

Questions

in Complex Systems

- Is "emergence" the pivotal concept for interpreting reality of human life in all its complexity - Scientific endeavors, personal morality, religious understanding ... ?
- Is there a conflict between religious and scientific findings?
Is religion any more irrational than many other disciplines including science?
Most of the decisions that we make in life is based on irrational faith.
- How much of nature have we understood?
Are there vast domains beyond present science?
Can there be an entirely new attribute?
- Is emergence another word for saying "we do not know how and why, but it happens". Is it equivalent to Anirvachanige?
- Is vitalism a misunderstood concept? Is it coming back in other forms?
- Have we exhausted detection of all facets of nature? With what confidence we can say that.
- Can we build a machine that has a body, a brain and kokoro (spirituality)?
- Can we create an algorithm for survival as an insect? - to survive by itself.

Can we build Computers and Robots with
"Kokoro" in the end?

Can we take the (Japanese) attitude - Incei Samling
and wait for it to evolve?

Why are the laws of physics the same -
only a belief?

Topics

Mathematics: From Pythagoras to Gödel.

- Unreasonable effectiveness of mathematics in physical science. (Wigner)
- Mathematics and Logic

"Metaphysics has always been the ape of mathematics"
C.S. Pierce in 1891.

Plato did not admit a student to the Academy unless he had training in Geometry.

Sec. 3 in Philosophy of Science - Frank.
Geometry: As an example of Science.

Axioms, Theorems, Postulates. Sense observation.
Aristotle: }
Intelligible Principles }
Observational facts }

Descartes, Mill, Kant.

See quasi-intuitively - Self-evident

Rationalism: My mind must be able to grasp this essence. Otherwise, I could not demonstrate their properties.

Empiricism: There are no principles the validity of which can be confirmed by the power of Reason alone.

The Rationalist refers to a triangle as an object of our imagination where the empiricist refers to a triangle as a physical object.

Mill - empiricist Axioms of geometry - result of sense-observation

20th Century - Helmholtz, Poincaré, Einstein.

Einstein: How is it possible that mathematics, a product of human thought, that is independent of experience, fits so beautifully the objects of physical reality?
Can human reason —

• Holism to Reductionism Atomic Theory.

Kanada to Niels Bohr.

Brownian motion and Einstein

• Beyond the Atom - Fundamental Particles - as
building blocks of the universe

The Universe:

Naked Eye Astronomy - Space Astronomics.

Ancient Concepts
(Vedas) etc.

From Nothing to Everything
Creation of space, time and matter
and forces of Nature.

Changing Concepts of the contents and extent of the
Universe.

Charles Townes

I do not understand how the
Scientific approach alone, as separated
from religious approach can explain the
origin of all things. It is true that
physicists hope to look behind 'big bang'
and possibly to explain the origin of
our universe, as for example, a type of
fluctuation. But then, if that is a
fluctuation and how did this in turn begin
to exist? In my mind the question of origin
seems always left unanswered if to expect for

a scientific view alone

Religion the first attempt
to explain the world (spontaneously)

* Science of Religion

Katayama (Tokyo Confucius)

The Science of Religion defines it as what "makes clear
the ultimate meaning of human life."

- Religion is the ultimate solution to human problems.
Religion has a virtuous as well as a guilty side
like science.
- When religion becomes absolute that is when
fundamentalism takes root.
- Man is always in search of something to lean on. to
use as a guide line to live by. (Shintoism for Japanese)
- In 1493, the followers of Magellan (who died in 1492)
succeeded in circum navigation of the world. It should
have been decisive that the earth was a sphere at this time.
But Religious Dogma was still the absolute truth

Faith to Reason.
Theocentric to anthropocentric.
Reason independent of faith } Transformation begins
start by dawn of Modern Science

- Role of intuition in the development of Science.

Religion provides the understanding of human nature -
ethical, moral values etc. What Science does not.
∴ Science and Religion are Complementary, is that correct?

- What about George Ellis's view that:
Moral Dimension of the Universe emerges only
at a certain level of complexity in the evolution
of matter - when sentient beings or autonomous
agents co-operate in social groups?

Reductionist Laws at lower level }
Emergent Laws at higher levels }

Top-Down (Mythology) } theories.
Bottom-Up - (Crane) }

Foundations of Life Sciences

What is life? Is there an unambiguous definition?

Where, when and how life originated?

(The Biblical view

The Eastern view

Darwin's gradual evolution

Spontaneous generation like parasites?

Origin of Mind and Consciousness -

Foundations of Neurobiology.

Where does psychology fall?

Extraterrestrial life - Other forms of life (Kaufmann)

Foundations of Medical Science - Eastern
Western

Order in Nature

Hierarchy of levels.

Brain and mathematics.

and the decoding of atoms.

is mind written into nature at the deepest level?

(properties of particles created in space are written into space - or quantum vacuum?) - by my mind

The key assumptions of science — ① physical universe is ordered in a fashion known

Then are gigantic acts of faith.

No logical compulsion for universe to be orderly. (Did God order this order?)

Laws? Who created them? Why?

Do laws exist reasonlessly?

Immediately after the Big Bang - the universe had a

ferocious gas. How did this lead to galaxies, stars, planets etc. life.

For all this to happen, the laws have to be very special. - 'constant of nature' have to be specific.

An infinite number of unseen universes are required to create the one that we are aware of

[Just to say God created what is not a satisfactory reply]

Davies:

Do we live in a universe that came into existence for no reason and which consists of nothing more than a collection of mindless particles, not moved by blind purposeless forces towards a pointless final state? or is there something more to it? Is the universe an absurdity? Can science reveal the meaning, perhaps...? Should we incorporate 'spirituality' for this purpose?

William Phillips (Nobel Laureate - Laser Cooling of atoms)

Faith: Hebrew describes faith as "... the substance of things hoped for, the evidence of things not seen."

My faith may be non-scientific (not unscientific), but it is not irrational.

When I examine the orderliness, understandability, and the beauty of the universe, I am led to the conclusion that a higher intelligence designed what I see. My scientific appreciation of the coherence, the delightful simplicity of physics strengthens my belief in God. The function of the universe seems uncannily suited to the development of life. Small changes in any number of fundamental constants of nature or initial conditions for the universe would have made it impossible for life as we know it to develop. Why is the universe so finely tuned for the existence of life? More to the point, why is the universe so finely tuned to for the existence of us? Why of the infinite possibilities - the one that supports intelligent life is chosen?

This is not compelling evidence.

Why did God create a world in which volcanoes destroy cities or disease brings unspeakable pain to children?

I simply don't know.

The book of Job: There are simply some things that we are not going to understand.

Three types of activities of man impelled by ego under the stress of desire, want -

- (i) Biological Conditioning
 - (ii) under injunction of Scriptures - Rituals
 - (iii) meditation - Upasana
- } for enjoyment in this life or next.

Vastu Tantra - Jnana Nishtha
 Purusha Tantra - Karma Nishtha.

* Only Karma or Upasana undertaken with a complete renunciation of attachment to the fruits of action can purify and prepare the soul for the reception of the highest knowledge

clear distinction between Karma (including Upasana) and Jnana.
 means to $\xrightarrow{\hspace{10em}}$ end of knowledge.
 Subject initiated effort $\xrightarrow{\hspace{10em}}$ Object defined knowledge.

* ego (action + suffering) =
superimposition of on the Atman (Absolute Consciousness)

Common substratum between subject and object =
 = the ONE = Consciousness Absolute.

* Knowledge of Brahman does not come through Purusha Tantra. It only prepares one to realize that knowledge. Brahman is realizable only by Vastu Tantra.

Indescribable Reality =
 Barrier removed. $\left\{ \begin{array}{l} \text{Subject-object distinction} \\ \text{removed. What is that} \\ \text{knowledge?} \end{array} \right.$

It knows itself as
 "I am Brahman"

• The Self should be realized not heard of.

** " Know that alone as Brahman, yet that people know as object"
 ke up.

astronomy brought a special focus on compact binaries in globular clusters, and low mass binaries in the galactic bulge. Neutron star masses have been determined and several black hole candidates identified. About 300 accreting X-ray binaries have been detected in our Milky Way galaxy and in the neighbouring Large Magellanic and Small Magellanic clouds. A large majority have neutron stars as one of the binaries and in about 25 cases the X-ray emitting object is a black hole. The pulsar periods range from few milliseconds to 600 seconds.

