

# The Quest for Ultimate Reality

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## Abstract

In the past several millennia, there have been many streams of knowledge that have been pursued in quest of ultimate reality. In this talk I will concentrate on just two streams, the scientific stream which is only a few hundred years old and the vedantic stream which is several thousands of years old. In science there have been two main branches - the physical sciences essentially in dealing with the inanimate part of the world and the life sciences which are concerned with the animate part of the world. To begin with, the physical sciences pursued the path of "reductionism", (explaining the whole in terms of parts) and here eminently successful in unravelling and explaining the structure and the wide variety of phenomena encountered in nature. With the help of more and more powerful instruments and making use of advanced technologies, the physical scientists established the more and more subtle constituents of the world - the elements, molecules, atoms, nuclei, fundamental particles and the four forces of nature - the gravitational, the electromagnetic, the weak and the strong forces. For the explanations of simple and complex phenomena, the concepts of space, time, matter, motion and causality were drawn from commonsense and quantified and adopted suitably. However when the scientists here riding on this wave of success, certain thoroughly unexpected discoveries towards the end of the 19th century and the early 20th, threw them completely out of gear, and it became necessary and compelling in the hands of the theoretical physicists to transform completely the familiar concepts which became abstract and mathematical. Widely different kinds of experience got integrated -

Why do different streams of knowledge point to the same reality?

electricity and magnetism, space and time, matter and energy, space and gravitation, and so on. The four forces responsible for entirely different kinds of activity were integrated into a single force that got differentiated as a function of space and time. Empty space, now called the quantum vacuum, was no longer the absence of everything matter and energy, but the repository of all fundamental constants may be in the form of representative waves. Thus vacuum has become the 'oneness' - the ultimate substratum from which everything else - including space, time, matter and energy emerge as bubbles emerged on the sea. This picture of ultimate reality has been buttressed by the experimental discovery of the expanding universe and its explanation in terms of the so-called big bang explosion. Of course there are many gaps to be filled. Though life sciences proceeded differently, because of the widely different nature of organisms, a closer connection with physical sciences became apparent with the realisation that the physical constituents of organisms here now differs from the inanimate world; no new elements or forces have been discovered. The advent of molecular biology in the middle of the 20th century has brought it even closer. The hope and the endeavour is that all the phenomena associated with organisms, including life and consciousness will one day be explained in terms of physico-chemical processes, though one is very far from it. A crucial question is whether everything will be explained at the molecular level itself or whether one has to take recourse to the deeper levels and the quantum processes that the physicists have been compelled to pursue; whether the secrets of quantum vacuum will be required for explanation of life and consciousness which have defied explanations so far.

More than three thousand five hundred years ago, the Upanishads, the last part of the Vedas spelled out in the 'four' mahavakyas the grand unification of everything in human experience as manifestations of one Supreme entity i.e. Brahman. Shankara changes in the 8th Century A.D. expounded how this oneness and the experienced multiplicity of the Universe could be reconciled and understood in terms of the two Referee frames, the transactional and transcendental.

While the similarities of these ancient insights to the conclusions of modern Science are obvious, and the one does not need the support of the other, it would be very relevant in the context of the present ~~of~~ Symposium to discuss the significance of these similarities with an open mind.

# The quest for ultimate reality

B V SREEKANTAN

## Science and Beyond

*Cosmology, Consciousness and Technology  
in the Indic Traditions*

*Editors:*

Sangeetha Menon • B V Sreekantana • Anindya Sinha  
Philip Clayton • R Narasimha



NATIONAL INSTITUTE OF ADVANCED STUDIES  
Bangalore, India  
2004

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## Multiple faces of reality

