, this individual soul and universal soul, how they become identical when man goes beyond mind. That is the main journey there. It is portrayed. How man starting from mental level can proceed further beyond mind. That is the main core part of that ***Ashtavakra Geetha*** . Actually many Geethas in Mahabharath, there is main focus is on that one. Man must go beyond mind. That is the central theme.

Priya Prasad : My question is directed to Swamy Atmapriyananda. Sir, Science or scientists arrived at the knowledge, derived knowledge based on evidence, otherwise we wouldn't have Jonas Salk who cured Polio. However philosophy is a different approach to knowledge which we cannot ignore having, meditating myself, I know the effects, of the impact it has on my life. Now you are a scientist who became a monk. My question to you is, is there a 'sweet spot' between science and skeptics and philosophers and the monks where they can come together somehow and how did you do that ? So that I guess is my question, that 'sweet spot' between these two realms. Thank You.

Atmapriyananda: There are two kinds of knowledge issues today – one is from senses. Senses give us inputs and from there we derive knowledge and this symbolic knowledge which is, which Science always uses. There is a different kind of knowledge which is *intimate knowledge* which we just know what it is, but you can't define it, you can't conceptualize it, for example, somebody ask you, 'Define time'. Everybody knows what is time and you can't define what is time, because 'you are in it'. You can't yourself because you are it. There is a different kind of knowledge in which you intimately, intuitively feel something to be true, something to be real, but you can't conceptualize it and analyze it. So analytical knowledge is something which science goes for and everything in the world doesn't come through analysis. I read a famous book by Arthur Eddington whichb I studied in school. On the last chapter, Science and Mysticism he gives a very simple example. There is a scientific knowledge which comes through analysis and there is a different kind of knowledge which comes intimately, he gives the example of a joke- a humor, a sense of humor. Suppose somebody tells you a joke then if there is a scientist who asks, 'Come on tell me, what is a joke'. You have the characteristics of a joke, one, two, three, four, five. If these characteristics are satisfied, it is really and truly a joke. I will tell you a joke, 'Wait, I am a scientist'. I will find out whether it is a joke. You go on analyzing the joke. At the end of it you come to conclusion, 'Yes it is really, truly a joke'. Lets laugh. By the time you analyze the joke, the tendency to laugh is gone. So he says ubeautifully that the analysis of a joke retains all the characteristics of a joke except its laughableness. It just doesn't do to analyze a joke. You react to it spontaneously. So there are certain people who have institutive feeling toward God, which is something beyond the mind. You can't really put it analytically except by saying that I feel it is true. And suppose you say, you feel it is true, it may not be true

and it satisfies you it gives you happiness, it gives a universal joy, wonderful joy so why not. So let the scientists be unhappy with the analysis and let the philosopher be happy with his synthesis. Why not? So the idea is everything cannot be analytically proven. There is ua famous story about Ramanujan, Srinivasa Ramanujan. Hardy asked him, how do you get them? What is the proof of these theorems? Sir proof I see, I know, they are true. Beyond that I can't say anything. Then how do you get those theorems, where do you get them. He said, 'My Kuladevatha, Godess of Namakkal, near Tanjore in Tamilnad, she comes and tells me these theorems and I write down. Then Hardy said, 'This boy is really, truly a mathematical genius but hopelessly religious.'

Girisha : My question is for all the panelists. We discussed a lot about time. One aspect of time is that we always feel that it flows in the forward direction and that's how we feel.In Physics we use Second Law of Thermodynamics, to explain. Why it could be so? What do the various schools of Philosophy have got to say, why do we feel time why does it flow the way it does for us?

Atmapriyananda: Time flows. Now the organizers are already looking at it, the time flows and time flows from the past, through the present into the future. Why the God created the way he created time we do not know, but time has a definite arrow. In physics there are three arrows, one is the arrow of time, the arrow of entropy. Entropy in a closed system always increases as you know and the universe expands. So you are asking why God made time flow in one direction.

Girisha : God created. Is there anything that?

Atmapriyananda: Just like asking why God made electron negative and proton positive? It is that way.I think his question is whether there is something similar in the traditions that you all represent, that is, unidirectional time.

Geshe Dorji Damdu:
Okay. Infact, from what I mentioned earlier. This is very important point. Say when you look at the same object, the plant, you see it as a plant. And the same object through a electron microscope different vision, then you will see it in the form of molecules. When you experience at molecular level then the concept of plant dissolves. Likewise we can do the same thing with time. So time can be seen in one perspective. From that point of view, time flows in a arrow, as a arrow of time. It doesn't flow back. Whereas when we look at the same time, the way we look at the plant from the molecular level, just as the plant dissolves, even the time dissolves. In that experience, not only time dissolves, all phenomenon dissolves. So when you really state that this

is ***'Moksh'***, this is where you experience that all your sickness, aging,death, all these flow in time dissolves. So that's ***Moksh***. Thank You.

Madhu Khanna : Can I just add to this. I think you know one of the things about this the form of Shastra we are discussing about to look at it and interpret it When you look at the Vedas, there is the concept of ***Vrita***, Vrita is cosmic order. That is, it is a very important concept. Vritam and Satyam. So there is an ecological argument. You know..on the basis of which time can be understood. You know I would call it an ecological argument, that you know, these years saw the universe dissolving and along with that they saw certain aspects of consciousness disappearing and appearing you know. So there is that ecological point of view. A lot of our philosophy is derived from that. But we don't connect the two.

Deshmuk : I am a neurologist. In this great symposium, one chair is missing and that is the chair for Neurobiologist. There is a lot of very interesting information in neuro-biology, which can explain most of the things that has been discussed. I will add to this only two aspects of this. One is the concept of Spanda, Spanda means Impulse. And that 'impulse' has a neurobiological basis – 'cardio respiratory impulse', every time the heart beats, blood is pulsated through the whole body, through the brain stem. Brainstem has a network which is called the Homeostatic network that maintains our body at health. Everything in equilibrium and then this homeostatic network stimulate the reticular activity system will then generates conscious arousal, an impulse of conscious arousal, that conscious arousal becomes conscious awareness. Conscious awareness when directed becomes conscious attention. So this consciousness arousal and awareness is the matrix of attention. From this matrix arises the conscious vector, will then create subject-object duality and our experience. And then with the development of memory, especially the working memory in the cortex, we generate the experience of sequencing – one event then next, the next, the next..which create the sense of time. Now I also want to briefly comment about the sense of time, in the hypothalamus there is a nucleus called ***'Supra chiasmatic Nucleus'*** which continuously monitor the whole cosmic influences, the lunar cycle, the solar cycle, the seasonal cycles, the whole thing is monitored by the ***'Supra chiasmatic Nucleus'*** and that defines the rhythms of the whole body and the body and the brain has rhythms from one millisecond which is just a spike to the whole life time. Somebody talked about times particle. I think we can also think of time as time waves. And if we consider time waves, then the whole biggest time wave is 13.3 billion years or whatever the life of the universe itself. All the individuals, I just want to say that all these facts can be expressed by we human beings and there have been great examples of these experiences. For example, Swamy Swaroopananda of Benares, says, 'Akhanda Anthari Sahaja Spoorna Akahanda Anthari means there is a continuous, spoorna or impulse of well-spring within your heart. Listen to it and you will understand the whole phenomenon of life and mind. And also one more quote from Atmabodh, by Adi Shnakaracharya, ' When all the superficialities and mental activities goes away then there is an integration from a drop of water

to the ocean or small quantum space to the infinite space or small quantum energy to the infinite energy. In neuroscience now, in one of my lecture, we consider three clocks.

Prof. Shivanand Kanavi : Excuse me. Can you please line up ?

Deshmuk : Ok. I will leave it there.

Prof Sisir Roy: Dr.Kanavi : can I ask him just one clarification. You know that in the atomic scale of the brain, ion channel ions are propagating in just one direction, so I can see that arrow of time or direction of time is inbuilt in our brain function.

Deshmuk: Yes. That's true.

Ranjeeth: I am a student of Buddhsim. I sort of thought to offer a story from the ***Avatamsaka Sutra*** which is very popular in East Asian Buddhism with the scientists as well with the other people. Here they talk of a metaphor that there is a God Indra and the God Indra throws a net all over the universe and in each knot of the net there is a jewel and each jewel reflects other jewels in itself. So not only does it reflect each other jewel, it is also reflected in each other jewel. So you these interdependence, quantum entanglement and is such extremely valid with current ecology and post modernism. I just wanted to offer it up with you.yjuh Thank You.

Sumanto Roy : I have two inter-related questions and I will try to make it as focused as possible. The first question relates to the fundamental problem of the precise inter-relation between mind, consciousness on the one hand and on the other hand matter. Mainly I am asking this to physicists. The classical conception of matter probably has undergone a lot of change because in Quantum Mechanics we basically deal with ***psi*** which is Probability Amplitude. So now what is the fundamental ... you know..ontological constituent of this universe. What is the new and validated concept of matter and which is more fundamental, because do we need to revise the .you know...traditional materialist concept of mind and thoughts and consciousness as a result of the interaction of the neural networks and therefore when we pass away, your system, bodily system disintegrates and your personal consciousness will no longer be there. Does it require any sort of revision? What is the fundamental conception of matter from a theoretical perspective. So if you can kindly address it.

Prof Sisir Roy: We have physicist in our panel. If they can.. You know that if you look at from the ontological view point , the concept of Quantum Vacuum, should we try to understand Quantum Fields and their interactions and this Quantum Vacuum..it consists of kind of imprints or attributes of quantum fields like magnetic field, electron field .. there are others .. so there is a substratum which is physical. The substratum is not beyond space and time. But if you look at

the pure consciousness it is supposed to be beyond space and time. So we have a core reality called substratum which has kind of physical characteristics. But there the problem is, how different attributes of the physical physics come out of the fluctuations. That problem is not yet solved. And if only look at the property of the Quantum Vacuum it is self referential, self organizing. So in a sense again, some of these properties are like properties of consciousness itself.

Sumanto Roy : In constancy or stasis or structures which are eternal. On the other hand .....you know..... like Whitehead's processed philosophy certain structures emerge out of interaction between multiple entities. I would like to ask you if it is right to say that Vedanta kind of focuses or sort of assumes the true and eternal unchanging form of reality whereas in Buddhism it is like Prathithyasamutpada where multiple factors interacting to give rise to co-dependent origination. So which side is more reasonable given our not our assumptions but our validated scientific knowledge.