There are two classes of X-ray binaries – low mass and high mass. The low mass binaries have a low magnetic field ($< 10^{11}$ gauss) and do not show X-ray pulsation. The orbital period ranged from 1 to 10 hrs and they show X-ray eclipses and irregular dips in their light curves and also show Quasi Periodic Oscillation (QPO) phenomena. The high mass binaries have typically $10^{12} - 10^{13}$ gauss magnetic fields and show X-ray pulsations.

As mentioned earlier, CygX-1 was the first candidate for a black hole. In recent years many transient x-ray sources have been identified as candidates for black holes (3 to 10 M_{\odot}). Some typical examples are GS1124-68 (Nova MUS 1991), GRO J 11655-40 (Nova Sco 1994) and GRO J0422+32 (Nova Per 1992). With the Chandra X-ray satellite a black hole of mass $>500 M_{\odot}$ has been discovered (**P Kaaret *et al*⁽²⁴⁾**).

The detection of non-thermal X-ray emission from SN remnants like CasA, SN1006 and VelaSNR (**Favata *et al*⁽²⁵⁾**) has given support to the theory that SN remnants could be the sites for the origin of high energy cosmic rays. Spectroscopic studies with ASCA and Chandra have enabled the mapping of the abundance of elements and the temperatures of the shocked gas regions of SN.

The Indian Contribution in the Field of X-ray Astronomy

The equatorial latitudes have a distinct advantage for observations in X-ray and γ -ray astronomies. This advantage comes from the fact that because of higher geomagnetic cut-off of cosmic ray primaries, the induced background of secondary photons in the upper

"Yashmat" or the objective "this":

The world which features as time, space, causation, action, and reaction along with living actors there in both human and non-human is not an enduring entity.

Change = Sequence in time ∴ Causality.

* Causal chain must break with the idea of a FIRST CAUSE which is unchangingly permanent

- The universe even according to science is changeful permanent.
- Brahman is to be seen not as the cause of the world but its substratum.

* Shankara:

The "I" as identified with the body is individualized and separate, where as the "Self" as the (Sakshi) witness of the idea of "I" is a cosmic entity

The former is what is acting, suffering, transmigrating the latter is (as witness) is unchanging, eternal and all-pervading --- consciousness itself

"Behind the phenomenal world of change and impermanence and underlying the empirical ego expressing itself as the 'I' in all living beings is the one and the same reality whose characteristic description is given in one of the Upanishads:

The one deity remains hidden in all beings. He is all pervasive, the indwelling Self in all regulator of all actions, the support of all beings the witness, consciousness, non-dual and without qualities"

accretion rate about a solar mass per year. In the case of NGC6841 time variations in intensity have been observed on time scales of a few hundred seconds. Many Seyferts have shown time variations on the scale of days. In the case of NGC4151 an X-ray flare lasted for less than an hour. These variations indicate that the size of the X-ray emitting region is small $\sim 10^{15}$ cms supporting the hypothesis of giant black holes at the centers of these active galactic nuclei.

The spectral features of AGN show roughly comparable amounts of power in each logarithmic interval of energy in the GV and also the characteristic of high energy X-rays extending to the γ -ray region of 1.5 MeV. However, there is a pronounced ultra violet bump at 10 eV followed by a power law X-ray spectrum. This scenario leads to an interesting speculation, of relevance to high energy neutrino astronomy. If we consider the active galactic nucleus having a fast rotating accretion disc around a giant black hole and an accretion shock formed at some distance due to the in full of matter gravitational energy is converted to highly relativistic particles and the AGN could become sources of 10^{14} - 10^{20} eV neutrinos through the decay processes of particles produced by the relativistic particles. What is exciting is that the estimated energy fluxes of neutrinos fall within the range of detection possibilities in the present day underwater and under ice installations. These we will discuss (later) in the section on Neutrino Astronomies (Barwick *et al*⁽²³⁾).

The first X-ray satellite UHURU revealed some 400 X-ray sources. Over the last three decades more than 20 satellites for X-ray astronomy alone have been launched with a variety of increasingly more sophisticated detector systems and focusing devices. These include position sensitive proportional counters, gas scintillation counters, imaging telescopes with changeable focal plane instruments, etc. There have been a large number of hard X-ray experiments flown on stratospheric balloons. The outcome has been the realization that practically every type of astronomical object – stars, binary systems, RSCV-n binaries, supernova remnants, ordinary galaxies, radio galaxies, seyfert galaxies, Quasi Stellar Objects (QSO's) are all X-ray emitters. Time variation studies over large range of time scales – fraction of a second to months have been carried out. X-ray

(11)

*** Physical World (According to Shankara)

The Physical World is defined by Shankara as a phenomenon well-regulated into space, time causation, with living souls cast into this arena of action and reaction, all of which are determined by definite laws (Prathihyata)

The observer of this phenomenal world is a self-conscious entity which expresses itself in the notion of "I", this notion invariably being defined identified with the physical body of the observer. and therefore of necessity, feeling itself as distinct from what it observes.

The third entity from which these two have arisen and into which they have to necessarily merge in order to establish their inter-relation, is conceived as their cause. The relation between Brahman and the creation (the World), is thus initially conceived as one of cause and effect.

In his final definition of Reality, with which this cause is identified, Shankara synthesizes the world of space, time, causation and its observer into a reality designated as Brahman signifying its infinitude. This final state happens to be of self-transcendence as applied to both the world (Prameya) and its observer (Pramatr) - i.e. the "I" observing it - thus eliminating all characteristics by which they are initially defined.

HerX-1 was discovered by the X-ray astronomy satellite, UHURU, in 1972 (Tananbaum⁽¹⁵⁾). It was first seen as a hard X-ray source by TIFR group (Manchanda *et al*⁽¹⁶⁾) in 1973, in their balloon flight from Hyderabad. There are three distinct periodicities associated with this source: (i) a 1.2 second pulsation, (ii) a 1.7 day binary orbit period and (iii) a 35 day cycle that modulates the intensity of the source in an irregular fashion of approximately 9 bright days and 26 dim days. From the companion star HZ-Hercules the reprocessed IR and optical pulses are seen. A very important landmark was the discovery of the 53 keV line feature (Trumper *et al*⁽¹⁷⁾) in 1978 which was clear evidence for cyclotron emission. For the first time this result established unambiguously the presence of magnetic fields in the neighbourhood of the neutron stars is as high as $\sim 10^{12}$ gauss. The slowing down of the pulsar in Herx-1 is occasionally erratic. The pulse profile also fluctuates. HerX-1 has been detected as a pulsed TeV source on occasions. (Dowthwaite *et al*⁽¹⁸⁾, Weekes *et al*⁽¹⁹⁾). One of the most pronounced TeV burst lasting ~ 20 mins has been recorded by the TIFR group operating in Pachmarhi⁽²²⁾. Pulsed 10^{15} eV emission has also been recorded on several occasions (Dingus *et al*⁽²⁰⁾, Gupta *et al*⁽²¹⁾). An anomaly is that the signals do not conform to what is expected of pure γ -ray showers, since the muon content is comparable to hadron showers.

Active Galactic Nuclei – Quasars, Seyferts, BL-Lacerta, Cataclysmic Variables

One of the first extragalactic X-ray source to be detected is the quasar 3c273 in rocket experiments. As early as 1971, UHURU (Gursky *et al*⁽²²⁾) found evidence of x-ray emission from the Seyfert Galaxies NGC1275 and NGC4151. In the case of NGC1275 the X-ray flux at emission was $\sim 10^{44}$ ergs/sc which was equal to the total optical emission of the galaxy. In the case of NGC4151 the X-ray emission was 10^{42} ergs/sc comparable to the emission of the nucleus of the galaxy. UHURU also established that the galaxy NGC5128 at the center of the radio source CEN-A is a dominant X-ray source. The notion that active galaxies are powered by the accretion on to super massive black holes has steadily gained ground. The black hole masses could be as high as 10^6 to 10^9 solar masses. The dynamical scales in these areas are of the order of 100 Sc., the mass

Empirical means of knowledge does not work once the world and the observer distinction is removed. These two the world and the I are sublated.

Pramana, Prameya, Pramatra — Relative Character

No bondage by space, time, causality
only a single reality remains.