Experience in the interpretation of many natural phenomena has shown that contrary to the adage 'seeing is believing', appearance can be very different from reality and reality itself can be at different levels depending on our perspective. Many a weary, thirsty traveller, trudging along a hot, arid desert, has been elated by the sight of a sheet of welcome water right in front of him reflecting the palm trees, only to be sorely disappointed at the realization that it is only a mirage and not reality. On a rainy evening, we have enjoyed the dazzling beauty of the multicoloured rainbow in front of us only to realise that the rainbow disappears when the sun behind us is covered by a cloud. In both these cases, we can convince ourselves that they are not tricks of our imagination by photographing the mirage as well as the rainbow. The photographs show the reflection of the palm tree and of the rainbow, the multicoloured arc stretching across the sky. In both cases, the physicist tells you that the reality is different from the appearance. In the case of the mirage, it is the effect of the refraction (bending) of the light reflected by the palm trees, in the intervening hot air in which the refractive index is changing with height due to a temperature gradient. Consequently, on the retina of the eye or on the camera film, the picture produced by the lens is similar to reflection in water. In the case of the rainbow, the display of colours along an arc is the combined effect of refraction, reflection and again refraction of light by those water droplets that happen to lie along the surface of a cone with its vertex at the eye and having a half angle of  $22.5^\circ$ . The position of the sun, which is the source of light for the droplets to reflect and refract, has necessarily to be low in the horizon behind us. Clearly, in both these cases, the objective reality, of what exactly is happening out there is very different from appearance. The deception, if we may call it so, is

not entirely in the human brain. It is only through proper analysis of the situation that the reality can be figured out. This may not be possible always. When we start analysing any phenomenon in nature scientifically, we find that there are various levels of reality depending on the level and purpose of explanation. A simple illustration will make this clear.

Suppose I take a stone and let it go from a certain height. The stone falls to the ground. Why? A school boy will say that the stone is a solid piece of matter and it falls down due to the gravitational force that operates between the earth and the stone, as first pointed out four hundred years ago by Newton. A chemist will say that the stone is composed of various compounds of elements like silicon, oxygen, iron etc., and it is the collection of all these molecules held together by the molecular forces, that is falling down. An atomic physicist will elaborate further and say that the molecules are made of atoms with nuclei at the centre and electrons orbiting around them. A nuclear physicist will say that the nuclei of all the elements are made of protons and neutrons, held together by nuclear forces. So in reality, the stone is a bunch of protons, neutrons and electrons that is falling down. A particle physicist will go one step further and say that the protons and neutrons themselves are made of quarks held together by quark-quark forces. So in reality, it is the entire system of quarks and leptons (electrons) falling down.

It is only at the gross level of observation that the falling of the stone can really be observed by the human eye. The explanations at all the deeper levels are based on the application of knowledge gained in different contexts, may be in different disciplines and at different times. While we would have stopped at the atomic level before the 1950s, by 2000 we are ready to go even deeper than quarks and electrons. This is because of the developments in the field of elementary particle physics on the one hand and the corresponding developments in theoretical physics and astronomy, on the other. In the falling stone phenomenon, clearly there are two aspects – one is the finer and finer material constituents and the other is the nature of the forces that operate at various levels. There is a third aspect which is generally not considered, but as we shall see, is the most important one. That is, the empty space in which the stone is falling and which also exists in between solid particles, in between molecules, in between atomic particles, in between nuclear particles and so on. It is an interesting fact that 99.99% of even a dense piece of iron is just empty space. For a long time in

science it was thought that this empty space had no particular role to play except to serve as the non-interacting medium for matter particles to move around under the influence of forces. This is a totally wrong idea. It has now become clear that empty space plays an extremely important role both in defining the ultimate constituents of matter and the way in which the forces are mediated between the constituents. Newton introduced the idea of the gravitational force to explain why a stone falls down, why the moon goes round the earth or why the earth goes round the sun and so on. While he formulated the mathematical equations to explain these, he did not explain how this force originated and how it was transmitted across such large distances. This 'action at a distance' problem was somehow thought to be connected with the presence of the mysterious aether, a non-material medium that pervaded all space. A similar problem was also encountered in electricity and magnetism. Faraday introduced the idea of 'field', which helped in the mathematical formulation of the problem, not throwing any light on the nature of the aether which was again brought in to sustain the 'field'. Maxwell tried his best to explain the propagation of the electro-magnetic waves in terms of the elastic properties of the aether, but did not succeed.

