Sri Lanka Journal of Social Sciences 2006/2007 ***29/30*** *(1&2): 71-86*

SCIENCE AND PHILOSOPHY: TOWARDS A NON SUBSTANTIALIST WORLD VIEW

ARJUNA DE ZOYSA

Abstract

I have argued in this presentation for a change in a scientific world view, from that of the study of forms to that of process. In doing so we need to understand as to how process creates form. In showing this I have at first drawn from the history of Buddhist philosophy; with its concepts of `*sunyata*' (Emptiness) and radical interdependency (Hua-yen). I then show its parallel with modern Fractal geometries, which through the use of rather simple mathematics, shows as to how process could derive form. I have then gone on to Quantum constructions, which is without doubt the most advanced scientific development in modern times, and attempted to show two vital directions which contradict the classical scientific world view. The classical view retains a Descartian, `out there' , deterministic framework. It is noted that science excluding that of Quantum physics remains embedded in this Descartian framework. I argue that with the break down of determinism, and the non locality of phenomena suggested by Quantum Mechanics, allows for an independent functioning of consciousness, which then is not a mere epiphenomena of neuronal activity within the brain. Such a view has wide implications on how we live and how we die.

These developments are culturally and philosophically different from the current dominant world view; and further has far reaching consequences, in how we observe the many phenomena which are at present either ignored or debunked by modern science. If scientists understand that they construct rather than discover they would leave room for other knowledge systems which may be ancient and traditional, but perhaps more open in their constructions.

Modern science as we know of today is of many kinds, employing many methods in its investigations; for example, methodologies range from the double blind test of the medical scientist, to speculative investigations of the cosmologists,

---

An earlier version of this paper was presented at the Conference to celebrate the `World Philosophy Day' organized by the NSF Research Committee on Social Sciences on 21st to 22nd November 2006 at the SLFI ,Colombo.

concluding by way of circumstantial evidence, what he deems as a Black hole, swallowing matter infinitely. If methodology is of many kinds (Dupre, 1993), then is there a unified ontology that we can agree on and identify this as the true face of science? Are atoms, quarks or superstrings forming the fundamental structure of matter, on which various ontological super-structures could be built on? Unfortunately, an examination of the theories of Quantum physicists show us that there could be many such fundamental ontologies. From particulate matter to waves and waves that turn into particles and particles which turn into waves. Some of these ontologies are just clever constructions of mathematicians or their related disciplines and have value within the mathematical spaces they occupy. However, their transformation into physical space is fraught with ambiguity. The desperate search for what then can be called a fundamental ontology goes on. Can a unified field theory be derived from this confusion of all kinds of ontologies and methods we call science?

The rather simple philosophical position that science (modern or otherwise), constructs from its observations and does not discover a reality (Silva, 2003) should be understood if one is to comprehend this `Science of many Kinds'. Science, like all other knowledge systems, is historical; its constructions are fashioned by a historical pathway, which began in ancient times but was given a particular turning during the period of the European renaissance and awakening. I will here first examine this historical pathway. I feel that such an examination will throw much light on this `thing' we call science.

Historical Pathways

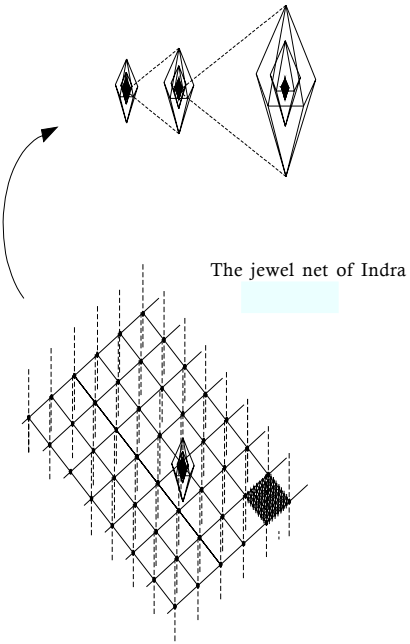
The first beginnings of what we recognize as modern science began with the Greeks of antiquity, at perhaps the time that India was a growing hotbed of religions and philosophies, (circa time of the Buddha 500 BC). Extensive studies now show that Greece was not all European (Martin Bernal, 1987), but this is not my focus, and I will therefore not elaborate further. I could identify at least two philosophical trends in ancient Greece which I would call Heraclitian and Platonic named after their early authors. Heraclitus and his school considered the universe to be in a state of flux, ever changing, with no ontological essence to it. Plato and his followers considered what we see as appearance, (changing may be), but the real essence of this changing show was believed to be immutable and unchanging. It is only the shadow that moved, the immutable essence was what Plato deemed to be real.