- ②② The empirical means of knowledge, such as mind, and senses are accepted as valid (by implication, the world they apprehend is also equally valid) till the direct knowledge of self dawns, thus answering the popular view that Shankara holds the world to be an illusion

*** The object which is the content of my knowledge and the object out-there in the external world are not exactly identical; the former is an adaptation of the latter, in accordance with the structure of the instruments of knowledge I employ.

These features identified the existence of a neutron star in the Crab Nebula with a magnetic field of $\sim 10^{12}$ gauss. The presence of pulsed X-rays from other neutron stars were detected later in many experiments both in the soft and hard X-ray regions.

CygX-3

CygX-3 entered the catalog of astronomical objects in 1966 as one of brightest X-ray sources discovered in that decade. The first X-ray satellite UHURU (**Giacconi et al⁽¹²⁾**)¹³ and later the Copernicus ^{X-ray Satellite} revealed a 4.79 hour periodicity in X-rays and was naturally interpreted as a binary system. However, no pulsations were recorded from this source. Attempts at identification of a radio source associated with this strong X-ray source revealed that the radio emission was very weak. However, on September 2, 1972, a Canadian astronomer by sheer chance observed that the radio intensity of this source had increased by a factor of 100. This increase was confirmed by other observers. The intensity decreased after 10 days. Since then a radio watch was kept on this source for several years; and it was established that the source goes into a flaring activity about once a year (**Braes and Miley⁽¹³⁾**). This source was also followed up by the two γ -ray satellites COS and SASII, which gave contradicting results. While SASII reported observing the 4.8 hr periodicity in the 40 MeV range, COS did not observe any γ -ray flux from this source. CygX-3 is located in the edge of the galaxy, beyond a dusty spiral arm and cannot be therefore be seen optically. In the infrared it has been picked up as a 11 or 12 magnitude star ~~in IR~~ and is consistent with a blue giant at a distance of ~ 10 pc. The Crimean astrophysics observatory group (**Stepanion⁽¹⁴⁾**) reported the observation of TeV gamma rays from the direction of the CygX-3 with a period of 4.8 hrs during September-November of 1972. Radio bursts had occurred on September 2, 19 and 22 of that year. This was confirmed by other groups later. There have been occasional flaring activity even in the PeV energy range.

HerX-1

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The notion that the flow of time is not the same everywhere and depends on the motion of the reference frame is totally contrary to our experience. However time dilatation is one of the first relativistic effects to be established by cosmic ray experiments. [The life time of the mu-meson when it is brought to rest in the laboratory is 2.2 microseconds. In cosmic rays most of these are produced at heights above 10 kms. If they travel with a velocity of light (3×10^{10} cm/sec) the time required to travel 10 kms is $\frac{10^6 \text{ cms}}{3 \times 10^{10}} \approx 3.3 \times 10^{-5}$ seconds. But for the time dilatation effect of relativity, very few mesons would have reached the ground. Later experiments verified the time dilatation factor of $(\frac{E}{mc^2})$ where E is the energy of the meson and m is the mass of the meson.]

Space is ^{one} category of our experience and time is another category. According to Einstein we have to combine space and time and make such space-time continuum which is mathematically easy, but conceptually difficult. This shows that in science we have to transcend beyond the limits of our experience. This became particularly so with the advent of quantum mechanics and relativity.

An important result that followed from the special theory of relativity of Einstein was the famous relation $E=mc^2$ according to which mass (m) and Energy (E) were equivalent. This relation gave the quantitative connection between the two. Surprisingly the universal constant 'c' the velocity of light comes into the connecting relation. Another relation that followed from the General Theory of Relativity of Einstein is the equivalence of mass and curvature of the space-time continuum. The higher the mass the smaller is the radius of curvature.

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Dr B K Anitha

We see that all our common sense based concepts on the basis of which classical science has built underwent radical changes with the advent of the theory of relativity and quantum mechanics. Einstein remarked that "Common sense is actually nothing more than a deposit of prejudices laid down in the mind ~~of~~ prior to the age of eighteen. Every new idea one encounters later must combat this ~~accretion~~ accretion of "self-evident" concepts."

The equivalence of mass and ~~curvature~~ space-time curvature or the "gravitation" of Einstein was not a force. It is an illusion that has grown out of erroneous mechanical concepts of nature. Just as Maxwell and Faraday assumed that a magnet creates certain properties in surrounding space, in a similar fashion Einstein came to the conclusion that the stars, moon and other celestial objects individually determine the properties of space around them. The gravitational field is determined by the geometry (curvature) of space. The profound conclusion is that matter curves space and matter is curved space. On the basis of his special theory of relativity, Einstein had predicted that light from a star behind the sun would be bent by the gravitational field in the neighborhood of sun. This has been verified in several experiments carried out during solar eclipses.

We shall now consider another startling aspect of space that comes from quantum mechanics, we have already referred to the anti-particle of the electron, namely the positron (see Table) which has identical properties of the electron except for its electric

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Charge which is positive. How is the positron produced?
Experiments showed that always an electron-positron pair is produced. Why?

Another interesting aspect of empty space (vacuum) is highlighted by Dirac's more fundamental of the quantum relativistic wave equation of the electron led to the postulation of the 'positron' and later its experimental discovery. Dirac in a lecture in Australia in 1975, said "Vacuum was thought previously as a region of space that does not contain anything at all. Now we must adopt a new picture. We must say that vacuum is a region of space where we have the lowest possible energy. ~~The more electrons we can put into the negative energy states~~ Now to get to the lowest energy we must fill up all the states of negative energy (according to the Einstein relation $E = c\sqrt{m^2c^2 + p^2}$ both positive and negative energy states are allowed). The more electrons we can put into the negative energy states, the lower the total energy becomes. Thus we must set a new picture of the vacuum in which all negative energy states are occupied and all the positive energy states are unoccupied. We can get a departure from vacuum state in two ways: One way is to bring an electron into a positive energy state; the other is to have a "hole" in the distribution of negative energy states. That focusses attention on the "holes" ... as I said before the negative energy particle, according to classical Lorentz equation will move as though it had a positive energy and a positive charge ..."

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Commenting on the Future of physics at the end of (1983) his book 'Probabilities of the Quantum World' Daniel

Danin says:

"Clearly the depths of nature are bottomless. The time will come when Quantum Mechanics reaches the bounds of applicability as happened with classical mechanics in this (20th) century. For this to happen the studies of the microscopic world would have to reach and penetrate a yet unknown level of reality. It seems that physicists have already a "knock from below". At any rate they keep listening... For instance there are hints that on a smaller than submicroscopic scale the inevitable changes in the geometrical properties of space-time will play the ~~decisive role~~ decisive role. And this may have revolutionary consequences for the description of nature.

One thing is clear: the future development and deeper probing of physics will not revive older and familiar ~~concepts~~ classical concepts, but will lead to new astonishing surprises and new great ordeals, out of which will spring joys of new, yet unforeseen knowledge."

Surprisingly Dimitri Mendeleev (1834-1907), in his book "Fundamentals of Chemistry", in the ~~for~~ Preface to the 8th Edition of his book has

12	M S Reema (A. No. 102) Reyanivas, Aroor Ponganadn (PO) Kilimanoor, Thiruvananthapuram Keral 695 601	MA, Archaeology, Kerala University, 2004 Culture and Archeology	72% has knowledge of Brahmi, Grantha and scripts which may be useful for exploring literary sources etc?
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Written

"At first the Sciences, as bridges, could be built only with ~~the~~ strong supports and long beams. I would look like to show ... that for a long time, the Sciences could be built as suspension bridges supported by network of cables though individually each of the cables could snap; in this way ravines could be spanned which had ~~been~~ seemed ~~impossible~~ impassable. Thus Sciences learned how to span the ravines of the unknown without touching the bottom, to reach firm ground of Reality and cover the entire visible world"

Origin of the Universe, of Life and of Consciousness:

So far we have considered the characteristics of the parameters matter, space, time, force and energy that have been delineated on the basis of experience, observation, experimentation, formulation of theory and ~~ex~~ verification.

A critical question that arises is, if these are the ontological constituents of the universe, how did they arise? For a very long time in the history of science, it has thought that this question would for ever remain a speculative one - a theoretical one that can never be verified. and hence will fall outside the scope of science.

Now, thanks to the power of observation, both more and more sophisticated instrumentation, over the last hundred years, a very possible scenario of creation of all these has emerged - this is the Big Bang creation of the universe; which started off as a qualitative theory and has over the years become quantitative to a great extent.