The aether theory itself was discarded with the advent of the theory of relativity. Einstein replaced aether by the four-dimensional space-time continuum to explain the experimentally observed result that the velocity of light is independent of the motion of the observer or the source, in contradiction to the law of addition of velocities. In his general theory of relativity, Einstein dispensed with the idea of gravitational force and attributed the particular trajectory followed by objects like the earth to the curvature of the space-time continuum around massive objects like the sun. Einstein came to what was thought to be an intriguing conclusion that matter curved space and curved space itself was matter. Which is the reality? Matter or space?

The confinement of the electron to a specific orbit around the proton in the case of a hydrogen atom, is due to the electrostatic force between the positively charged proton and the negatively charged electron. The proton has a dimension less than  $10^{-13}$  cm and the orbit of the electron is  $10^{-8}$  cm. How does the electrical force act when the distance gap is quite large in terms of the dimensions of the proton? What is the physical mechanism?

The concept of force itself is an anthropomorphic concept that we become familiar with by experiencing the tension that we feel in the muscles when we lift a heavy weight or push a cart. The force is exerted only through contact. How does any force act when there is a gap however small the gap is? With the concept of aether discarded, this became an acute problem.

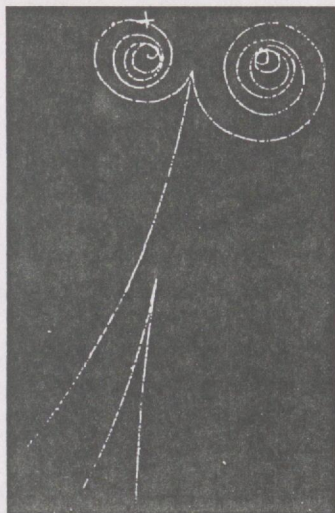
Einstein spent the last thirty years of his life trying to unify gravitation and electromagnetism, but did not succeed. Let us see what quantum mechanics has to say about electromagnetic interaction.

### Vacuum and reality

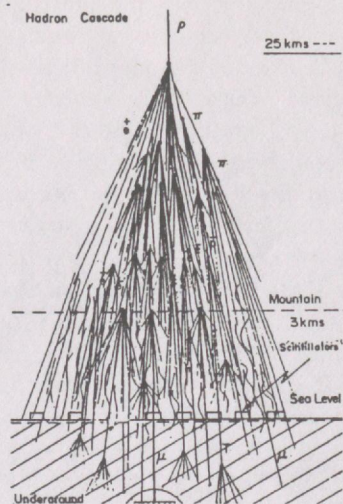
According to quantum mechanics, all particles are considered to be quanta of corresponding fields – the photon is the quantum of an electromagnetic field, the electron is the quantum of an electron field, the proton of a proton field and so on. One of the important consequences of the field theory is that there is no space anywhere in the universe whatsoever, where there is no field. The question arises: What about vacuum? In vacuum also there are fields, but their energy is zero, which means they are fields without any real particles. If there is a field there must be oscillations which are impossible without particles. The way out of this dilemma is to introduce the idea of 'virtual particles' which appear and disappear. When an electron field oscillates, photons appear and disappear. When a meson field oscillates mesons appear and disappear. Does this mean that there is violation of energy conservation? This is where the famous uncertainty principle of Heisenberg comes to the rescue. As long as the particles appear and disappear within the time allowed by the uncertainty principle ( $\Delta E \cdot \Delta t > \sim \hbar$ ), there is no violation. Accordingly, the more massive the particle that appears, the shorter is the time in which it has to disappear. Such transient particles are the virtual particles and they cannot be recorded directly with any instruments. Each particle has a cloud of virtual particles around it and in a sense this cloud travels along with the particle. When two particles interact, according to this theory, the virtual particles are exchanged. Thus the force of interaction is transmitted through the exchange of virtual particles. The creation of these virtual particles was attributed to the presence of quantum mechanical fields as the constituents of vacuum itself. Though these virtual particles cannot be recorded by instruments, their creation results in physical effects like the Lamb shift and the Casimir effect which are recorded and measured and give full support to the theory of