Prof Sisir Roy: This is very, very interesting question.

Sumanto Roy: This is mainly for both Atmapriyananda and Geshe Damdul

Prof Sisir Roy: Before that let me tell you from the scientific perspective..what we have achieved. Very recently we found that the very existence of the fundamental constants of nature – speed of light, Gravitational constant and Planck constant. That very existence states that the conscious activity of the brain should be there in this universe. So this is like a kind of dependent existence. Not dependent origination. So if you look at Pratityasamutpada, sometimes they say also dependent existence. Now our experts in panel, they can elaborate.

Atmapriyananda: Whether change will go first or constancy will go first is a big argument between us. You know the fundamental argument, whether philosophy or science or even common sense, "which is more fundamental, is it change or is it rest?" But inside everything is changing, everything is rotating, everything is changing and everything is in rotational motion as you know the rotational motion is equivalent to 'super harmonic motion'. There is Spandana, there is vibration, there is motion everywhere. There is nothing in the whole particle universe which is eternally at rest. Vedanta says, 'If everything is changing, who sees the change? If the person who is looking at the changes is also changing?

Sumanto Roy: It is.Many of the cells are also replaced after a certain time period. So what is being conserved is not individual …

Atmapriyananda: So if he also changing what is the guarantee that what he sees is right? Because by the time he sees a change, he has changed already. It is just like, I will tell you a small joke without offending you. No this is a joke. There is a person who is a drunkard. He wanted to take a loan from somebody and someone told him you please give us a loan, then what is the guarantee that he will give it back. No don't worry, I will give it back. After a couple of weeks he asked give me back the loan. I didn't take any loan from you. I knew that you would lie. Then where did you take the loan from? I took the loan from the place where a bull was sitting there. So the bull is sitting here, so give me back the loan. The bull was sitting somewhere else and the bull has changed its place and comes somewhere else. So suppose if there is a person who is looking at the change, then he himself is changing, what is the guarantee that the change he is looking at itself is not true? So these are many complicated questions actually. And therefore Buddhism has solved again this problem by Praityasamutpada and J.Krishnamurthy in the modern times and Ramana Maharshi to some extent elaborated on this. See thought continuously works. I am looking at the psychological point of view. There is a continuation of thought, every moment a thought arises and falls. Where is the thinker? The one statement is, 'Thought being insecure, wants to project the thinker into thinking some kind of security and thought being conditioned by the thinker, sorry, thinker being conditioned by this thought, which is constantly moving, the thinker itself is a constant emanates from the thought, he rises with the thought and falls with the thought.

So Ramana Maharshi's idea is that at every point of time, when you have a thought, there is a ego which is associated with the thought, 'I think' and when the thought subside, the ego also subside So there is continuity of the movement of this thought as a whole which gives you the feeling, the illusion of the continuity of the Self. This is a Buddhist idea " etc", but Vedanta will say that the entire thing as a whole will be on the move. Suppose you say, movement is fundamental, you can take the entire universe, where is space for the entire universe to move? And therefore there should be a 'Whole' which does not change or in which the concept of 'change' and 'changelessness' itself vanishes. You can't say it changes, because it changes with respect to something else and you can't it does not change, because the concept of 'change' itself doesn't arise when there is a complete sort of 'Whole'. So 'change' and 'changelessness' in a sense coalesce and Vedanta therefore says, 'there comes a point of time in a man's life when evolution and through thought and through inwardness and through meditation and heightened awareness in which he goes beyond the idea of 'change' as well as 'changelessness'. Both 'change' and 'changelessness' arise as concepts from the mind and when you transcend the mind, the idea of 'change' and 'changelessness' those people sees and therefore you don't say whether change is a fundamental reality, the Atman, the Ultimate Reality does not change. Because if you think of change in space-time, it is not that kind of 'changelessness'. The Atman is the supreme reality is not 'changeless', in the sense that it is opposed to 'change'. It is

'changeless' as beyond space-time and therefore the concept of 'changeless' and 'change' itself vanishes.

Geshe Dorji Damdul : There are two things happening here. One is let me correct what Athmapriyananda said. In Buddhism it is not true that everything is permanent. That is not true. Because, within Buddhism I said very clearly everything that exists can be classified into two, one which is impermanent, 'changing' and the other one which is 'unchanging'. So keep in mind, this is a very basic framework of Buddhist philosophy. So one thing and then the other one in terms of change. Say the person who is that person who did that and now who experiences the result. So this question is being asked. So it is very important to keep in mind, for example, If somebody asks you, say, 'Ok, where did you do your school?' 'Where did you do your kindergarten?' Oh, I did this in school A, but you are already a very old person, already 20 plus, how come you attended the such a school, the kindergarten school, you are already 20 plus. So here the change is there. It is so obvious, that the person who gives the answer, that I went to this school, when I was 5 years old. When the person who gives the answer knows it is so obvious that there is a change, "I was very young, I was very cute then. Now I am not cute". So this change is so obvious. Even the person who gives the answer knows that. At the same time, if you say that these are two different persons, it is totally a disaster, it contradicts all the conventional norms. So finally what for we have to study all these things? What for, we have to establish all this philosophy? And these things. It is finally to make our life easier to get a lasting happiness. So now from that point of view, how do you account for the Self, the same Self which went to Class 5. Now it can finish all the Class 5. This is known as the 'continuum'. This is explained on the basis of what is known as the continuum'. This is such an important concept, without establishing this concept then you will be attracting all the internal contradictions, so with the continuum we say 'I' .So this 'I' which is in the past, present and future. So this 'I' isn't changing, earlier it was very young and very cute, and now its' not as cute. Then later on it is going to be even older, but all the while what is known as the 'I' which pervades. So this is explained on the basis of the continuum.

Dr.Ramachandra G Bhat: Alaya Vigyana?

Geshe Dorji Damdul : No.No.Alaya Vigyana is believed to be one of the lowest forms of Buddhism. So this concept of the 'I', the self, which exists in all three times and at the same time it is changing. So therefore there is no contradiction, in saying that the Self changes and at the same time the Self is a constant for all the causes which one is engaged in earlier and now experience the result. So there is no contradiction.

Atmapriyananda: I think we are talking in two voices. See Vedanta accepts 'change' and 'changelessness' in the following way. The kind of change you are talking about which is

'Pravaha Prathipathinitya' and that is not the kind of changelessness about which Vedanta talks about the Atman. The Atman is absolutely 'changeless' in time and space, beyond space and time, it is absolutely changeless not this kind of 'change and changelessness' Pravaha Prathipathinitya. It means the following. Suppose you are taking bath in a river, in Ganges for example, and next day somebody else goes and take bath, 'Ah did you take bath in the Ganges?' 'Of course, I did.' 'Was it the same water you took bath yesterday? No, the water is moved, but the Ganges is still there. The flow of the Ganges, as a flow, is supposed to be changeless, in the way he was talking about. That is not the way in which Vedanta talks about Atman. It is not Pravaha ***Samsara***, the world is Nitya, is changeless in this sense, it is continuously flowing. But the Vedantic changelessness, is absolutely and irrevocably, totally, completely changeless and is beyond time and space. The kind of changelessness you are talking, component you are trying to insert into this Vedanta knows it very well It is of course change and it appears to be unchanging because we have the identity or continuum. The continuum of change is the absolute changelessness which Vedanta talks about.

Dr.Ramachandra G Bhat: Abadita Sathya

Atmapriyananda : Trikala Abadita Sathya is what we talk about.

Anil Rajavamshi :I am an observer. I have been observing consciousness of all the participants for the last few days. So I am not going to ask any profound questions. This question is of course for Swamiji. There is an indication that Swamy Vivekanda met Tesla, Nikola Tesla. Is there anything written up on that ?Either from Vivkenanda Ashram etc or from other side.

Atmapriyananda : And he is going to give a scientific demonstration. If that happens, mathematical demonstration he says and if that happens Samkayan cosmology can be put on a very profound foundation. Swamiji was thinking of writing a book on ancient Samkayan cosmology, visibly the modern science. Somehow he felt Samkyan cosmology comes closest to Science. What exactly transpired between them is not known, except to mention that Tesla is to give a mathematical demonstration.

Alex Hanky: I should like to start by thanking Prof Sisir Roy, Prof. B V Sreekantan and Prof. Sangeeta Menon so much for organizing such a wonderful conference and a wonderful symposium for all of us to participate. Thank You, so much. I just want to make a brief comment. I have been studying the relationship between the Vedic sciences and the modern sciences at my teachers instructions since 1973. I have come to the conclusion that the Vedic sciences are far in advance than the modern sciences for a very simple reason. Vedic sciences distinguish between the ***Sthoola*** gross levels that are open to perception and the ***Sooksma*** levels which are not open to gross sensory perception, but which can be perceived in trance yogic states based on the development of consciousness. The ***Sooksma*** states control the ***Sthoola*** states and

therefore anything which you can perform on the ***Sooksma*** level is bound to be more powerful than anything which is restricted to the ***Sthoola*** level. So the vedic sciences, the vedic technologies are absolutely bound to be more powerful and advanced than the modern sciences. Having said that, I have arrived solely at the conclusion that many of the ***Sooksma*** activities are located at *instability* points in various systems. Most matter is stable. When something becomes unstable it gives variable responses as physiological systems do to repeated stimuli. So as far as I can tell, the secret of ***Sooksma*** abilities lies developing the instabilities to a much greater extent in stabilizing them and this seems to be the purpose of the meditation programmes which activate ***Ritambara power*** which was mentioned and other states in which many different things can be cognized, deeper things can be understood and the vedic sciences reach the culmination.

Mani Kumar: I have been studying electrical networks of human nervous system. Mine is not a question. When Madhu Khanna madam was mentioning about seven chakras, I got something into my mind. As all electrical devices in this room have a ground connection, in the same way all the electrical networks of human nervous system have seven grounds actually. We use those seven grounds in order to get the exact electrical measurements of our responses. Amazingly these seven Chakras positions are exactly matched at the seven grounds of the human electrical networks. In general, Yoga and meditation practices stabilizes the vibrations of these Chakras. That's what people usually say. I think there is a concept called Ground Stabilization in electrical theory that is, in order to put the ground at zero volts, we need some sort of stabilization exercise I think. I think, this is such a valuable input. This will open a new window in order to look into the consciousness. Thank You so much.