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9.	Aditya Raman Singh (A. No. 107) D-2/257, Danish Nagar, Hoshangabad Road Bhopal 462026 Tel. 0755-241 7064 Email: arsbg2001@yahoo.com	M.Tech, Material Sciences, Barkatullah Univ., 2003; MA History culture and Archaeology, MP BHOJ University, 2004 Material Sciences	Has done several degrees in range of subjects
10.	Sharmista S Yadav (A. No. 42) 144, 3 rd Floor Juhu Sai Darshan Apts Cross Road No. 5, JVPPD, Juhu Mumbai 49 Tel. 022-3950 0017; 34493907; 0141-2652905; 09820904033 Email: sharmistas@yahoo.com	M.Tech., Urban and Regional Planning, Centre for Environ. Planning and Technology, Ahmedabad, 1996 Craft sector in the context of globalization	Good Experience in Crafts, diploma and post-graduate diploma in Architecture/urban planning; however not sure if these are accepted?
11	S Prijeendran (a. No. 104) 'Indra', Vellarada, Vellarada P.O., Trivandrum, Kerala 695 505, Tel. 9447009609, 0471- 2242247(r)	MA, Archaeology, Univ. of Kerala, 2004 Archaeology (geology, zoology, botany, environmental science and anthropology)	Dissertation on Padmanabhapuram Temple?

The two chief expansion astronomical observations were:

- (i) the differential expansion of the universe with distance
- (ii) the existence of a homogeneous, isotropic, ~~microscopic~~ universal microwave radiation.
- (iii) the determination of the ratio of ~~hydrogen to helium~~ helium to hydrogen in the universe.

Observations of the sky with the 60" and 100" telescopes in the early part of the last century Slipher and Hubble had found that the bright patches that had been seen with the smaller telescopes were actually discrete galaxies composed of large number of stars like our own Milky Way Galaxy.

Their spectroscopic observations revealed that these galaxies are receding from us and a curious feature was that the larger the distance, the larger the velocity of recession. Attributing the red shift in the spectral lines to the well known Doppler effect, Hubble deduced the famous relation $v = H r$

where v is the velocity of recession and r is the distance between the galaxies and H is the proportionality constant known as the Hubble constant. The figure shows the ~~relation~~ current status of the relation between red shift and the distance of the galaxy extended over a wide range by Sandage.

The implication of such a universal expansion for cosmology - the science relating to the creation of the cosmos or the universe - was first envisaged by Abbe Lemaitre. Such an expansion meant that as we go back in time any region of the universe would reach a highly squeezed state of much higher density

Dr Sundar Sarukkai

Sl. No.	Name & Address	Qualification and Research Interest	Remarks
5.	S K Arun Murthi (A. No. 9) 12/1, Malleswaram AMARA 13 th Cross, 11 th Main Bangalore 560 003 Tel: 2346 9330 Email: arun_jamadagni@hotmail.com	MA: Philosophy, Bangalore Univ., 2001, Master of Business Management, Calcutta Univ., 1986 Philosophy of Science	Should be called. Has varied background and is also trained in philosophy, He was a gold Medallist in MA in philosophy, will be able to contribute to my present research.
6.	Swarnali Majumder (A. No. 67) 95/1, M.B. Road, Birati, Kolkata 700 051 West Bengal	MSc, Part-1 Pure Mathematics, part-II appeared, Calcutta Univ., 2004 Philosophy of Mathematics	Problem. No philosophy training. Statement has couple of problems. Am not sure whether to call her for interview.
7.	S Sharath Chandra S Sharath Chandra 'Vandana', 163 Manasara Road, 2 nd Cross Indiranagar Mysore 570 010	ME , Satellite communication Philosophy of Science and Mathematics	Good record: Some philosophy courses attended. Research interests and topics in the statement is quite different from mine

and this density would naturally go up to higher values and at some of time would reach infinite value, namely a "Singularity" in the words of mathematicians.

According to the Big Bang theory the universe is really that happened. The universe started with a "Singularity" of that for some unknown, unfathomable reason ~~exploded~~ exploded creating the space-time continuum that expanded. clearly this in this

Big Bang explosion the first physical features to be created were space and time at a very high temperature. The entire scenario of creation and time sequence of the emergence of various constituents of the universe as a function of time extending from 10^{-43} s to of the explosion to the present time is very elegantly presented in fig 1.1.1

is reproduced from the book of Smoot. The legend on the sides describe the physics of the different time zones. The figure gives us in a graphic way the values of the parameters time since Big Bang, size of the universe, density, temperature and corresponding energy of the particles. It is important to point out that all these parameters and the physics as portrayed in the earlier figure are based on (i) the present temperature of the universe as given by the universal 30 radiation, (ii) the rate of expansion of the universe, (iii) the measured and extrapolated red shift and (iv) most importantly (iv) the results of the high energy ~~accelerator experiments~~ particle physics experiments carried out at the various accelerators.

The limit of 10^{-43} s comes from the fact at times smaller than this value the gravitational

3.	M Malani (A. No. 92) No. 16/1, 3 rd Cross, M.T. Layout, 13 th Cross Malleswaram, Bangalore 560 003 Tel. 2334 5327 Email: malini_sjrc@yahoo.com	MA, History, Bangalore Univ., 1997 History	
4.	S J Rani Mole (A. No. 35) Sam House, Plakkad Karuvehil P.O., Ezhukone Kollam Dist, Kerala 691 505	MA, Archaeology, Univ. of Kerala, 2004 Archaeology	

NIAS DOCTORAL PROGRAMME-2004

School of Humanities

Prof. B V Sreekantan (Officiating Dean)

Prof. S Settar

Sl. No.	Name & Address	C	Remarks
1.	M B Rajani (A. no. 37) 305, Sangeetha Apartments 5 th Cross, Malleswaram Bangalore 560 003 Tel/Fax. 2356 1558 Email: mbrajani@hotmail.com	MA, Contemporary Crafts (Textiles), Surrey Institute of Art and Design, Univ., College, Farnham, Surrey, UK, 2003 History, culture and archaeology	<ul style="list-style-type: none"> • She was a wonderful record of field experience in arts, crafts and interest in remote sensing. She has written a dissertations, which if could be made available, we judged in order to evaluate its quality. • She was completed ONE YEAR MA course in contemporary crafts at the Surrey Institute of Art and Design, Univ., College, Farnham, Surrey, UK <p>These are in her favor.</p> <p>Caution After her schooling Ms. Rajani seems to have not gone through the regular course leading to Bachelor Degree and Master Degree, and the nature of her application to Bharatiya Vidya Bhavan cannot not be made out. I strongly doubt whether she would be admitted to PhD course by any Indian University: This point is to be carefully examined to make here eligible for a Fellowship leading to PhD.</p>
2.	Raghavendra Bhat (A. No. 36) Ishaana, Gude Devasthaana(near) Po. HERANJALU, Kundapura Dt. Udupi 576 219	MA, Kannadapandith History	

Regarding the expansion of the universe, it has been found that not only the universe is expanding but it is also expanding faster than what was believed all these days at the edge of the universe. This is opening up new physics.

What is more intriguing about the universe that we have become familiar to far is that ~~the~~ ~~the~~ ~~constants~~

the only 4% of the matter and radiation is of the type familiar to us. The ~~matter~~ remaining 96% remains to be identified and has been termed as 'dark matter' and 'dark energy'.

12	M S Reema (A. No. 102) Reyanivas, Aroor Ponganadn (PO) Kilimanoor, Thiruvananthapuram Keral 695 601	MA, Archaeology, Kerala University, 2004 Culture and Archeology	72% has knowledge of Brahmi, Grantha and scripts which may be useful for exploring literary sources etc?
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Dr Sangeetha Menon

Sl. No.	Name & Address	Qualification and Research Interest	Remarks
13	K Rajesh Kumar (A. No. 17) Doctoral Scholar Centre For Development Studies Prasanth Nagar, Ulloor Trivandrum- 695011 Kerala, India Ph : +91-471-2442481 Fax: +91-471-2447137 Mr Rajesh Kumar rajeshkumar@cds.ac.in theatresign@rediffmail.com	YES Qualification: M.Phil, Applied Economics, Centre For Development Studies, Thiruvananthapuram, JNU, Delhi, 2003; M.A., Development Economics, Dr. John Matthai Centre, Calicut University, 2001	Topic/Registration etc could be decided later
14	Deepti Diwakar (A. No. 30) 233 Sadashivanagar, 18 th Cross Bangalore 560 080 Tel: 23610330; 2361 2064 deeptidiwakar@hotmail.com	YES Qualification: MA, Radio Television San Francisco State Univ., USA, 2001 Research Interest: Consciousness Studies/Intercultural Communication	Topic/Registration etc could be decided later

Egyptian, Chinese, and Indian Civilization.
Greeks. Persian and Islam.