virtual particles, and the polarization of vacuum. Earlier to this quantum field theoretical approach, Dirac had been led to a different way of looking at the physical constitution of empty space or vacuum. This came about in Dirac's attempt to modify the quantum mechanical Schrodinger equation to the case of a fast-moving relativistic electron. The solution to this equation gave both positive and negative energy states to the electron. He did not ignore the negative energy states as unphysical. Instead he interpreted vacuum itself differently, by making the bold assumption that empty space or vacuum is not to be regarded as the absence of everything, but that which is filled with electrons in all the allowed negative energy states specified by his relativistic equation. While these negative energy states are not normally accessible, their existence becomes evident when there is a vacancy either due to spontaneous energy fluctuations or due to deposition of energy from outside. When this vacancy is created, out of the emptiness two entities turn up. One is a positive energy electron and the other, a 'hole' in the Dirac Sea, which is equivalent to a particle of positive charge and positive energy. This positively charged particle was discovered experimentally in cosmic ray experiments and had the same mass as the electron and was given the name "positron". Thus Dirac's theory was the first to predict the creation of particle-antiparticle pairs through materialization of quanta. It is now well-known that corresponding to every particle there is an anti-particle – antiprotons, antineutrons, anti- $\Lambda^0$ , etc., have all been discovered in cosmic ray and accelerator experiments. Thus in Dirac's formalism, vacuum is regarded not only as the reservoir of all electrons in all negative energy states, but also of all elementary particles in their allowed negative energy states.

From both the approaches, one thing is clear – that empty space or vacuum is not empty, but is a potentially rich medium, whose properties play a very significant role in the microworld of elementary particles and their interactions. Figures 1 and 2 illustrate how those grandiose ideas translate into happenings in the physical world of observation with sophisticated experiments. Figure 1 is an example of the creation of an electron-positron pair in an accelerator experiment. Figure 2 illustrates the complex modality of transformation of the energy of a single incoming high energy cosmic ray particle arriving from somewhere in the cosmos to that of more than a billion particles in the atmosphere of the earth – the creation, propagation and annihilation of a variety of particles all in less than a few tens of microseconds – through a series of cascade and spontaneous decay



**Figure 1.** Electron-positron pair production. A high-energy gamma ray coming in from above scatters off an atomic electron, losing some of its energy and producing an energetic recoil electron and an electron-positron pair. The electron and positron paths curve because the chamber is placed in a strong magnetic field. The direction of the curves reveals the signs of the particles' charges.



**Figure 2.** Development of a nuclear cum-electromagnetic-cascade in the atmosphere. The energy of a single cosmic ray particle of energy say  $10^{17}$  eV is converted into those of a billion particles – electrons, gamma rays, pions, muons, neutrinos etc. All these particles in a sense were hidden in the vacuum as potential waves.

processes enabled by the hidden empty space.