Madhu Khanna: Thank You, so much. This is really news to me. I think we can collaborate on this because there is extensive literature on the Kundalini Shakti and phow it rises , but I just want to point out that there are different systems, even within the Kashmiri Shaivism. Some believe in nine, but seven is the standard. Seven chakras is the standard system which is accepted. Other traditions have more Chakras, but that's another field.

Atmapriyananda: What about Shat Chakras?

Madhu Khanna: They have Shat. But with the Crown, the ***Sahasrara***, it is seven.

Atmapriyananda: Six plus one.

Madhu Khanna: Sahasrar is the one which connects to the higher planes of consciousness. I just have a comment to make with your permission, because I have been hearing these wonderful observations. You see, basically what is it, when you…in the Upanishads there is a description of ***Pancha Koshas*** that we are all composed of five sheaths – the corporeal frame and then the body of ***Pran***, then the body of ***Manas*** –mind, then ***Vigyan*** and finally body of bliss.

Basically the way I get the message when I read it. Every human being has the capacity to look at the world in five different ways. You can look at it in corporeal, you can look it at as Prana, you know just as vibrations, you look it through the mind and split it apart as scientists do. Vigyana is intuitive perception and bliss is even higher than that. So for a instance, I often tell my students that if you touch that bliss within yourself, when you see two people fighting, you will not fight back, if somebody fights with you, because you are in bliss and you will be, you know, sharing that bliss. So these five levels of consciousness, five perspectives is important because the intuitive and the rational has to be integrated . I think we have reached that moment in history and Fritjof Capra made a very interesting statement. He says, 'Science doesn't need philosophy or nPhilosophy doesn't need science, but humans need both.' Because you can't just separate. Therefore, I want to thank you for creating this forum, for the audience and of course Sangeetha. Thank You.

Krishna Swamy :The time frame chases me. Of course. I have modalities question, organizing question. So it is non-technical, so to say. Understanding of consciousness, the inter-connectedness and intentment of Quarks is one thing. The dynamic dance of Shiva, the dynamic equilibrium of Shiva, was in an enthralling manner projected by a group from CERN, European association for nuclear research. Last week in Delhi, I had the opportunity to attend that and it was fantastic. Especially true from various nations, individuals from various nations, six people had a terrific dance. We call them particles, sub-atomic particles, that can we have a dynamic Eastern type of, Eastern kind of dynamic dance arranged with this kind of energy. Can we arrange a unique way of presenting a dance like that lecture demonstration.

Madhu Khanna: Yes absolutely. You know if you read the Natya Shastra theory of dance, one of the thing that comes is that all movement is held by a still access. So in all the postures of ***Bharatnatyam*** it is true. There is a still axis which is balancing the movement.

Krishna Swamy: So we can arrange a programme I thought is one thing.

Dr.Ramachandra G Bhat: Is that cosmic dance of Shiva? That's what Fritjof Capra has projected that one. He has elaborated very well. That we can understand very well. Even that vibration ***Mahakampana***, every time going on.That you can have it.Because every particle is vibrating.

Krishna Swamy: And we have overwhelming theoretical basis and great number of danseuses and dancers will also dance out. Point number one. I would like Prof.Bhandari to answer this. It is a sad state of affairs in our country that, monuments are not cherished and properly kept organized. We all know that it is not a secret for Indians. Number two. In Vijayamangala, a rich village near Erode district, from where I come, near that I am living. Vijayamangala temple,

Jaina temple is in ruins. But it is a beautiful temple, a medieval temple, archaeologically speaking, it is certainly a medieval temple. And apart from no Pujas, no worship and probably the crows, ants etc. the animal kingdom have stayed there and very few human being go there, even for a week. Some people like me, yearly once we go and the whole sanctity is lost. Somehow have to have a system by which we can pressurize the government being activists in some way or the other to bring a change in such ruins temples whether Jaina or whichever religion. This is for Prof Madhu Khanna to act upon it, not to say a few words.

Prof. Shivanand Kanavi: Now we are almost at the end of it. Prof. Sangeetha Menon also asked me to say a few words. I came here to attend the conference and I was asked to be a part of this symposium and listen to all of you. I come from a Theoretical Physics background who later became a journalist. So I am more interested in communicating ideas, trying to understand complex ideas and try to communicate them. From the background of Physics, yesterday somefrom the audience called all of us Charavakas who don't believe in the Atman and that everything rises from matter etc. But however that be, but I with brief introduction to various traditions in Indian philosophy, I thought that various concepts very striking. I mean I am not talking about complete schemas, theories and systems, but the concepts. Some of the concepts, for example, the Samkya theory of Shristi of Prakriti or Pradhana and Purusha That there is ..both are Nitya. Both are eternal, but as they say one cannot act without the other. In Fact, they gave the concept of the lame and the blind, leading to the Shristi. I found very interesting. Similarly the concept of ***Svabhava Vada*** in Samkya which is very similar to the law of nature and finally if something is going in an elliptical orbit, why is it going in an elliptical orbit. You can say it's law of nature, you can say it is one over r squared, but why one over r squared. Finally we say, that's the way it is. That is Svabhava. And this whole concept of one cause, we know that it is a complex whether it is a many body theory, many body physics or in societal phenomenon – that not a single cause leads to a single effect. So many causes leading to an effect, that is what I understand as ***Pratityasamutpada*** . I think it is a great concept which we can verify and we talk about in many body physics and so on. And similarly the atomistic theories, whether they come from Vaisheshika, Jaina or Ajivika.. I mean they are great contributions because ..you have to stop somewhere, you cannot have anything infinitely divisible. The moment you have something infinitely divisible, then how do you compare two things? What is the difference between as you say a stone and a mountain? Both have ***paramanu***, but if both have uncountable infinity of paramanu why something is smaller, why something is bigger? So that which you can measure things, weigh things there is discreteness at the bottom of nature, which is what you know we are talking about so it is very interesting to hear about ***Kalanu, Pradesha*** you all these types of atoms of time, atoms of space and of course matter as well. And similarly the fact that nothing, you know the Newtonian concepts of absolute space, time, rest, motion being..we know that in Modern Physics we don't accept them.. that there is motion everywhere, there is Zero Point Energy, vacuum fluctuations etc. etc. and it's so .. resonates so

much with the Indian concepts. For example, ***Jagatyam Jagat***, that everything is moving. The word jagat is defined as something which is in motion is Eshopanishad. And similarly the concept of not take something blindly but using ***Pramanas*** ..you know the various ***Pramanas*** to prove it. So Prameya, so all this is from the ***Nyaya Vaisheshika*** , jointly called ***Tarka*** and I think... these so appealing to scientist that even if you do not accept.. even if you do not understand many of the other concepts, that some of these things conceptually methodologically, I think are highly appealing ... which makes us..people like me, look at tradition without prejudice and try to understand it on it's own terms before trying to compare and criticize and you know .. or call something idealist, materialist etc. etc which looks like mechanical kind of category. Lastly I think something which is very very important for scientific discussion and even for social democratic way of living is this whole humility and mutual respect which is expressed in the parable of blind men describing the elephant and which ***Anekantavada*** talks about it. That every aspect the whole relativism that is expected, that is expressed in that. Relativism of truth, that everything is a point of view and even if you integrate all of them you might end up with something which is not really the elephant. So you will only asymptotically reach the reality, asymptotically reach the truth, the elephant and that is the hope. But that itself demolishes all kinds of absolutism. And with absolutism there cannot be any democracy. If you say this is the Truth and I monopolize the truth then that's the end of it. So the very fact that there is this approach in traditional Indian systems that there has to be mutual respect and that humility and that this is our view, we are ready to listen to your view and you know may be we learn from each other and adapt and so on.. I think it is a great sustainer of both scientific development as well as our own social existence as a diverse society. Thank You very much... I would just like to say that this is a wonderful interaction. I missed earlier parts of the conference .. I attended some of them and today' symposium was fantastic ... so I heartily thank Prof. Menon and the NIAS for organizing this wonderful thing and of course all the sponsors who supported it and I am really glad to see so many of them supporting this kind of a conference. Thank You very much.

Appendix II: On the Nature of Reality

(A Conversation between Rabindranath Tagore and Professor Albert Einstein in the afternoon of July 14, 1930, at the Professor's residence in Kaputh)

EINSTEIN Do you believe in the Divine as isolated from the world?

TAGORE: Not isolated. The infinite personality of man comprehends the universe. There cannot be anything that cannot be subsumed by the human personality, and this proves that the truth of the universe is human truth. I have taken a scientific fact to illustrate this – Matter is composed of protons and electrons, with gaps between them; but matter may seem to be solid. Similarly humanity is composed of individuals, yet they have their interconnection of human relationship, which gives living solidarity to man's world. The entire universe is linked up with us in a similar manner, it is a human universe. I have pursued this thought through art, literature and the religious consciousness of man.

EINSTEIN: There are two different conceptions about the nature of the universe: (i) The world as a unity dependent on humanity. (ii) The world as reality independent of the human factor.

TAGORE: When our universe is in harmony with man, the eternal, we know it as truth, we feel it as beauty.

EINSTEIN: This is a purely human conception of the universe.

TAGORE: There can be no other conception. This world is a human world – the scientific view of it is also that of the scientific man. There is some standard of reason and enjoyment which gives it truth, the standard of the Eternal Man whose uexperiences are through our experiences.
EINSTEIN: This is a realization of the human entity.

TAGORE: Yes, one eternal entity. We have to realize it through our emotions and activities. We realize the Supreme Man, who has no individual limitations, Science is concerned with that which is not confined to individuals; it is the impersonal human world of truths. Religion realizes these truths and links them up with our deeper needs. Our individual consciousness of truth gains universal significance. Religion applies values to truth, and we know truth as good through own harmony with it.

EINSTEIN: Truth, then, or beauty, is not independent of man?

TAGORE: No.

EINSTEIN: If there would be no human beings any more, the Apollo of Belvedere would no longer be beautiful?

TAGORE: No.

EINSTEIN: I agree with regard to this conception of Beauty, but not with regard to Truth.

TAGORE: Why not? Truth is realized through men.

EINSTEIN: I cannot prove that my conception is right, but that is my religion.

TAGORE: Beauty is in the ideal of perfect harmony, which is in the Universal Being; truth the perfect comprehension of the Universal Mind. We individuals approach it through own mistakes and blunders, through our accumulated experience, through our illumined consciousness - how, otherwise can we know Truth?