Metallurgy, Medicine.

Pyramids, Mohenjodaro and Harappa - Scientific principles of water management. Sanitation. Habitate.

- Medieval Science } Beginnings of Modern Science.
Some aspects of philosophy - get transformed to science.
Theism - atheism - agnosticism - science (?)

- Bacon, Descartes, Galileo, Newton, Leibniz.

- Newton's Laws } ^{alone} cannot lead to idea of entropy and its derivation

Boltzmann
Maxwell
Gibbs

Thermodynamics + Statistics - Averaging -

Is it emergence? Arrow of time

Microscopic variables - Pressure, Temp, Volume
($PV = RT$) - gas laws

Time reversal character of the micro world is lost in macro world (because of entropy increase) by averaging procedure in statistical mechanics

* Macro is our experience. Why do we humans perceive the mathematically averaged behaviours
Is this connected to evolution?

Holo in greek is whole

Science: Schrodinger

(1951)

" I consider science as an integral part of an endeavour to answer the one great philosophical question which embraces all others, the one that Plotinus expressed by his brief "who are we"? And more than that I consider this not one of the tasks, but the tasks of science the one that counts"

Associates of NIAS: May 6, 5005

What Euclid is to Europe, Panini is to India – Or Are They?

Frits Staal

Frits Staal, Professor Emeritus of Philosophy and of South Asian Studies at the University of California, Berkeley, wrote some 15 books and 150 articles on Indian Logic and Linguistics, Vedic Ritual, Mantras, Mysticism and other topics. "What Euclid is to Europe, Panini is to India" was the thesis of his Inaugural Lecture as Professor of Philosophy at the University of Amsterdam in 1963. In Europe, Plato required geometry from all his students. Newton's *Principia* and Spinoza's *Ethics* copied Euclid. All over the world the axiomatic method is a triumph of modern logic and mathematics. In India, grammar is the Science of the Sciences and Panini's grammar starts with the *Sivasutras* from which it may be logically derived. Chomsky and Halle's major work on phonology ends with the same rule as Panini's grammar. Professor Staal has some further thoughts.

Machines are constructed, but organisms grow and are self-organizing.

In Search of Deep order in Nature - Universe

- String theories.
- Cosmology - Dark Energy.
- Mathematics and Biology.

"The Modern Mind" 2001
Peter Watson.
Perennial (2002)
Harper-Collins NY.

- Chaoplexity.
- DNA-Finger Printing (1983)

- Cloning
- Do genes hold Culture on a leash?
(Neo-Darwinist) Wilson. (Socio biological
consequences of
Sluts.)

"the brain exists because it promotes the
survival and multiplication of genes that
direct its assembly" E.O. Wilson. (1978)
on Human Nature
Cambridge

Cultural and even ethical life of humanity can
be explained biologically, genetically - Wilson

James Lovelock: Gaia hypothesis: (1979)

"The whole of the earth biota is one
inter-regulated system more akin to physiology
than to physics (i.e. that the gases of
the atmosphere, the salinity and alkalinity
of the oceans are regulated to keep the
maximum number of things alive like a
gigantic organism"

Neo-Darwinism

Purpose of
the brain?

Gaia

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Richard Dawkins - Disperses funny notions of evolution(?)

Memes - the cultural equivalents of genes?

Memes

" A result of human cognitive evolution, such things as ideas, tunes, books, and cultural practices come to resemble genes in that the most successful - those that help their possessors to thrive - live on and so 'reproduce' and be used by later generations

(The Blind Watchmaker)
London Longman (1986)

" If I were to give an award for the best idea anyone has ever had, I'd give to Darwin, ahead of Newton and Einstein and everyone else. In a single stroke, the idea of evolution by natural selection unifies the realm of life, meaning, and purpose with the realm of space, time, cause and effect, mechanism and physical law.

Daniel Dennett in
"Darwin's Dangerous Ideas
the evolution of meaning
and meaning of life." (1995)

Life, intelligence, language, art and ultimately consciousness, are in essence, no more than engineering problems. We haven't got them yet. but we know.

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Stephen Jay Gould (against Neo-Darwinism)

Punctuated Equilibrium - (1972)
alternative to phyletic gradualism.

" The thrust was that an examination of fossils showed that whereas all Darwinians (orthodox) tended to see evolutionary change as gradual in fact there were in the past long periods of stasis where nothing happened, followed by sudden and rapid periods of dramatic change.
(Sudden = thousands of years!)
if not initial of years.

" of the "tape" of evolution were to be run again, it need not turn out in the same way" (?)

Francis Crick: " Astonishing Hypothesis" (1984)

John Maddox (What remains to be discovered)

" No amount of introspection can enable a person to discover just what set of neurons in what part of his or her head is executing some thought process. Such information is hidden from usen "

Is Consciousness an Emergent property?

John Searle (Mills Professor of Philosophy, University of California, Berkeley) - individual molecules of water do not have liquidity.

Colin McGinn: Consciousness is resistant to explanation in principle and for all time

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Penrose and Consciousness (Has he proved anything?)

Penrose believes that a new kind of dualism is needed, that in effect a whole set of new physical laws may apply inside the brain, which account for consciousness. Penrose's particular contribution is that quantum physics operate within the tiny structures known as tubules, within the nerve cells of the brain to produce - in some as yet unspecified way - the phenomenon we recognize as consciousness.

Penrose thinks that we live in three worlds - the physical, the mental and the mathematical. The physical world grounds the mental world which in turn grounds the mathematical world and the mathematical world is the ground for the physical world and so on around the circle. His speculation is enticing and original, but it is still speculation.

[Shadows of the Mind]

Dennett: Human consciousness and identity arise from the narrative of their lives and this can be related to specific brain states.

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Space, time and matter

The theory of relativity combined space and time into one entity - Space-time continuum. Quantum Mechanics focused attention on the importance of extremely short intervals of space ($\ll 10^{-13}$ cm) and extremely short intervals of time (10^{-6} s - 10^{-23} s). Products of particles - mesons and neutrons pair - λ less than 10^{-23} s. Speed intervals of $< 10^{-16}$ cm.

When did man arise on the earth?

Mary and Louis Leakey

(p. 86) Archaeologists and paleontologist - Excavations in Kenya and Tanzania - late 1930's - at Oldvai Gorge - 30 ft. deep - 30 miles long Chasim from 1930-1959 - Leakey dug at this place. No earth shattering discovery. (Leakey has been in Kenya) Morning of 17th July 1959 - Discovery of the skull of an early Homo - probably Australopithecine - more ape-like - Leakey's theory - Midway between Australopithecine and modern ~~Homo sapiens~~ Homo sapiens - ~~Zinj~~ Zinjanthropus boisei - Zinj - ancient arabic word for the coast. Earlier Man - 600,000 yrs old (from stratigraphy) Carbon Dating C^{14} - proved it \rightarrow 1-75 million yrs

Man originated in Africa and then spread out to other parts of the globe

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Karl Popper "The Logic of Scientific ~~Revolution~~ ^{Discovery}"
(1959)

view " ~~Scientist encounters~~ The Scientist encounters the world - Nature - essentially as a stranger, and that is what sets the scientific enterprise apart from everything else is that it only entertains knowledge or experience that is capable of falsification. For Popper this is what distinguishes Science from Religion, say or Metaphysics: Revelation, faith or intuition have no part, at least no central role; rather knowledge increases incrementally, but that knowledge is never 'finished' in the sense that anything is 'knowable' as true for all time."

Thomas Kuhn "Structure of Scientific Revolutions"

M.P. physicist → historian of science

How major changes come about in science.

Copernican Revolution
Discovery of oxygen
Discovery of X-rays
Relativity

Stable Periods followed by
Anomalies - change of
paradigm - totally new
paradigm.

(A new theory wins before the adherents of old theory die)?
Kuhn: Science worked in a distinctive way - very well - in parts. - More tentative than before.