potential properties of vacuum or

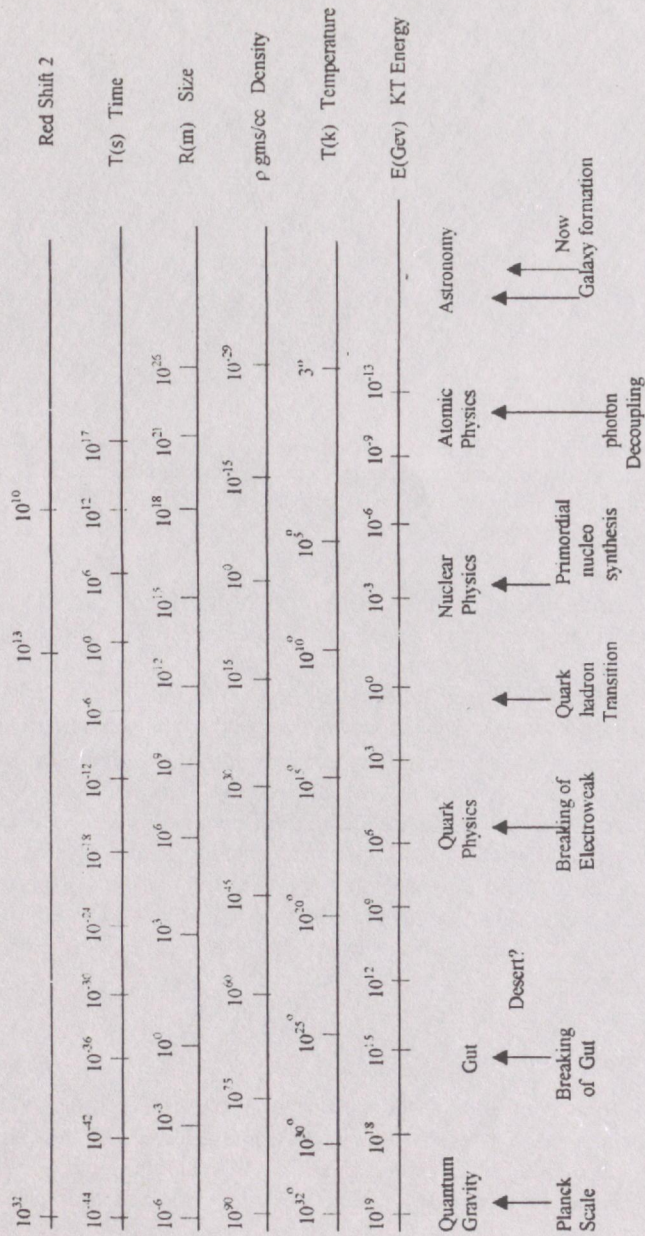
### Big Bang and creation

According to the Big Bang theory of creation, what was first created in that glorious act was this expanding space or vacuum endowed with all the physical properties that have been figured out through experiments on the collisions of high energy particles and the formulation of the theories of relativity and quantum mechanics.

In the Big Bang Scenario, it is envisaged that time, space, laws of physics and values of natural constants were all created almost

simultaneously or in quick succession. As Dyson has pointed out, the Big Bang theory does not say anything about the Big Bang itself, about what exactly exploded and why. The beauty of the theory and perhaps the reason for its success is that the sequence of events after  $\sim 10^{-43}$  s can all be worked out in sufficient and accurate detail. For this sequence to happen, it is necessary that the expanding space-time continuum or quantum vacuum be the repository of all the quantum fields corresponding to all the fundamental particles. The ambient temperature of the radiation at this juncture works out to a temperature of more than  $10^{32}$  K (energy of the radiation is in excess of  $10^{18}$  eV). The expansion results in the cooling of the universe and provides the necessary conditions for the creation of quark-gluon plasma at  $10^{-6}$  seconds. One second after the bang, the neutron-proton ratio is frozen and nucleosynthesis starts at 180 seconds when the universe has cooled to  $10^9$  K. Of course, in this whole exercise we are assuming the validity of the same laws of physics and the constants of nature from  $10^{-43}$  s to  $10^{17}$  s and over a temperature range of  $10^{32}$  K to  $10^{-3}$  K. Figure 3 portrays the possible time sequence of the physical parameters over the different epochs. Figure 4, taken from the book of Smoot and Davidson (1993), provides a graphic illustration of the physical, chemical and biological evolutions as a function of time and finally the emergence of the human, who is able to comprehend the whole sequence, thanks to developments in science and technology.