EINSTEIN: I cannot prove scientifically that the truth must be conceived as a truth that is valid independent of humanity; but I believe it firmly. I believe, for instance, that the Pythagorean theorem in geometry states something that is approximately true, independent of the existence of man. Anyway, if there is a reality independent of man there is also a truth relative to this reality; and in the same way the negation of the first engenders a negation of the existence of the latter.

TAGORE: Truth, which is one with the Universal Being, must essentially be human; otherwise, whatever we individuals realize as true can never be called truth - at least, the truth which is described as scientific and can only be reached through the process of logic, in other words, by an organ of thoughts which is human. According to the Indian philosophy there is Brahman, the absolute Truth, which cannot be conceived by the isolation of the individual mind or described by words, but can only be realized by completely merging the individual in its infinity. But such a truth cannot belong to Science. The nature of truth which we are discussing is an appearance - that is to say, what appears to be true to the human mind, and therefore is human, and may be called maya, or illusion.

EINSTEIN: So according to your conception, which may be the Indian conception, it is not the illusion of the individual, but of humanity as a whole.

TAGORE: In science we go through the discipline of eliminating the personal limitations of our individual minds and thus reach that comprehension of truth which is in the mind of the Universal Man.

EINSTEIN: The problem begins whether Truth is independent of our consciousness.

TAGORE: What we call truth lies in the rational harmony between the subjective and objective aspects of reality, both of which belong to the super-personal man.

EINSTEIN: Even in our everyday life we feel compelled to ascribe a reality independent of man to the objects we use. We do this to connect the experiences of our senses in a reasonable way. For instance, if nobody is in this house, yet that table remains where it is.

TAGORE: Yes, it remains outside the individual mind, but not outside the universal mind. The table which I perceive is perceptible by the same kind of consciousness which I possess.

EINSTEIN: Our natural point of view in regard to the existence of truth apart from humanity cannot be explained or proved, but it is a belief which nobody can lack—no primitive beings even. We attribute to Truth a super-human objectivity; it is indispensable for us, this reality which is independent of our existence and our experience and our mind – though we cannot say what it means.

TAGORE: Science has proved that the table as a solid object is an appearance, and therefore that which the human mind perceives as a table would not exist if that mind were naught. At the same time it must be admitted that the fact, that the ultimate physical reality of the table is nothing but a multitude of separate revolving centres of electric forces, also belongs to the human mind.

In the apprehension of truth there is an eternal conflict between the universal human mind and the same mind confined in the individual. The perpetual process of reconciliation is being carried on in our science and philosophy, and in our ethics. In any case, if there be any truth absolutely unrelated to humanity then for us it is absolutely non-existing.

It is not difficult to imagine a mind to which the sequence of things happens not in space, but only in time like the sequence of notes in music. For such a mind its conception of reality is akin to the musical reality in which Pythagorean geometry can have no meaning. There is the reality of paper, infinitely different from the reality of literature. For the kind of mind possessed by the moth, which eats that paper, literature is absolutely non-existent, yet for Man's mind literature has a greater value of truth than the paper itself. In a similar manner, if there be some truth which

has no sensuous or rational relation to the human mind it will ever remain as nothing so long as we remain human beings.
EINSTEIN: Then I am more religious than you are!

TAGORE: My religion is in the reconciliation of the Super-personal Man, the Universal human spirit, in my own individual being. This has been the subject of my Hilbert Lectures, which I have called "The Religion of Man".

Appendix III: Biocentrism

We have seen from the earlier chapters of this book , that the current scientific approach to reach ultimate reality is based on the ' reductionist ' method which has led to ' quantum vacuum' as the most plausible substratum that can be regarded as the ultimate reality that is behind the creation of the various features of the universe...its extent, composition and forces responsible for the variety of phenomena that have come to our knowledge. This 'quantum vacuum' is assumed to be composed of a variety of energy fields endowed with special properties that give rise to the special characteristics of the particles like leptons and quarks that spontaneously manifest themselves due to fluctuations.. While this has led to a reasonable explanation of the inanimate phenomena in the universe, despite hundred years of Scientific research, it has not been possible to explain two most important features namely ' life' and 'consciousness'.

In very recent years , a new approach is being attempted by scientists Donald Hoffman of the Department of Cognitive Sciences University of California , Irvine and Robert Lanza and Bob Berman Astronomer and science journalist . Their approach is radically different. According to Donald Hoffman(1) " Space-time and physical objects are not insights into objective reality, but species -specific adaptations that allow us to survive and reproduce. This requires a radical reformulation of our notions of the nature of objective reality and our notion of time. In the light of the evolutionary results,, I propose a formal model of consciousness based on a mathematical structure called conscious agents. I then propose how time and space merge from the interaction of conscious agents."

Lanza and Berman (2, 3) have published two books with the titles ' Biocentrism' , and. ' Biocentrism and Beyond ' in which they propound their thesis that Life and Cinsciousness are the keys to the understanding the nature of the universe.

The five principles of Biocentrism postulated by them are :

1. What we perceive as reality is a process that involves our consciousness,
2. Our External and Internal perceptions are intricately intertwined. They are different sides of the same coin.
3. The. behavior of subatomic particles, indeed all particles and objects is intrinsically linked to the presence of an Observer. Without the presence of a conscious observer , they are best exist in an undetermined state of probability waves.

4. Without ' Consciousness ' matter dwells in an undetermined state of probability. Any universe that could have proceeded Consciousness only existed in a probability sense.
5. The. Very structure of the universe is explainable only through Biocentrism. The universe is fine tuned for life, which makes perfect sense as life creates the universe and not the other way round. The universe is simply the spatio-temporal logic of the self.

References:

1. Donald Hoffmaan(2014) The origin of time in conscious agents; Cosmology Vol.18, pp.494-520.
2. (2) Robert Lanza and Bob Berman(2009). Ben Bella Books, Dallas.
3. (3) Robert Lanza and Bob Berman(2014) Ben Bella Books , Dallas

Appendix IV: Collection of Quotations

Abstract.
Here, we present a series of quotations, brief statements on three topics namely reality, consciousness, and oneness which we have discussed extensively in the earlier chapters. The quotations are from scriptures, philosophers, scientists, wise men of different countries and belonging to various times. We have deliberately not ordered them in a historical sequence, nor discipline wise to bring out effectively one message that a large majority of them subscribe to the idea that these three topics are closely related and some of them emphasize that three are one and the same. What is remarkable is that they have come to this unique conclusion by following entirely different methods of pursuit of knowledge. Clearly, Mount Everest can be reached by many routes, what is required is the necessary dedicated effort (science, meditation, insights).

Schrodinger: (Physicist, NL) I do not believe that we can approach any understanding of the mind-matter problem on a dualistic basis. There is no reason at all for dualism.

Matter is a construction from sense impressions and representations [vorstellungen] in a certain combination and what one calls an `individual mind' consists ofcourse of the same elements. It is the same material, merely comprehended in a different way.

In the first kind of comprehension the world is finally constructed, in the second *self*. The world is certainly no dream, no phantom and certainly the self is not merely a `summation' of connected sensations in a peculiarly fluctuating sequence .... when I reflect carefully, two distinct things are not given to me at all. Both come to me uniformly from the same source. I find no inhomogenuity in the flow, no separation of spiritual and material. It is all from the same substance.

The I That is God

(i) My body functions as a pure mechanism according to the laws of nature.
(ii) Yet I know, by incontrovertible experience that I am directing its motions, of which I foresee the effects that may be fateful and all important, in which case I feel and take full responsibility for them.

The only possible inference from these two facts, I think, that I, I in the widest meaning of the word, that is to say, every conscious mind that ever said or felt "I" – am the person, if any who controls the "motion of atoms" according to the laws of nature.

In itself, this insight is not new. The earliest records data back to some 2500 years or more. From the early great Upanishads the recognition ATMAN=BRAHMAN (the personal self equals the omnipresent, all-comprehending eternal self) was an Indian thought considered far from being blasphemous, to represent the quintessence of deepest insight into the happenings of the world.

The saying of all scholars of Vedanta was, after having learnt to pronounce with their lips, to really assimilate in their minds the grandest of all thoughts.

[Aham Brahmasmi, Shivoham]
Again, the mystics of many centuries, independently, yet in perfect harmony with each other (somewhat like the particles in an ideal gas) have described, each of them, the unique experience of his or her life in terms that can be condensed in the phrase: DEUS FACTUS SUM (I have become God)

Heisenberg: (Physicist, NL)
You know in the west, we have built a large, beautiful ship. It has all the comforts in it. But one thing is missing; it has no compass and does not know where to go. Men like Tagore and Gandhi and their spiritual forbears found the compass. Why not this compass not be put in the ship, so that both can realize their purpose.

David Bohm (Physicist)
Underlying the apparently chaotic realm of physical appearances – the explicate order – there is always a deeper hidden implicate order.
Implicate order is the quantum potential – a field consisting of fluctuating pilot waves. The overlapping of these pilot waves generates what appears to us as particles which constitute the explicate order.
Even such seemingly fundamental concepts as space and time may be merely explicate manifestations of some deeper implicate order.
What underlies all is unknown and cannot be grasped by thought.

John Archibald Wheeler (Physicist)
The language of Eastern Mystics and Western physicists are becoming similar

May the universe in some strange sense be brought into being by the participation of those who participate!

The vital act is the act of participation

Participator is the incontrovertible new concept given by quantum mechanics. It strikes down the term "observer" of classical theory, the man who stands behind thick glass wall and watches what goes on without taking part. It cannot be done, quantum mechanics says.

The key to understanding the universe is you.

The distinction "in-here", "out-there" may not exist. What is out-there apparently depends in a rigorous mathematical sense as well as philosophical one, upon what we decide in-here.

What we experience is not external reality but our interaction with it.

Heisenberg : What we observe is not nature itself, but nature exposed to our method of questioning. The wave function does not represent a real situation, but our knowledge of a physical situation. The wave function collapse is not an actual physical event, but represents the change that occurs in our knowledge when we become aware of the result of measurement.

BELL (Physicist)**:** The world is filled with innumerable non-local influences.

Furthermore these unmediated connections are present not only in rare and exotic circumstances, but underlie all events of everyday life. Non local connections are ubiquitous because reality is non-local.