[Influence of Post Modernism on Foundation of Science]

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Methods of Learning Intelligence

- (i) Freely Experience
- (ii) Systematic observation - clearly define or plan of how
- (iii) Formulation of theory - Concepts, Relations, Laws.
Controlled Experiments Quantitative
- (iv) Use of mathematics in the formulation of theory is
Mathematical Formulation of the the laws - Theoretical
Manipulation - prediction
- (v) Verification of the predictions
- (vi) Use of instruments

All the vast amount of data collected over centuries of efforts
and analyzed by scientists in different periods of time had to be
and explained by introducing a theory of concepts

To explain the details of the vast amount of data collected over
centuries

In the 18th Century one of the concerns of the Chemists was how to make Chemical Sciences independent of Mechanical Sciences which had dominated in the extraction of all Sciences. This required that the objects dealt with in Chemistry were different from those in Mechanical investigations - go outside the mechanical concepts into particles, atoms, aggregates subject to mechanical operations

Boyle - Chemical atom - Prima Mixta - Chemical elements
mechanical atom - Minima

"Nature of Science" V. Ilgin, A. Kalonkon

- Being a manifold phenomenon, Science is studied in the framework of approaches based on logic, methodology, social psychology, economics, statistics, information theory, cybernetics etc
- The present work, taking the epistemological approach is focussed on gnoseological of problems of Science as knowledge
Epistemological units: theory, family of theories, paradigm, (taxons) research programme, intellectual tradition types of knowledge and finally knowledge as a whole

Scientificity

- Science is supported by an ensemble of invariant principles
- The contents and meanings of these principles are relative
- The existence of such principles is absolute.

Hard Core Science - true elements absorbed from the total body of science
the sedimental base - the evidential base -
Reliable knowledge crystallised in the course of progress of science.

What Scientists do now, will become child's play later.
The character, content, and meaning of Science changes
They do not lose the feature of Scientificity.

Frontier Science →

→ Regulate feature - non-triviality, informativeness, heuristic quality
→ Less Rigid - exactness, rigorlessness, substantiation
relaxed

Frontline Science - mostly hypothetical, unreliable.
 The task of frontline science is to generate new knowledge

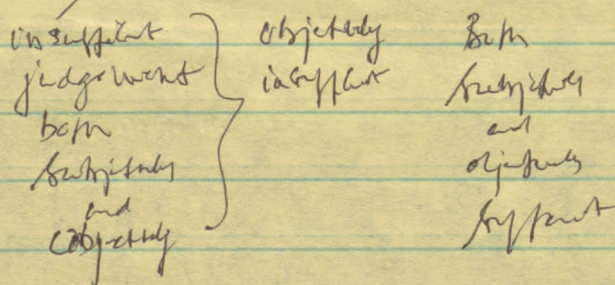
Different types of Science are dominated by different values and norms

Knowledge $\left\{ \begin{array}{l} \text{as skills - handiwork} \\ \text{as information} \\ \text{interpretation of knowledge - epistemological taxon} \end{array} \right\}$

Substantive knowledge - truth abstracted from subjective evaluations and recognition

Kant \rightarrow "judgement valid for every rational being"

Subjective judgement has 3 stages - opinion, belief, knowledge



Principles of Sufficient Reason } No scientific proposition can be proved to
 Leibniz } be correct without a sufficient reason
 Why it ~~cannot be otherwise~~ is so
 and not otherwise"
 Scientific knowledge is apodictic - the apodictic of
 knowledge is compulsory.

Everyday knowledge
 Scientific knowledge

Genesis of Science: Why, How and When of Science.

8th - 6th Century BC

Myth \rightarrow Logos Conversion
Middle, Far East, Greece

Spiritual-personal \rightarrow objective, substantial basis

Reality as "objective" - Subject & Objective Considerate

Shifts to "Natural interpretation of events" - not supernatural.
Cause-effect hypothesis

• No Consensus on When, how and how of Science.

• Epistemological Standard - Science as an activity that produced NEW KNOWLEDGE

Was Oriental Culture Capable of generating Science?

Egypt, Mesopotamia, India and China - Agriculture, Crafts, War arts
and Commerce

Floods - Competition of Land \rightarrow Geometry, Computations

Science = goal directed creation of new knowledge NO in these lands

Oriental Science - Solution of Applied tasks - "not cognition for sake of Cognition"

• True Cradle of Science is Greece (6th - 4th Century BC)

A simple elegant, most comprehensive definition of Science and Religion is given by the Nobel Laureate Charles Townes⁽¹⁾ that is as follows:

Science is the attempt to understand the structure of the universe and how it works including ourselves.
Religion is the attempt to understand the purpose and meaning of the universe including our own lives.

This is almost like a Sutra in a Sanskrit text - say that of Patanjali and there are many vast implications of many of the terms used in the above sentence, particularly those that I have underlined. By calling them attempts, the tentative character of both Science and Religion have been emphasized. By using the word, ^{universe} the vast range of ontology that we have to deal with has been brought in with an eye on the mechanism that is operative in the structure.

The definition of 'Religion' implies that the purpose and meaning of the universe and of ourselves is not available in Science. The word 'understand' brings in all the epistemology that is required.

Experience is the basis of all our physical and mental activity and needs no definition since it is self-evident.

Experience thus needs no definition since it is a self-evident feature of all of us and grows through the process of living and interacting with others and learning (अनुभवो ज्ञानं, ज्ञानिनः तल्लक्षणः)

is the basis of all our analysis and understanding. Understanding has always to be in terms of what we already know, helped by analogy and extrapolation.

electromagnetic, the nuclear and gluonic forces are not rigid bodies like rods that are permanently attached and move down with the particles they connect. According to present concepts of forces, their action is through the creation and absorption of virtual pairs of particles and antiparticles. So strictly speaking, it is not only the bunch of quarks and electrons falling down, it is also the continuous creation and annihilation of virtual pairs of particles in the space between the falling particles. This highlights yet another intricate action that is going on which is very relevant to the act of the stone falling as one piece, but which is not apparent, at the gross levels. We normally treat the space as 'empty' of 'everything'. Actually this is not the case. Space is the repository of the ultimate constituents of all matter and forces, but existing in such a form that either by spontaneous fluctuation (which is one of the properties of this vacuum) or by the deposition of positive energy they can be made manifest. For example, in the case of a hydrogen atom, the electromagnetic force between the proton and electron is due to the continuous creation and annihilation of electrons and positrons created as virtual particle pairs by the mediating photons emitted by the charged particles. In the case of quark-quark forces the gluons are exchanged. Though the virtual pairs cannot be recorded by any instruments directly because of the extremely short time for their existence and the very short distance intervals in which they manifest, the effects of their production have been recorded (Lambshift, Casimir force etc.). What all this is telling us is that what meets the eye is very different from the plethora of many subtle phenomena taking place at deeper levels which are not only unseen, but unseeable.

In the above paragraphs, we have talked about force as due to exchange of virtual particles. This is a very different concept from the original ideas of force fields that were introduced in connection with gravitational, electric, magnetic and electromagnetic phenomena. The fields were introduced as mathematical concepts without defining what the physical contents of the field are. It was assumed that these are some vague properties of 'ether' which itself was supposed to be non-material something, not identifiable. For several centuries the ether concept held sway, but was finally replaced by the four dimensional space-time continuum by Einstein, as part of his special theory of relativity.

While quantum mechanics highlighted the properties of empty space in terms of its ultimate constituents (fundamental particles or fields representing them), the special and general theories of relativity brought out some other interesting aspects of space - connecting geometrical properties of space with matter and energy. The old common sense idea of time as

What is the Universe? In a sense it is everything that we become aware of individually and collectively. The figure shows the different categories of the Universe. Not all are in the experience of every one. Most Scientists hold the physical Universe as the primary and all the others as secondary to the primary Universe though the exact connections are not clearly established. There are Scientists and philosophers who hold the view that the physical and mental are different. There are some mathematicians who believe that the reality of the mathematical Universe is no different from that of the physical Universe.

Let us first consider the physical Universe. We become aware of it through the five senses - the eyes, the ears, the nose, the skin and the tongue which project the different aspects of the gross nature of the world around us - essentially the properties of the objects on the earth and in our neighbourhood. Often the eyes attend to us the celestial objects like the sun, planets and stars and the skin the heat that the sun is radiating.

Right from very early times, the different civilizations recognized that all that surrounds us can be brought in under the category of five elements - the Pancha Bhutas - earth, water, Air, fire and space - variants of the same both in the eastern and western cultures.