What is the significance and meaning of all this from the point of view of the quest for ultimate reality? For one thing, it is clear that the observed reality of the universe is a function of time and even the unobserved but deduced physical reality is a function of time. If the Big Bang theory is the correct theory of creation, (it is the most plausible one at the present time despite serious incomprehensible features at the beginning of space-time), then the physical universe came into existence at a finite time in the past  $\sim 10$ – $15$  billion years ago. However, the theory does not tell us how the space-time continuum or vacuum in the language of the quantum physicist, got all the properties it has to have in the first instance and how the laws of nature were defined. It is just a narration of the sequence of events that occurred with the constituents that emerged from space-time, subject to certain laws and governed by certain constants of nature. Emergence of life or consciousness was not an automatic consequence of these sequences. At least it has not been proved to be so yet. It has to be emphasized, however, that not all the properties of vacuum have been specified yet. Every time a new particle is discovered in accelerator experiments, the



Adapted from Particle Physics and Cosmology. [Collins. Martin. Squires]

Figure 3. The history of the Universe Hot Big Bang model

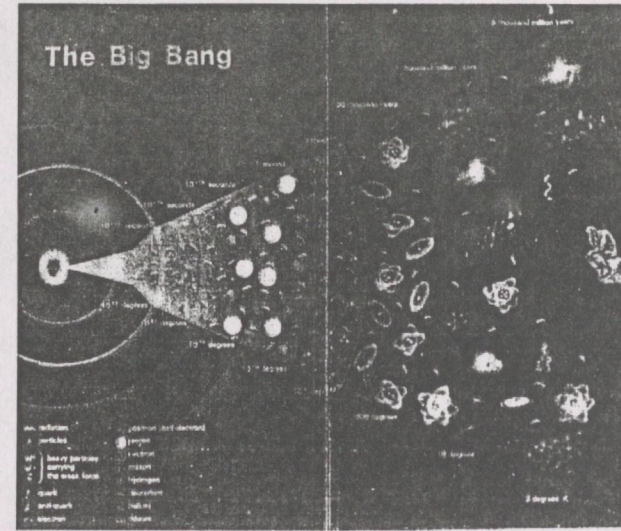


Figure 4. Big Bang to evolution of a pondering man – particle, chemical, biological evolutions – over a period of 10–15 billion years (from Smoot and Davidson 1993).

corresponding particle and the anti-particle field are accommodated in the vacuum. Thus properties of vacuum that specify life or consciousness will not become apparent until they are looked for in a specific way.

**Vacuum and oneness**

Vacuum as substratum highlights one important aspect of all creation – namely, ‘oneness’ or interconnectedness. In this sense, it removes the dichotomy of living and non-living, mind and matter. The present efforts of molecular biologists and neuro-scientists have been directed to explain both life and consciousness by chemical, electrical and physical processes. Clearly when one is dealing with consciousness, the category of experience, i.e., feelings, sensations, thoughts, is very different from the other kind of experience dealing with electrical signals, oscillations and chemicals that one becomes familiar with in the laboratory. One can establish only certain correlations. Such correlations may be of great value to psychologists or neurosurgeons in curing certain types of mental illnesses. The only way the gap can be bridged is by some kind of transcendence similar to what happened in physical sciences. Moving to a higher dimension – moving into a four-dimensional space–time continuum, Einstein recognised many new



streams of knowledge, especially the ancient insights that have had their origin in this part of the world, have to say about this.

Schrodinger in his article "The I that is God" says:

"But immediate experiences in themselves, however various and disparate they be, are logically incapable of contradicting each other. So let us see whether we cannot draw the correct non-contradictory conclusion from the following two premises:

- (i) My body functions as a pure mechanism according to the laws of nature.
- (ii) Yet I know, by incontrovertible direct experiences 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 is, I think, that I – I in the widest meaning of the word, that is to say every conscious mind that has ever said or felt "I" – am the person, if any who controls the "motion of atoms" according to the laws of nature. Within a cultural milieu (kulturkries), where certain conceptions (which once had and still have a wider meaning amongst other peoples) have been limited and specialized, it is daring to give to this conclusion the simple wording that it requires. In Christian terminology to say: "Hence I am God Almighty" sounds both blasphemous and lunatic. But please disregard these connotations for the moment and consider whether the above inference is not the closest that a biologist can get to proving God and immortality at one stroke.