Einstein (Physicist, NL):A human being is part of the whole world called by us the universe, a part limited in space and time. He experiences himself, his thoughts and feelings as something separated from the rest – a kind of optical delusion of his consciousness.

The delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons near to us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty. Nobody is able to achieve this complexity by striving for such achievements is, in itself, a part of the liberation and foundation of inner security.

Democritus (460-370 BC) : Reality underlying appearances consisted of nothing but atoms and void.

Plato (429-347 BC) (Philosopher): Reality not to be found in the physical world (world of Sensibilia) but rather in the non-physical world of intelligibilia - a world that houses mathematical entities and other non-physical objects of thought. Only by turning away from the

sensible world and contemplating on the non-physical objects of intellection, could real understanding be achieved. There is a theoretical counterpart to what we can see – PERFECT Forms deduced from thought.

Einstein: The external world really exists. Any legitimate use of the word can say that the external world of physics is the only one that exists.

Geometry is free to create complex systems of logically sound conclusions without any reference to experience. But it is left to experience and experience alone to give these constructs a physical meaning.

Experience remains, ofcourse, the sole criterion of the physical utility of a mathematical construction. But the creative principle resides in mathematics. In a certain sense therefore *I hold it true that pure thought can grasp reality, as the ancients dreamed.*

Reality is the real business of Physics.

Paul Davies: The philosophy that the reality of the world is rooted in observation is akin to what is known as logical positivism. It seems perhaps alien to us because, in most cases, the world still behaves as if it had an independent existence. It is actually only when we witness quantum phenomena that this impression looks untenable. Even then in their practical work many physicists continue to think of the microworld in common sense way. The reason for this is that many of the purely abstract mathematical concepts employed become so familiar that they assume a spurious air of reality in their own right – example "Energy" merely mathematical concept that connects observations.

What Bohr's philosophy suggests is that words like 'electron', 'proton', 'atom', should be regarded in the same way – as useful models that consolidate in our imagination what is only a set of mathematical relations, connecting observations.

Kuhn: Reality is ultimately unknowable; any attempt to describe it obscures as much as it illuminates.

Bohr (Physicist): Subatomic entities such as electrons have no real existence; they exist in probabilistic limbo of many possible superposed states until forced into a single state by an act of observation.

The electrons or photons may act like waves or like particles depending on how they are experimentally observed.

Wheeler(Physicist): May not be entirely physical. Our cosmos may be a participating phenomenon, requiring observation and thus consciousness itself.

Faust: In this thy nothing. May I find all.

Radhakrishnan (Philosopher): Unreal the world is, Illusory it is not.

Feyerabend: You think that this one day fly, this little bit of nothing – a human being according to today's cosmology can figure it all out? This to me seems so crazy. It cannot possibly be true. What they figured out is one particular response to their actions and this response given the universe and the reality behind this is laughing! Ha! Ha!. They think, they have found me out!

Stanislaw Grof (Transpersonal Psychologist) I have concluded that the data from the LSD research indicate an urgent need for a drastic revision of the existing paradigm for psychology, psychiatry and medicine and possibly science in general. There is at present little doubt in my mind that our current understanding of the universe, of the nature of reality and particularly of human beings is superficial, incorrect and incomplete.

Niels Bohr: But, we ought to remember that religion uses languages in quite a different way from science. The language of religion is more closely related to language of poetry than language of science. True we are inclined to think that science deals with information about objective facts and poetry with subjective feelings. Hence we conclude that if religion does indeed deal with objective truths, it ought to adopt the same criteria as of truth in science. But, I myself find that the division of the world into an objective and subjective side much too arbitrary. The fact that religions through the ages have spoken in images, parables, and paradoxes means simply that there are no ways of grasping reality to which they refer. But that does not mean that it is not a genuine reality. And splitting the reality into an objective and a subjective side won't get us very far. That is why I consider those developments in physics during the last decades which have shown how problematized. Such conceptions as 'objective' and 'subjective' are a great liberation of thought.

Schuman(Psychologist): For all practical purposes we have no direct conscious experience of the brain processes that underlie their thoughts, feelings, and actions. Most of our consciousness is curiously displaced from the organ (brain) which is hypothesized to construct the experience of consciousness. When we move our hands, we do not experience the fact that the movement of muscles in our hands is actually controlled by patterns of brain processes.

Fischbach: Mind is often equated with consciousness, a subjective sense of self-awareness. A vigilant inner core that does the sensing and moving is a powerful metaphor, but there is no

apriori reason to assign a particular locus to consciousness or even to assume that such global awareness exists as physiological unified entity. Moreover, there is more to mind than consciousness or the cerebral cortex. Urges, moods, desires and subconscious forms of learning are mental phenomena in the broad view. We are not zombies. Affect depends on the functions of neurons in the same manner as consciousness thought.

Whitehead (Philosopher, Mathematician): Neither physical nature nor life can be understood unless we fuse them together as the essential factors in the composition of 'really real' things.

Bohr &Pauli : While, Bohr maintained a studious ontological neutrality. Pauli was of the view that finding a new conception of reality was a virally important task and that this would radically revise the physis-psyche connection inherits from the 17^{th} century science.

Ranjit Nair: Pauli's interpretation takes the wave function to be an element of reality, indeed as the primary reality, must be surely distinguished from those interpretations (e.g. Bohr) in which the wave function is regarded essentially as a calculational device which yields probabilistic predictions for classically defined observations. Pauli's interpretation therefore embraces a realism about microphysical theory which Bohr confines to macrophysical (classical theory) theory.

According to Pauli not only portrays an objective reality, it also concerns, the observer's information about reality. The 'observer' of Pauli, however, is not necessarily conscious mind, but a sort of generalized impersonal subjectivity for want of a better term – (the anima mundi stacks where observer's cannot tread)

*Zen-like view of reality in which all forces and all matter come from a single source.

David Hodgson: Mind can to some extent be said to be a function of the brain, but only, if brain is understood not as the detectable microscopic object but as the quantum reality underlying both this object and the mental events of consciousness. Mind and brain are manifestations of and view points towards, a 'single reality', but with important differences, in particular in relation to the development over time of this reality and (specifically) the causes and explanations of such developments.

Max Born: No language which lends itself to visualizability can describe the quantum jumps. The angular momentum of a subatomic particle is fixed, definite and known, but one should not imagine that there is anything in the nature of matter actually rotating.

T.H. Huxley: we are conscious automata with consciousness playing no more role than that of a steam whistle which accompanies the work of a locomotive [but which is without influence on its machinery].

William James: Taking a purely naturalistic view of the matter, it seems to me reasonable to suppose that unless consciousness served a useful purpose it would not have been superadded to life.

Neki: Consciousness directs the genes that are responsible for coding.

Samal: Once everything is reduced to information consciousness is the ability to process the information.

William James: One conclusion was forced on my mind at that time (when he was having a luminous experience after taking nitrous oxide) and my impression of its truth has ever since remained unshaken. It is that our normal waking consciousness, whilst all about it, parted from it by the filmiest of screens there lie potential forms of consciousness entirely different. We may go through life without suspecting their existence, but apply the requisite stimulus and at a touch they are there in all their completeness, definite types of mentality which probably have somewhere their field of application and adaptation. No account of the universe in its totality can be final which leaves these other forms of consciousness quite disregarded.

B Ramamurthy (Neuro surgeon): Neurobiologists define consciousness as the ability of the organism to respond purposefully and thus consciousness is a basic function of life at all levels of evolution

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[Does each neuron possess consciousness? Do other cells possess a modicum of C?]

All matter, energy in the universe is subject to some sort of law or control and the response to this control or law may be defined as 'consciousness'.

Under this concept all objects in the universe including those on earth manifest some level or other of this 'force' – 'consciousness' depending on the matter constituting them. Thus the manifestation of 'consciousness' is maximum in the higher 'evolved' beings rather than those in the lower levels.

Crick and Koch: One could hope to achieve true understanding of consciousness or any other mental phenomena only by examining neurons and interactions between them – only then

models of consciousness analogous to those that explain hereditary in terms of DNA can be created.

Crick: In his book "Astonishing hypothesis" :

Your joys, your sorrows, your memories, your ambitions, your sense of personal identity and free will are in fact no more than the behavior of vast assemblies of nerve cells and their associated molecules.

Daniel Dennet: Consciousness and our sense that we possess a united self – was an illusion arising out of the interaction of many different 'subprogrammes' run on brains hardware.

Weinberg: If neuroscientists ever explain consciousness for example 'they will explain it in terms of the brain' and the brain is what it is because of historical accidents and because of the universal principles of chemistry and physics.

Wheeler: Reality might not be entirely physical. Our cosmos may be a participatory phenomenon, requiring observation and thus consciousness itself.

Stent (Biologist): If crick feels that consciousness was scientifically tractable, then that possibility must be taken seriously.

A purely physiological explanation of consciousness would not be as comprehensible or as meaningful as most people would like it to be, nor would it solve moral and ethical questions.
One would design a computer to become an expert in restaurants, but this machine would never know what a steak tastes like.

Harry Hunt (Psychologist): Consciousness is something that is before each of us at this very moment, yet not sought or noticed as such until questioned. Consciousness is the basis of synthesizing, directing volitional capacities of the mind. Awareness is non-causal, epiphenomenal expression of the more fundamental computational capacity.

Even if we know the exact neural processes occurring with experience of pain or colour, that would not necessarily show us how these processes were those conscious experiences, let alone eliminate the language and categories that describe them.

Sperry (Neuro-surgen): Consciousness is a higher order emergent from holistic neural properties that will in turn exercise 'downward' control our neural functions.

Miller (Psychologist): All motile creatures must be 'conscious' in some form because their motility requires it for safe navigation and indicates it behaviourally – down to protozoa which have no separate nervous system – if this is unconscious functioning then, unconsciousness must evolve as much or more than consciousness.

Noam Chomsky: Consciousness is only one of the many mysterious properties of nature.

Steven Pinkar: Consciousness, free will, the self and other riddles posed by the mind are probably unsolvable.

R.C. Pradhan (Philosopher): Is consciousness not a positive reality? – a supervenience on material universe? Is it part of a higher order non-material phenomena?

How does a material objective like the brain produce characteristically different phenomenon like consciousness. Your have to have an I (subject) which has to have conscious experience. No consciousness without "I"?