Our everyday experience in dealing with the information received from the senses led to the recognition of the essential constants - matter and radiation and three concepts space, time and causality behind all the activities and encounters in three states solid, liquid and gas and space that has empty has regard for the location and disposition of matter and change has connected with flow of time. Every effect had to have a cause that preceded it in space and time.

deeper fundamental level? ^{It is very instructive and illuminating to become familiar with} Let us examine what happens in physical sciences in similar situations, ~~not involving~~ ^{directly} the brain or mind.

Reality and levels of explanation in physical sciences

It has happened in the field of science, particularly in physics, that even the same event requires widely different concepts for explanation depending on the level and purpose for which the explanations are required. Let us examine a few typical examples ~~of such cases~~.

Suppose

~~Supposing~~ I take a piece of stone and drop it from a certain height. It falls to the ground. Why? The standard school-boy's answer is that the gravitational force between the stone and the earth is responsible for this. The stone is a solid and therefore does not change its shape while falling down, while it may break into smaller pieces when it hits the ground. This same phenomenon is explained by a chemist in a more elaborate way. He will say that the stone is a compound made of several elements like silicon, oxygen and other impurities and the molecules of these elements are made of atoms held together by electromagnetic forces. So when the stone falls it is an assembly of atoms falling down held together by these forces. An atomic cum nuclear scientist goes one step further and will say that all these atoms are made of protons, neutrons and electrons bound together by nuclear forces and so what is happening when the stone is falling is that a bunch of protons, electrons and neutrons are all falling down together held by nuclear and electromagnetic forces. A fundamental particle physicist will go even further and say that the protons and neutrons are made of quarks held together by gluonic forces and it is the assembly of quarks, gluons and electrons that is falling.

What this shows is that though the gross phenomenon is just the falling of a stone, the realities are different at different levels of explanation. The reality goes on changing as we delve deeper and deeper into the structure of matter and nature of forces. Different levels of reality meet different purposes. An engineer designing a steel bridge does not have to go beyond the molecular structure of iron, while a pharmaceutical chemist designing a drug has to go to deeper levels. A nuclear engineer has to go to the nuclear levels for designing reactors and providing protection against radioactive emissions.

What we have considered so far is about the finer and finer constituents of matter. While we have made a reference to the various forces, we have not considered some of the intricacies involved. As the stone is falling, it is entering new regions of space. The

With the advent of science these features matter, reduction, space, time and causality based on everyday common sense experience have taken on into science and further elaborated by quantifying them, introducing units and measuring instruments. Specificity became the characteristic of scientificity. This enabled the formulation of laws that could be stated mathematically in the form of equation and solved for different cases and predictions made. The mathematization of the physical situations led to the recognition of the importance of the specific values of the constants of nature.

Though it is difficult to say when exactly the identification of the different elements that constitute matter began in the history of chemistry, by the end of 19th Century it was known that 92 elements, hydrogen to Uranium constitute all the matter encountered on the earth. Einstein's explanation of the Brownian motion had led to in a sense established the existence of the molecular concept of elements and compounds and Bohr's theory of the atom and Rutherford's discovery of the nucleus and Bohr's theory of the atom were important landmarks in the reductionistic down journey to the ultimate constituents of matter. One had expected that this journey would stop at the atom of each element. Hadn't many surprises were in store. It turned out that the atoms of all the elements nuclei of all the elements were composed of the same two fundamental particles - protons and neutrons. Only their number varied. Further investigations into the structure of these nuclear particles both cosmic rays and high energy beams of particles provided at high energy accelerated revealed the micro world of elementary particles (See Table) that had characteristic properties like mass, spin, charge etc, but were extremely

neutrons and electrons. For certain purposes one can stop at the level of signals and chemicals. The question is whether we can stop at these gross levels for understanding what consciousness is.

The terms on the right hand side of the Table ~~the category~~ ^{i.e.} (B) fall into an entirely different category. There we come across terms like beauty, fragrance, softness, etc. which we learn in the process of everyday living and through interaction with others. They cannot be described in terms of more fundamental entities. They cannot be quantified. They have a certain intensely personal (subjective) character about them. Some of these like joy, happiness etc. are triggered by past associations and memories of events and individuals. More than anything else, we read a certain 'meaning' to these. They are not just data as in the first case (A). ^{quantifiable}

The crucial difference between (A) and (B) is that while (A) can happen even when one is unconscious, (B) can never happen when one is unconscious. Even if all the signals and chemicals are released in the brain and its accessories, (B) cannot happen if the person is in a unconscious state or when he is not paying attention - when the intentionality for registering the particular happening is not there. While for seeing a flower or registering its fragrance, (A) is necessary, (A) alone is not sufficient for (B) to happen. On the other hand (B) can happen in a different way - by thinking of the flower and recalling from memory, ^{say} its fragrance. ^{quantifiable}

Let us consider the reverse situation when the input is not from outside, but from within. If I "will" to get up, then the necessary instructions are sent to the relevant parts of my body and I stand up. What or Who is this I, that wills and how does the will get translated to all the mechanical actions of the body? Clearly I can "will" only when I am conscious.

In both these examples, the net result is some kind of 'action'. In the first case the source is physical and the action is mental and in the other the source is mental and the action is physical. In both cases, the action takes place in a certain space-time framework - the body and its surroundings and in a certain time sequence.

Is it possible at all to relate these two different kinds of experiences of the same event in any meaningful way? Clearly at the gross level they appear to be distinctly different and unconnected entities though the two experiences are the consequences of the same physical event, namely seeing and smelling a flower by the same individual. Can they be reconciled at a

short lived. Though these particles have very short
 lived they had a very important role to play in
 binding the particles inside the nucleus. Investigation
 of the properties of these unstable elementary particles led
 to most surprising result that the protons and neutrons
 that constitute the nuclei were themselves made of six
 more elementary particles that have been called "quarks"
 that are held together inside the proton or neutron by
 the exchange of another set of particles known as
 gluons. In this field of elementary particle research, a very
 significant development in the field of scientific activity
 was the close collaboration between theorists and experimentalists.
 Also the construction of higher and higher energy accelerators
 became major technological endeavours. Thus again
 collaboration between physicists and technologists became
 inevitable. The history of 20th Century physics is unique
 in this respect. The technologies of the 20th Century -
 electronics, computer, high vacuum, high magnetic fields,
 special types of particle detectors - had refrigeration, etc.
 were all the product of scientific insights obtained
 earlier in the pursuit of pure science. The
 chronological developments of the technologies and of the
 sciences are given in tables ()

Some are of the opinion that consciousness is an emergent phenomenon arising from the co-operative electro-physical-chemical activities in the neural networks and blood streams.

The Table 1 illustrates the two kinds of experiences generated in an individual when he looks at say a rose flower.



A (Physicalism) What happens in the Brain and Its accessories	B (Mentalism) What happens in the mind
• Formation of 'image' of the flower in the retina.	• Distinctive perception and recognition of the flower as a rose.
• Activation of rods and cones in the retina's various layers.	• Evokes sense of beauty - Smell of the rose flower <i>awareness and recognition</i>
• Generation of action potentials - electrical pulses.	• The colour of the flower.
• Transmission of pulses through axons in neurons.	• The softness and smoothness of petals on touching the same.
• Happenings in Synapses and Dendrites	• Appreciation of Symmetry, beauty and aroma.
• Releases of Neuro-transmitter chemicals at various locations	• Earlier happy associations flood the mind
• Activation of Cortices	• Emotions triggered.
<u>Basically:-</u> Electrical Signals } in various oscillations chemicals } locations time sequence.	The mind is able to gauge the size, distance, shape and other physical characteristics as well.