In itself, this insight is not new. The earliest records to my knowledge, date back to some 2500 years or more. From the early great Upanisads, the recognition  $\text{ĀTMAN} = \text{BRAHMAN}$  (the personal Self equals the Omnipresent, all-comprehending eternal Self) was in Indian thought considered, far from being blasphemous, to represent the quintessence of deep insight into happenings of the world. The striving of all the scholars of Vedanta was, after having learnt to pronounce with their lips, really to assimilate in their minds this grandest of all thoughts.

Again, the mystics of many centuries, independently, yet in perfect harmony with one another (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  $\text{DEUS FACTUS SUM}$  (I have become God)".

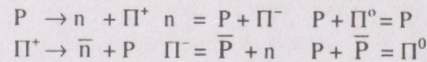
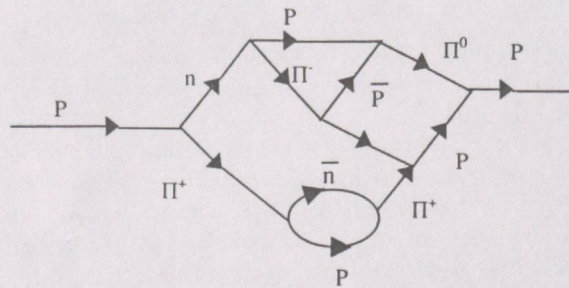
The quintessence of Vedanta is in the four Mahāvākyas from four Upanisads which are as follows:

Prajñānam Brahma	Consciousness is Brahman	Aitareya Upanisad Rg Veda
Tat Tvam Asi	That Thou Art	Chandogya Upanisad Sama Veda
Ayam Ātma Brahma	This Self is Brahman	Mandukya Upanisad Atharva Veda
Aham Brahmāsmi	I am Brahman	Brihadāranyaka Upanisad Yajur Veda

These four profound utterances reflect the philosophy of "oneness" of everything in the Universe – I, you, the body, the soul, the consciousness – and identify tat ONE with Brahman – the ultimate reality. To the question, why do we experience the multiplicity and not the oneness, the answer can be found, among others, in the Advaita philosophy of Sankaracarya (800 AD). According to Sankara, the problem has to be analysed from two distinctly different viewpoints. One is the transactional (*vyavahārika*) point of view and the other the transcendental (*pāramārthika*) point of view. The transactional point of view is the one that we are familiar with in our daily life and activities. From this point of view, the material world with which science is mostly concerned is real and one has to pursue every available way of finding solutions to every day problems. However, our experience tells that in addition to the waking state experience of the external world, we have two other experiences, the dreaming state and the deep sleep state which, from our memories of the realities of those states, show different aspects of our concepts of space, time, causality, etc. In the deep sleep state, even the concepts of space and time disappear. So reality appears different in different mental states of the same individual. According to Sankara, there are still higher mental states and the reality experienced in those states reveals the oneness behind all the multiplicity and, in that state, space, time, matter, etc., merge with the unchanging, eternal blissful state (*Ānanda*) of sublime reality.

What is to be emphasized is that, in ordinary everyday life, multiplicity is the reality. It is not an illusion as wrongly conveyed by many. It is only for the person who has reached the higher mental state (the Jñāni) that the world is unreal and the oneness, the Brahman, is the only reality. "Ekameva, Advayam Brahma, Neha Nanasti Kinchana" – there is only Brahman, the one without a second, there is no duality whatsoever.

Reality appearing different from different viewpoints is something that the scientist also has come to accept, particularly after the advent of the theory of relativity. In Quantum Mechanics also, the chameleon-like nature of reality becomes obvious from a reference to figure 6. This is purely a consequence of the formation of virtual particles that we discussed earlier and the possible states of these particles in extremely short intervals of time (say less than  $10^{-21}$  seconds).