The experience is not a material body. What is the nature of self or I. Is there a biological explanation for the "I" to come about? Consciousness is Sui generis. There are no psycho-physical laws in nature. Therefore supervenience does not work consciousness is ontologically primary to all other entities in the universe.

Jonathan Shear: The problem of not being able to explain consciousness is not just a problem about consciousness, it is a problem directly confronting the enterprise of science. In trying to make science objective, one has systematically removed consciousness from science and is now trying to find explanation for it. Consciousness is non-spatial. Physical world is spatial. Then how can physical world give rise to consciousness?

H. N . Shankar: Consciousness is that which is common to all our experiences.

Wildman: Is consciousness a fundamental property of the universe? Prior to matter?

Nagel: The subjectivity of consciousness is an irreducible feature of reality without which we cannot do physics or anything else – and it must occupy a fundamental place in any credible world view as matter, energy, time and matter.

There is much above and below human range that is invisible and inanimate.

Prof. Narasimha Accordingto Yoga Vasista , the whole stuff of the universe is consciousness as water is of seas and it vibrates through the intellect as water pounds through the ocean waves

[Ekam vastu jagat sarvam
Cin-matram var iva ambudhih |
Tad-eva spandate dhibhih
Suddha variiva vichi bhih]

Herman Weyl (Mathematician): The question of the reality of the world mingles inseparably with the question of the reason for its mathematical harmony. The latter clearly points in the direction of transcendency than that of transcendental world – towards the origin rather than beyond all knowledge, in God alone, emanating from Him, the light of consciousness, its own origin hidden from it grasps itself in self-penetration divided and suspended in between subject and object, between meaning and being.

Max Planck (Physicist-Jan 25, 1931): Consciousness, I regard as fundamental, I regard matter as derived from consciousness. We cannot get consciousness. Everything that we talk about, everything we regard as existing postulates ofconsciousness.

Eddington: I regard consciousness as fundamental. I regard matter as derived from consciousness; the old atheism is gone.

Herman Weyl (Mind and Nature): The world does not exist independently but only for consciousness.

Between the physical processes which are released in the terminal organs of the nervous conductors in the central brain and the image there upon appears to the perceiving subject, these gapes a hiatus, an abyss which no realistic conception of the world can span. It is the transition of the world of being to the world of appearing image or of consciousness.

Heitler (Physicist): What physics gives us a "sort of projection of the world on to a causal-quantitative plane just as a photograph is a projection of the 3-dimensional landscape on to a plane paper. Principles of life, will, action, perception, memory, purpose cannot be reduced to physic-chemical processes.

Eddington: The stuff of the world is Mind-Stuff. The mind-stuff is a not spread in space and time. Recognizing the entire world is abstract and without actuality apart from its linkage to consciousness, we restore consciousness to a fundamental position.

Von Weizsacker: Consciousness and matter are different aspects of the same reality.

Pauli: The only acceptable point of view appears to be the one that recognizes both sides of reality, the quantitative and qualitative, the physical and the psychic, as comparable with each other and can embrace them simultaneously. It would be most satisfactory if all of physics and psyche (matter and mind) could be seen as complementary aspects of the same reality.

David Darling: Consciousness is not a thing that appears suddenly. It does not abruptly spring into being by a few extra brain cells addition or by climbing a few rungs of evolutionary ladder.

To understand consciousness, you cannot treat it as an object, but as emergent higher level process with its own rules and properties. Therefore it cannot be explained in terms of brain physiology, ultimately upon trillions of mini-scale chemical reactions and electrical fluctuations.

Stent : No purely physiological theory can ever really explain consciousness since the process responsible for this wholly private experience will be seen to degenerate into seemingly quite ordinary workday reactions, no more or less fascinating than those that occur say in the lever.

An important feature of conscious is in its perception of time. There is nothing in physicists' space-time description that singles out 'time' as something that 'flows'. It is only the phenomenon of consciousness that requires us to think in terms of 'flowing time' at all.

Nick Herbert : Consciousness is a fundamental force that enters into necessary cooperation with matter to bring about the fine details of the everyday world.

There is no objective way of telling whether a given piece of matter is consciousness or not.

Though it may appear abstract, (subjective) it is consciousness that gives concreteness to all our observations of the external world.

Dyson: I think our consciousness is not just epiphenomena carried along by chemical events, but is an action against forcing the molecular complexes to make choice between one quantum state and another. In other words mind is already inherent in every electron.

[critic: For the orchestra to make sense, human consciousness has to be there .... Begging the question!]

Rodolfo Llinas (Neuroscientist): Firing of neurons is not just simultaneous but also coordinated. Magnot-encephalograph studies which measure electric currents in the brain –

electrical responses to musical tones – A whole lot of cells must be jumping up and down at the same time. Llinas believes that these oscillations are the building blocks of consciousness.

We can say that being awake or being conscious is nothing but a dreamlike state. It is a state that corresponds highly to external reality. But it has no objective reality, as with 'rainbow'. You can perceive it, but never touch or measure it.

Penrose: Consciousness may arise from quantum mechanics – the same process that governs the behaviours of subatomic particles.

Computer Scientist: Mind is something like a parallel processing computer. Consciousness is simply the coordinated single processing of individual agents. These agents described as simple computer programmes – sound like 'convergent zones' of Damsion

[Convergent zones: in the brain's left hemisphere. An area in the temporal lobe pulls together information about names of objects, animals, and people. While other areas act as nexus for verbs, a third area for assembling nouns and verbs into sentences.]

Systems view of consciousness: All structures from subatomic particles to galaxies, from bacteria to human beings are manifestations of the universe is self-organizing dynamics. [Almost the mystic view?]

Tielhard de Chardin: Evolution proceeds in the direction of increasing complexity and this increasing complexity is accompanied by a corresponding rise of consciousness, culminating in human spirituality.

Jung: The conscious mind grows out of unconscious psyche which is older than that and which goes on functioning together with it or even inspite of it. Jung distinguished two realms of unconscious psyche: Personal unconscious belonging to the individual and a collective unconscious that represents a deeper stratum of the psyche and is common to human kind.

Jung's concept of collective psyche distinguishes his psychology from Freud and others. It implies a link between individual and the entire cosmos.

"Unconscious is a process involving `collective present dynamics patterns' universal forms embedded in web of relationships – each archetype involves all the others".

Susan Greenfield : Feelings of consciousness are a way of bringing about a cohesion between all these systems and organs. "Emitting response is not consciousness" – that is the best that machines can do.

Centre of consciousness is everywhere – multiple areas working together. Nevertheless it is a single experience at any one moment. You are always conscious of something. It is an emergent property of non-specialized groups of brain cells that are continuously variable, continuous with respect to some kind of trigger or epicenter. What I think happens in the brain is that you have a trigger, something stimulates a hub or cells in the brain and they are activated in such a way that it is like ripples in the brain.

Edelman: To be conscious is to experience qualia.

Churchland : The weight of evidence indicates that conscious intelligence is wholly natural phenomena – is the activity of suitably organized matter.

Pippard: What is surely impossible is that a theoretical physicist given unlimited computing power should deduce from laws of physics that a certain complex structure is aware of its own existence.

J. Miller: Although consciousness exists by virtue of some physical property, just as bioluminescence exists by virtue of some chemical property of certain specialized cells, it is not as bioluminescence an observable property of living matter. It is not brain glow. Nor is it on the other hand an invisible property less readily detectable than other biological processes. It is detectable to any one who has it – to put it bluntly it is not detected at all – it is self-evidently self-evident to me.

Julian Janes: In Introcosm that is more myself than anything I can find in the mirror.

Sperry: I can dissect and analyze any part of the brain I want to and can do so even in more detail and sophisticated way. Yet it is frustrating to think that however hard I probe, I cannot find where some one's consciousness is or sense of humour.

Daniel Dennet: Multiple Draft Model: "There is no single definitive stream of consciousness because there is no central headquarters, no cartesian theatre where it can all come together" for the perusal of a central Meaner. Instead of such a single stream there are multiple channels in which specialist circuits try, in parallel pandemoniums, to do various things, creating multiple drafts, as they go. Most of these fragmentary drafts of "nature" play short-lived roles in the modulation of current activity, but some get promoted to further functional roles, in swift

succession by the activity of a virtual machine. The seriality of this machine is not a 'hard-wired' designed feature, but rather upshot of a succession of coalitions of these specialists".

Max Delbruck: The feeling of absurdity evoked by the question of mind from matter is perhaps similar to the feeling of absurdity with which we have learned to cope when we permit relativity theory to alter our intuitive concepts of space and time and quantum theory to alter our intuitive concepts of object and causality.

Daniel Danin: Quantum physics by taking human mind deep into matter could never 'touch the bottom'. It is just looking for it and will look for ever.

Paul Weiss: A true science of consciousness will deal with qualities rather than quantities and will be based on shared experiences rather than verifiable measurements – subjective to varying degrees.

G D Fischbach: Mind is often equated with consciousness – a subjective sense of awareness. But there is no a priori reason to assign a particular locus to consciousness or even to assume that such global awareness exists as a physiologically united entity. Moreover there is no more to mind than consciousness or cerebral cortex, urges, moods, desires and sub-consciousness forms of learning are mental phenomena in the broad view. We are not Zombies. Affect depends on the functions of the neurons in the same manner as does conscious thought.

Semir Zeki: It is no longer possible to divide the process of seeing from that of understanding as neurologists once imagined, nor is it possible to separate the acquisition of visual knowledge from consciousness. Indeed consciousness is the property of the complex neuronal apparatus that the brain has developed to acquire knowledge. This is not to say that understanding the work of the visual brain will resolve the problem of consciousness – far from it. But it is a good beginning.

Eccles and Popper: It has not so far been possible to develop any neurophysiological theory that explains how a diversity of brain events comes to be synthesized so that there is a unified conscious experience of global or gestalt character.

The neural machinery is a multiplex of radiating and receiving structures. The experience of unity comes not from a neurophysiological synthesis, but from the proposed integrating character of self-conscious Mind (SCM). We conjecture in the first place that the self-conscious Mind is developed in order to give the unity of the self in all of its conscious experiences and actions.

Sperry: conscious phenomena in this scheme are conceived to interact with and to govern largely the physiochemical and physiological aspects of the brain process. It obviously works the other way round as well, and thus mutual interaction is conceived between physiological and mental properties. Even so, the present interpretation would tend to restore mind to its old prestigious position over matter in the sense that mental phenomena seem to transcend phenomena of physiology and biochemistry.