In Table 1, on the left hand side (A), there are terms like electrical signals, oscillations, chemicals etc. that have specific connotations which we learn in the process of schooling at various levels, and start attaching certain kind of reality to them. It is to be pointed out that these are actually representations of something things which are more basic and physical. For example, the electrical signal represents the flow of a certain quantity of electrical charge in a certain period of time in a certain location. These parameters are again related to more subtler realities as we shall see later on. Similar is the situation with the neurochemicals which are made of various elements which in turn are made of fundamental particles like protons,

Discoveries which brought about changes in the Founders of Science:

Life Science:

- (i) Galen (b 129 AD) - Anatomical Explorer
Authority of the medical theory
- (ii) Vesalius (b 1514 AD) - Structure of the human Body
d 1564
- (iii) Van Leeuwenhoek - Microscope (Grinder of Lenses)
1632-1723 - rain water - "wretched beasts" magnification 2500 x
opened the microscope to the medical world
Serge Lee
- (iv) Harvey (1578)
Beating of the heart by opening it the chest-cavity
circulation of blood.
- (v) Jenner (1749-1823) Vaccination.
(Cow-pox - Small Pox vaccine) Those who had cow-pox did not contract small pox

Chemistry // (vi) Wohler - Synthesis of Urea } established organic Chemistry
(1828)

(vii) Darwin (1809-1882) - Wallace.
Theory of evolution

(viii) Louis Pasteur (1822-1895)
Fermentation - (established the impossibility of Spontaneous generation of germs?)
(Microbes)

(ix) Gregor Mendel (1822-1884)
Hereditary theory - Laws of Heredity

(x) Fleming - Penicillin (1881-1955)

calcium ions that act as *non-linear* dendritic{??} amplifiers and synaptic activity that can alter the information processing in a neuron on several time scales.

Neural Networks

$I = 10^{110}$ (coined by Elasser), I = Immense

The Neo-Cortex has 10^{10} neurons, Even with just yes-no gates, the total number of brains > I^{10}

- The electro-chemical action of the Brain and the associated Neuronal system connecting all parts of the body just reduces to
 - Generation, reception of action potentials
 - Release of Neuro-transmitters/chemicals (60-70 types)
- Even for one EVENT, the visual information is stored in the visual cortex and the audio in the auditory cortex. Different aspects of the vision intensity, colour, distance etc are stored in different regions as CHEMICALS
- What is the MECHANISM of co-ordination? What is it that integrates? If sensations are some kind of co-operative phenomena – there is no classical analog in physics. It has to be quantum-mechanical. (Superposed states, non-locality, duality, probabilistic(???) nature of happenings, the role of Quantum Mechanical vacuum or empty space, space-time continuum – higher dimensional realities all can come into play) – *Most importantly spontaneous creation*
- Slowly some evidence is accumulating that even the processes resulting in the release of neuro-transmitter chemicals – some of them atleast – are quantum mechanical in nature.

If at all, the Brain will have to be a Quantum Mechanical Computer – the analog of which has not been constructed yet. !

The Living Organism functions as an “Organic Whole”

[Mae-Wan Ho’ – JCS, Vol. 3, No. 3, 1996]

From: "Thoughts on ^{Synthesis of} Science and Religion" (2001)
Edited by T.D. Singh and Samarendra Bandopadhyaya
The Bhakti Vedantha Institute, Calcutta

- "Many Scientists will say 'I can't believe in religion, I can't be religious'. On the other hand, if you ask them 'Do you think you have free will?' almost every Scientist instinctively thinks so. He has free will. He can choose things some things. He can decide to go this way or that way. There is, in fact, no room for free will in present Scientific laws and yet almost every Scientist essentially assumes he has it"

Charles H. Townes
(Back of front flap of the book)

"I am saying to modern Scientists and theologians don't imagine that our latest ideas about the Big Bang or the human genome have solved the mysteries of the universe or the mysteries of life"

Freeman Dyson

On "India"

If I were asked under what sky the human mind has most fully developed some of its choicest gifts, has most deeply pondered on the great problems of life, and has found solutions of some of them which now deserve the attention of those who have studied Plato and Kant - I should point to India

Max Müller

The most beautiful and most profound emotion we can experience is in the sensation of the mystical. It is a source of all true science. He to whom this emotion is a stranger he who can no longer stand in awe, is good as dead. To know that what is ^{imp}penetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty that our dull faculties can comprehend only in their most primitive forms - this knowledge is at the centre of true religiousness.

Einstein

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quoted

1. Godel's Theorem - implication → limitation of logic-based approach to scientific enquiry
2. There are many aspects of reality beyond Rationality
3. Beyond Rationality → intuition, inspiration, direct perception, grace, divine power

Evolution - Big Bang to Man

① Big Bang - 13.7 Billion years ago

Questions: What exploded? Singularity? Infinite Energy?

No space - no time, no matter before

Quantum Fluctuation - of what

Is Heisenberg's principle of uncertainty valid

Along with space - Gravity created as curvature of

space?

② $> 10^{-43}$ s to 13.7×10^9 years - various evolutions

(i) Expanding space-time (4-d) continuum (Inflation)

(ii) String Theory Equivalents?

(iii) Temperature of space - $> 10^{28}$ K | (Extrapolation backwards
for ~ 30 radiation)

(iv) Creation of Particles by

(a) Spontaneous fluctuations

(b) Collisions

• Blackbody Cooling (COBE)
(MAP)

(v) Creation of X, Y pairs of matter $>$ ev

Delay of these to quarks and anti-quarks -

CP violation in delay \rightarrow Asymmetry - particle-antiparticle

Asymmetry in the universe

(Ideas extrapolated from Standard Model?)

(vi) Creation of quark-antiquark soup

(vii) Creation of stable - unstable particles, Force Particles

pions, kaons, N, \bar{N} , et, ...

Gluons, photons, LI

(viii) Formation of Atoms - EM Forces p, n, e^-

~~(ix)~~ (ix) Formation of Molecules H, He

(x) Formation of Galaxies - Stars, Planets - (What Sequence?)

(xi) Explosion of Stars

(xii) Evolution of Solar System - Earth

(Xiii) Evolution of earth - in 5 billion years

Hot Magma - Chemical Soup - Electric Discharges - amino acids -
Formation of long chain organic molecules - (proteins, Enzymes)

At what stage and how DNA was formed?

How did the sequence of organic evolution and the
specific roles of organs get defined?

What is the specific connection between DNA and Life? ^(unit of life) ^{cell}

Genes, Chromosomes, - Chemical reactions and time sequence

Why do DNA not function in similar fashion in vitro?

Is there any organism without DNA in its cell?

(Xiv) Darwin's Theory of Evolution:

- Competition
 - Struggle for existence
 - Survival of the fittest
 - Capability for reproduction
- Selection - Criteria Undefined.
post-facto.

Post Darwin → • Mutation - Random Causes - Change - evolution

• Why should there be struggle for existence? Does this not indicate
or mean a purpose?

• There are no criteria for fitness defined. Only those that
survive are regarded as the fittest. - The action is like that
of sieve.

Reproduction ability is an important aspect for evolution to take
place.

Mutation provides an opportunity for change.

Robert Griffiths:

(Professor of Physics at Carnegie Mellon University)

In Scientific Reduction Adversary or ally? (2002)

Science and the Spiritual Quest Edited by Mark Richardson, Robert John
Russell, Philip Clayton and
Kirk Wroughton - McNelly
Routledge, London, (2002)

"But from my perspective, the most likely casualty to further progress is not traditional theism, but instead naive materialism which supposes that tying human thought to chemical and physical processes in brain would somehow invalidate descriptions of human beings as free moral agents under obligation to love God and neighbor"

Arthur Peacocke

235 "Islam was the midwife to the Greek mother of our modern western scientific ~~thought~~ outlook"

Religion in general has been defined as "a cultural sign language" which promises a gain in life by corresponding to an ultimate reality"

Ancient Organismic Laws of Motion. Aristotle }
"Motion transfers its nature force" Aquinas }

Motion: Explanation of all physical phenomena is ultimately traceable to motion of some kind or other. - Acceleration, vibration, oscillation, etc.
Modern Mechanics vs earlier theory

Newtonian Mechanics - Law of Inertia - Self-Evident?

[For Aristotle or Thomas Aquinas - the effect of human desire upon the movement of the human body has the same thing as the effect of the mechanical "force" exerted by a wind blowing upon a sail ship
Mental or spiritual force vs physical force
It has more easy to understand the mental force than the physical force (?)

Mental concept of "Force" entered Technical Mechanics to Newtonian Mechanics

o Infiltration of the Organismic Laws to Newtonian Mechanics
Mech force = will power (?) - action of our wills
It was David Hume that purged Mechanics from the realm of organismic laws.
" ... but the means by which the will performs so extraordinary an operation - he are far from being immediately conscious --

Galileo: A new generalization of our Common-sense experience.
It abandoned the concept of a "Prime Mover"
- traditional proof for existence of a God.

A system in which Newtonian Laws are valid is called an "Inertial System" - Approximates Earth, System of Stars.