P = Proton, n = Neutron,  $\bar{P}$  = Anti-proton,  $\bar{n}$  = Anti-Neutron,  $\pi^+$  = Positive  $\pi$  meson,  $\pi^-$  = Negative  $\pi$  meson,  $\pi^0$  = Neutral  $\pi$  meson

**Figure 6.** A proton moving from point A to B can be for a short time in any of these virtual states.

It is interesting that there is a very close similarity between these states of reality and what the Buddhist doctrine of Momentariness (Kṣaṇa bhanga vāda) states (see Hiriyanna): "Nothing that is, lasts for longer than one instant". This is the cycle of origin and destruction. Reality is flux or flow; the notion of stability is illusory. No man can step into the same river twice. Even when some thing is not changing, it is not constant, but is reproducing itself – like a flame. Neither external reality nor the self lasts longer than an instant, but everything may continue as a series for any length of time.

Einstein, who originally held the view "All knowledge of reality starts from experience and ends in it", changed later to the view "Experience remains, of course, the sole criterion of the physical reality of 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". Erwin Schrodinger held the view "The world is a construct of our sensations, perceptions, memories. It is convenient to regard it as existing objectively on its own. But certainty does not become manifest by mere existence".

While the one substratum, the quantum vacuum, is behind all the inanimate part of the universe, the question arises whether it covers also the animate part, particularly life and consciousness, as was the case with the oriental insights. There are two slightly different ways of looking at this issue. One is to use the hierarchical argument. Though life and consciousness fall in the domain of biology, the efforts of the biologists is to find explanations for both these in terms of chemical and physical processes which means ultimately they are looking for explanations in chemistry and physics for anything that happens at the levels of molecules or atoms. For any subtle processes, the chemists look for explanations in terms of the physics of ultra-small entities – atoms and elementary particles and strong, weak and electromagnetic forces. For some of the phenomena even in the inanimate world, the phenomenon of emergence, group behaviour of coherent constituents is becoming important. In this, properties emerge in group phenomena which are not there in the individual constituents. The exact mechanism of emergence is not clear. Life and consciousness may fall in this category. The second viewpoint is that the secrets of many of the physical phenomena in the universe are ultimately traced to the potential hidden properties of the vacuum. Every time a new fundamental particle is discovered in the laboratory, a new quantum field is added to the list of fields that constitutes vacuum. This is also the case when new forces are discovered. It may turn out the secret of life and consciousness may also be in some as yet undiscovered field of vacuum itself.

### Summary

In summary, we can say that modern physics, guided by experimental methodologies and theoretical formulations based on advanced mathematics, on the one hand, and ancient philosophical insights drawn from an entirely different approach on the other, have come to very

similar conclusions on the nature of ultimate reality. Both identify an all-pervading substratum (urstoff) from which everything manifests by itself. However, for this to happen according to physics, the substratum has to be endowed with special types of quantum fields corresponding to the ultimate constituents of matter and forces and interactions between them and evolution in time should adhere to certain laws of nature constrained by the numerical values of certain constants of nature. While owing to the gigantic experimental efforts over the past several centuries and ingenious theoretical formulations, these constituents, laws and constants have been determined, one cannot say yet that the full potential nature of this substratum, the quantum vacuum has been exhaustively defined. It has been found that to come even to this stage of recognition of oneness behind certain aspects of the diversity, several transcendences had to be made in fundamental concepts like space, time, causality, matter, energy, field, etc. All this emphasizes the inherent tentative nature of scientific explanations and also provides for the possibility of linking what may appear disparate entities today to fall later into a common fold. Though pictuarisation or visualisation in higher dimensions is a serious limitation for the human mind probably connected with evolutionary aspects as pointed out by Max Delbruck, mathematical treatment in higher dimensions has definitely facilitated this unification and recognition of mathematics as an important guiding principle of nature. This unreasonable role of mathematics in physical sciences still remains a big puzzle as underscored by Wigner a long time back.

The ancient insights on reality are based on revelations to certain gifted individuals in their higher mental states. In these transcendental states, the barriers posed by the normal limitations of the mind are automatically absent and reality is perceived in its pristine character with all the multiplicity merging into one. It is claimed that such transcendental states can be achieved through disciplining the mind by practices like meditation, yoga, zen, etc.

I would like to end with a repetition of the quotation from Einstein:

"All knowledge of reality starts from experience and ends in it. Experience remains, of course, the sole criterion of physical reality of 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 ancients dreamed".

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