Heisenberg: "Nature is aware in the same way that we are aware of each other"

Schrodinger: Consciousness is the very basis of all creations.

John Wheeler: John Wheeler who contends that the physics of the world is fully determined by the geometrical shape of space says:

Einstein, above his work and writings, held a long term vision. There is nothing in the world except curved empty space. Geometry bent one way here described gravitation; rippled another way somewhere else it manifests all the quantities of an Electromagnetic wave. Excited at still another place, the magic material that is space shows itself as a particle. There is nothing that is foreign and physical immersed in space. Everything that is, is constructed out of geometry. Even though there are serious problems in reconciling relativity and quantum mechanics in all aspects, we can summarize the broad trend as follows:

Physical reality has thus moved from matter → molecules → atoms → protons, neutrons, electrons → quarks and leptons →space or vacuum and geometry of space → matter.

We have seen that matter and radiation are equivalent and transform to each other. So ultimately, the physical substratum of everything is just one entity – quantum mechanical vacuum.

The question arises – does it help to reduce life, consciousness, mind, etc, to the motions of subatomic particles similar to matter? It looks that such a step even if realized is not likely to give. In quantum mechanics there is no material reality till the time observation is made.

Man is not a mere spectator to some vast cosmic clockwork nor trivial cog in a machine whose every action is pre-ordained.

Conscious mind is crucially involved in establishing what is real.

That which reaches our sense is at best a confusion of phantasmal energies – not sights, sounds, or any coherent qualities that we project on the physical world. Until that mental construction takes place, reality must wait in the wings.

The wave function of a particle, a purely mathematical thing is the only reality that is there until observation takes place.

Einstein (Changes his stand at a later stage in his life)

Earlier: All knowledge of reality starts from experience and end in it
Later: Experience remains, of course, the sole criterion of the physical utility of mathematical construction. But the creative principle resides is mathematics. In a certain sense I hold it true that pure thought can grasp reality as the ancients dreamed.

Schrödinger: Why music delights us? Why and how certain incidents move us into tears? Science, we believe, can in principle describe in full detail all that happens in the latter case in our sensorium and motorium from the moment the waves of compression and dilation reach our ear to the moment when certain glands secrete a salty fluid that emerges from our eyes. But of the feelings of delight and sorrow that accompany the process, science is ignorant and therefore reticent

.

Crick, fifty years later, tried to break this reticense, but could not succeed as he himself concludes in his book 'The Astonishing Hypothesis".

Einstein on: Role of Religion: Tradition, Revelation

Knowledge of what is does not open the door directly to what should be.

Scientific thinking alone cannot lead us to the ultimate and fundamental purpose of our existence. "To make clear these fundamental ends and valuations and to set them fast in the emotional life of the individual, seems to me precisely the most important function which religion has to perform in the social life of man. And if one asks whence drives the authority of such fundamental ends, since they cannot be stated and justified by merely reason one can only answer: They exist in a healthy society as powerful traditions, which act upon the conduct and aspirations and judgments of the individuals; they are there, that is, as something living, without its being necessary to find justification for their existence. They come into being not through demonstration, but through revelation, through the medium of powerful personalities. One must not attempt to justify them but rather to sense their nature simply and clearly. The higher principles of our aspirations and judgments are given to us in the Jewish-Christian religious

tradition. It is a very high goal, which with our weak powers we can reach only very inadequately, but which gives us a sure foundation of our aspirations and valuations".

Pauli: "Choise and sacrifice" out-look of modern physics

For I suspect that the alchemistical attempt at a unitary psychophysical language miscarried only because it was related to a visible concrete reality. But in physics today, we have an invisible reality (of atomic objects) in which the observer intervenes with a certain freedom (and is thereby confronted with the alternatives of "choice and sacrifice"); In the psychology of the unconscious we have processes which cannot always be unambiguously ascribed to a particular subject. The attempt at a psychological monism seems to me more promising, given the relevant language (unknown as yet and neutral as regard to psychophysical anti-thesis) would relate to a deeper invisible reality. We should then have found a mode of expression for the unity of all being, transcending the causality of classical physics as a form of correspondence (Bohr); a unity of which of psychophysical interrelation, and the coincidence of a priori instinctive form of ideation with external perception, are a special case. On such a view, traditional ontology and metaphysics becomes the sacrifice, but the choice falls on the unity of being.

Spinoza and Einstein:

By 1920, the philosopher that Einstein admired was Baruch Spinoza, the 17th century Jewish philosopher.
Spinoza:

i. Rejected the traditional concept of God
ii. Denied the existence of cosmic purpose
iii. All events in nature occur according to immutable laws of cause and effect
iv. The universe is governed by a mechanical or mathematical order and not according to purposeful or moral intention.

Though he employed the notion of "GOD", Spinoza applied it only to the structure of the impersonal cosmic order and declared that "neither intellect nor will appertain to God's nature". He therefore denied the Judo-Christian conception of a personal God

God is the infinite substance having the attributes of extension and thought. God is devoid of ethical properties, for good and evil are ionly relative to human desires. God's will equivalent to Law of nature. The ultimate objective of religious devotion can only be the perfect harmony of the universe. Human aspirations must accept the inexorable dictates of the deterministic lawas that govern life.

Oneness- Ultimate Reality

David Bohm: The conceptual pigeonholes we use to parse out the universe are our own making. They do not exist "out there" for out there is only indivible totality.

To his amazement, Bohm found that once they were in a plasma, electrons stopped behaving like individuals and started behaving as if they were part of a larger and interconnected whole. Although their individual movements appeared random, vast numbers of electrons were able to produce effects that were surprisingly well organized. Like some amoeboid creature, the plasma constantly regenerated itself and enclosed all impurities in a wall in the same way that biological organism might encase a foreign substance in a cyst. Will, endeavour, pain, delight and the responsibility connected with it – though they actually are.

And the reason for this disconcerting situation is just this: that for the purpose of constructing the picture of the external world, we have used the great simplifying device of cutting our own personality out, removing it, hence it is gone, it has evaporated, it is ostensibly not needed.

In particular and most importantly, this is the reason why the world view contains of itself no ethical values, no aesthetic values, not a word about our own ultimate scope or destination and no God, if your please. Whence I came, wither I go.

Science cannot tell us a word about why music delights us or why and how an old song moves us to tears.

Max Planck: (Concluding paragraph of his book "The Universe in the Light of Modern Physics", 1937)

There have been times when science and philosophy were alien, if not actually antagonistic to each other. These times have passed. Philosophers have realized that they have no right to dictate to scientists their aims and the methods for attaining them; and scientists have learned that the starting point of their investigation does not lie solely in the perception of the senses, and that science cannot exist without some small portion of metaphysics. Modern physics impresses us particularly with the truth of the old doctrine which teaches that there are realities existing apart from our sense perceptions, and that there are problems and conflicts where these realities are of greater value for us than the richest treasures of the world of experience.

Physics, Mathematics and Reality

Ken Wilber in Quantum Questions: When a physicist looks at `quantum reality "or" relativistic reality he is not looking at things in themselves at Noumenon, at direct and non-mediated reality. Rather the physicist is looking at nothing but a set of abstract differential equations – not at reality itself but a mathematical symbol of reality.

Heisenberg: It is important to realize that while the behaviors or smallest particles cannot be described unambiguously in ordinary language , the language of mathematics is still adequate for a clear cut account of what is going on.

Dirac: All matter is created out of some imperceptible substratum – nothingness, unimaginable and undetectable. But it is a peculiar nothingness out of which matter is created.

Einstein: Matter when we perceive is merely nothing but a great concentration of energy in very small regions. We may therefore regard matter as being constituted of space in which the field is extremely intense. Field is the only reality.

Paul Davies: The Mind-Body Problem

Well, if my brain is a physical system, subject to the same laws of physics as the objects surrounding the world, then my brain will do what it will do anyway whether or not there is a 'me' inside apparently driving it. So how can minds or selves actually do anything without violating or suspending the laws of physics.

Perhaps oneness removes all these contradictions!

Science and Beyond

Eddington: The symbolic nature of physics is generally recognized, and the scheme of physics is now formulated in such a way to make it almost self-evident that it is a partial aspect of something wider briefly the position is this. We have learnt that the exploration of the external world by the method of physical science leads not to a concrete reality, but to a shadow world of symbols, beneath which those methods are un-adapted for penetrating. Feeling that there must be more behind, we return to our starting point in 'human consciousness' – the one centre where more might become known. There [in the immediate inward consciousness].We find other strings, other revelations than those conditioned by the world of symbols …… physics most strangely insists that its methods do not penetrate behind the symbolism. Surely then the mental and spiritual nature of ourseves, known in our minds by an intimate contact transcending the methods of physics, supplies just that which science is admittedly unable to give.

To put it in a nutshell: according to this view, physics deals with shadows; to go beyond shadows is to go beyond physics; to go beyond physics is to head towards the meta-physical or mystical – that is why so many of our pioneering physicists were mystics **(Ken Wilber)**.

Schrödinger: The scientific picture of the world around me is very deficient. It gives a lot of information, puts all our experience in a magnificently consistent order, but is ghastly silent about all and sundry that is really near to our heart, that really matters to us. It cannot tell us a word about red and blue, bitter and sweet, physical pain and physical delight, it knows nothing of beautiful and ugly; good or bad, God and eternity. Science sometimes pretends to answer questions in that domain, but answers are very often so silly that we are not inclined to take them seriously.

So, in brief, we do not belong to this material world that science constructs for us. We are not in it; we are outside. We are only spectators. The reason why we believe that we are in it, that we belong to the picture, is because our bodies are in the picture. Our bodies belong to it. Not, only my own body but those of my friends, also of my dog and cat and horse and of all other people and animals. And this is the only means of communicating with them. Moreover, my body is implied in quite a few of the more interesting changes – movements etc., that go on in this material world and is implied in such a way that I feel myself partly the author of these goings on. But then comes the impasse, this very embarrassing discovery of science that I am not needed as an author. Within the scientific world picture all these happenings take care of themselves – they are amply accounted for by direct energy interplay. Even the human bodies movements "are its own', as Sherrington puts it. The scientific world picture vouches a very complete understanding of all that happens – it makes it a little too understandable. It allows you to imagine the total display as that of a mechanical clock work, which for all that science knows could go on just the same as it does without there being consciousness, will, endeavour, pain, delight and the responsibility connected with it – though they actually are. And the reason for this disconcerting situation is just this: that for the purpose of constructing the picture of the external world, we have used the great things simplifying device of cutting our own personality out, removing it; hence it is gone, it has evaporated, it is ostensibly not needed. In particular and most importantly, this is the reason why the world view contains of itself no ethical values, our own ultimate scope or destination and no God, if you please. Whence I came, Whither I go. Science cannot tell us a word about why music delights us or why and how an old song moves us to tears.

Appendix V: One of the Fundamentals of Hinduism
Nasadiyasukta, Rig Vedic Hymn of Creation

At first was neither Being nor Nonbeing.
There was not air nor yet sky beyond.
What was wrapping? Where? In whose protection?
Was Water there, unfathomable deep?

There was no death then, nor yet deathlessness;
of night or day there was not any sign.
The One breathed without breath by its own impulse.
Other than that was nothing at all.

Darkness was there, all wrapped around by darkness,
and all was Water indiscriminate, Then
that which was hidden by Void, that One, emerging,
stirring, through power of Ardor, came to be.

In the beginning Love arose,
which was primal germ cell of mind.
The Seers, searching in their hearts with wisdom,
discovered the connection of Being in Nonbeing.

A crosswise line cut Being from Nonbeing.
What was described above it, what below?
Bearers of seed there were and mighty forces,
thrust from below and forward move above.

Who really knows? Who can presume to tell it?
Whence was it born? Whence issued this creation?
Even the Gods came after its emergence.
Then who can tell from whence it came to be?

That out of which creation has arisen,
whether it held it firm or it did not,
He who surveys it in the highest heaven,
He surely knows – or maybe He does not!

-Translation by Prof. Raimundo Panikkar (Ref. 3, pp 58, "The Vedic Experience-Mantra-manjari", Pub. By Motilal Banarasidas)

The Nasadiya-Sukta of the Rig-Veda proclaims, for the first time, intimations of the Seer's sounding the depths of being. The astounding vision of the Transcendent by the relative is the apparent theme of this famous hymn. The Ultimate State is here depicted as not capable of being designated either as existence or as non-existence, for there was none, then, to perceive it, before the manifestation of the heaven and the earth. There was only an indescribable stillness as it were, deep in its content and defying approach to it by anyone. The Sukta says that there was neither death nor immortality, for there was no differentiation whatsoever. Naturally, there was neither day nor night. There was only That One Presence, throbbing in all splendor and glory but appearing as darkness to the eye that would like to behold it. There was nothing second to it; It alone was. From It creation arose. However, hot it all happened no one can say, for everyone came after creation. This is the central point of the Nasadiya Hymn, varied forms of the development of which lead to many ramifications of philosophic and religious meditations, in the Upanishads and the later established forms of religion. In a famous Mantra, the Rig-Veda declares that "Existence (or Reality) is One, though the wise ones call It by various epithets like Indra, Mitra, Varuna, Agni, Yama, Vayu", thus unifying all the gods in a singleness of Being.

Appendix VI: The Universe and Consciousness

Ref. Andre Linde (Astrophysicist), *The Universe, Life and Consciousness*, pp. 200-202, "Science and Spritial Quest", Mark Richardson, Robert John Russell, Philip Clayton and Kirk Wegter-Mc Nelly

According to standard materialistic doctrine, consciousness, like spacetime before the invention of general relativity, plays a secondary, subservient role, being considered just a function of matter and a tool for the description of the truly existing material world. Let us remember, though, that our knowledge of the world begins with perceptions, not with matter. I know for sure that my pain exists, my "green" exists, and my "sweet" exists. I do not need any proof of their existence, because these events are a part of me; everything else is a theory. Later we find out that our perceptions obey some laws, which can be most conveniently formulated if we assume that there is some underlying reality beyond our perceptions. This model of material world obeying laws of physics is so successful that we too readily forget our starting point and come to think that matter is the only reality, and that perceptions are only helpful for its description. This assumption is almost as natural (and maybe as false) as our previous assumption that space is only a mathematical tool for the description of matter. In fact, we are replacing the reality of our feelings with a successful theory of an independently existing material world. And the theory is so successful that we almost never think about its limitations until we are forced to address those deep issues, which do not fit into our model of reality.

It is certainly possible that nothing similar to the modification and generalization of the concept of space-time will occur with the concept of consciousness in the coming decades. But the thrust of research in quantum cosmology has taught us that the mere statement of a problem which might at first glance seem entirely metaphysical can sometimes, upon further reflection, take on real meaning and become highly significant for the further development of science. At this point, I would like to take a certain risk and formulate several questions for which we do not yet have any answers.

Is it not possible that consciousness, like spacetime, has its own intrinsic degrees of freedom, and that neglecting these will lead to a description of the universe that is fundamentally incomplete? What if our perceptions are as real (or maybe, in a certain sense, are even more real) than material objects? What if my red, my blue, my pain, are really existing objects, not merely reflections of the really existing material world? Is it possible to introduce a "space of elements of consciousness," and investigate a possibility that consciousness may exist by

itself, even in the absence of matter, just like gravitational waves, excitations of space, may exist in the absence of protons and electrons? Will it not turn out, with the further scientific developments, that the study of the universe and the study of consciousness will be inseparably linked, and that ultimately, progress in the one will be impossible without progress in the other? After the development of a unified geometrical description of the weak, strong, electromagnetic, and gravitational interactions, will the next important step not be the development of a unified approach to our entire world, including the world of consciousness?

All of these questions might seem somewhat naive, but it becomes increasingly difficult to investigate quantum cosmology without making an attempt to answer them. A few years ago it would have seemed equally naive to ask why there are so many different things in the universe, why nobody has ever seen parallel lines intersect, why the universe is almost homogeneous and looks approximately the same at different locations, why space-time is four-dimensional, and so on. Now, when inflationary cosmology provided a possible answer to these questions, one can only be surprised that prior to the 1980's, it was sometimes taken to be bad form even to discuss them.

It is best not to repeat old mistakes, but instead to forthrightly acknowledge that the problem of consciousness and the related problem of human life and death are not only unsolved, but at a fundamental level they are virtually completely unexamined. It is tempting to seek connections and analogies of some kind, even if they are shallow and superficial ones at first, in studying one more great problem - that of the birth, life, and death of the universe. It may yet become clear that these two problems are not so disparate after all.

Appendix VII :Ancient Wisdom and Schrodinger

From "Nature and Greeks" by *Erwin* Schrödinger, Cambridge University Press (1954)

By the serious attempt to put ourselves back into the intellectual situation of the ancient thinkers, far less experienced as regards the actual behavior of nature, but also very often much less biased, we may regain from them their freedom of thought – albeit possibly in order to use it, aided by our superior knowledge of facts, for correcting early mistakes of theirs that may still be baffling us.

Let me conclude this chapter by some quotations. The first bears closely on what has just been said. It is translated from Theodor Gomperz's Griechische Denker. To meet the possible objection that no practical advantage can spring from studying ancient opinion, which has been long superseded by better insight based on vastly superior information, a series of arguments is brought to the fore that ends with the following notable paragraph:

It is of even greater importance to recall an *indirect* kind of application or utilization that must be regarded as highly momentous. Nearly our entire intellectual education originates from the Greeks. A thorough knowledge of these origins is the indispensable prerequisite for *freeing* ourselves from their overwhelming influence. To ignore the past is here not merely undersirable, but simply impossible. You need not know of the doctrines and writings of the great masters of antiquity, of Plato and Aristotle, you need never have heard their names, none the less you are under the spell of their authority. Not only has their influence been passed on by those who took over from them in ancient and in modern times; our entire thinking, the logical categories in which it moves, the linguistic patterns it uses (being therefore dominated by them) – all this is in no small degree an artifact and is, in the main, the product of the great thinkers of antiquity. We must, indeed, investigate this process of becoming in all thoroughness, lest we mistake for primitive what is the result of growth and development, and for natural what is actual artificial.
The following lines are taken from the Preface of John Burnet's *Early Greek Philosophy:* `.... It is an adequate description of science to say that it is "thinking about the world in the Greek way". That is why science has never existed except among peoples who came under the influence of Greece.' This is the most concise justification a scientist could wish for, to excuse his propensity for 'wasting his time' in studies of this kind.

And an excuse seems to be needed. Ernst Mach, the physicist colleague of Gomperz at the University of Vienna, and eminent historian (!) of physics, had, a few decades earlier, spoken of

the `scarce and poor remnants of ancient science' [Popular Lectures, 3rd ed., essay no. xvii (J A Barth, 1903)]. He continues thus:

Our culture has gradually acquired full independence, soaring far above that of antiquity. It is following an entirely *new* trend. It centres around mathematical and scientific enlightenment. The traces of ancient ideas, still lingering in philosophy, jurisprudence, art and science constitute impediments rather than assets, and will come to be untenable in the long run in face of the development of our own views.

For all its supercilious crudeness, Mach's view has a relevant point in common with what I have quoted from Gomperz, namely the plea for our having to *overcome* the Greeks. But while Gomperz supports a non-trivial turn by obviously true arguments, Mach clinches the trivial side by gross exaggeration. In other passages of the same paper he recommends a quaint method of getting beyond antiquity, namely to neglect and ignore it. In this, for all I know, he had little success – fortunately, for the mistakes of the great, promulgated along with the discoveries of their genius, are apt to work serious havoc.

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Right from the time of Newton to Einstein, the scientific community believed that all phenomena in nature were due to motion of matter in space as a function of time. However, the philosophers both in the east and west believed that there is something more fundamental that is responsible for creation of space ,time and matter and life. In the most ancient Indian philosophical tradition that is based on the Vedic scriptures , the most fundamental entity is identified as Brahman while the Budhists identify it as Shunya. Experimental developments in science in the 19th and 20th, centuries and the corresponding theoretical developments have forced a complete transformation of the views on space, time ,matter and causality. It is now believed by most scientists that the most fundamental entity that is behind all happenings in nature is "Quantum Mechanical Vacuum" that is composed of energy waves endowed with special properties. It is the spontaneous fluctuations of this energy waves that is responsible for all creation and activity including creation of space, time and matter. This book discuses how the similarity of views about ultimte reality have arisen by two entirely different methods Empiricism and Introspection