These unchanging forms in his philosophy were the real essence to a changing dance of shadows that we normally encounter. Heraclitus on the other hand considered process itself to be primary, there being no ontological unchanging essence, as in the Platonic doctrine. The similarity of the Heraclitian position to Buddhism cannot be missed. He lived at the time of the Buddha in India, and whether the similarity of philosophies is by coincidence or by an actual cross cultural dialogue is yet to be known. However, what drove philosophy and science in the European world was platonic. The search for an essence of form and ideas, reverberated well with theistic ideas of an omnipotent God in the Jewish – Christian tradition, and it was not surprising that the essence-less process of change in the Heraclitian tradition was soon forgotten.

In India the ideas on process philosophies were developed extensively by *Vedantic* and Buddhist thinkers. The concept of *Sunyata* or emptiness had evolved from pre-Buddhist times but reached its Zenith by about the 7th Century A.C., in the Hua-yen school of Buddhism (Chinese). Extensive discourses (Dharmasiri,1997) on its meaning began in pre Buddhist times. A clear distinction was made between `sunyata' and `nothingness', showing how the world is born as form arising out of a Relationalism from amongst ongoing processes. The function of the number zero in mathematics became an early invention of this thinking and a powerful metaphor later.

In Hua-yen the inter dependence of form arising from such a relationalism was developed and depicted pictorially. The best known of such pictorial imagery is the `Jewel-net of Indra', an infinitely reflecting a set of polished jewels; a virtual fractal form which depicted such a radical interdependence of forms (Cook:,1991).

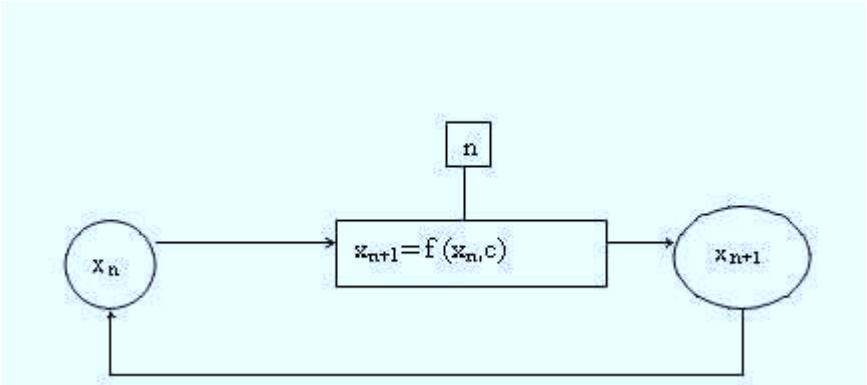
In this depiction, it is said that in a faraway place in the universe, in the heavenly abode of the great god Indra, there exists a most amazing net. This net which stretches infinitely in every direction contains an equally amazing jewel at each of the node points. Every one of these jewels are polished so well that an observer could see the reflection of all other jewels in the net. It follows that the reflected jewels will contain in them the reflection of all other jewels, and so on in infinite regression (De Zoysa, 1997:76). The Net is depicted below for illustration:



Modern Developments in computer graphics have been outstanding, and it is now possible to depict fractal images similar to the Jewel Net using rather simple mathematical algorithms. The same form of interdependency is depicted in another imagery given in Hua-yen literature, that of the Golden lion. It is said that the sage Fa-tsang explained the abstruse doctrine of "emptiness and totality" to his benefactor, the Empress, by means of the/using the Golden lion statue lying in the hallway. He asked her to imagine that in every part of the lion, its eyes, ears, tail and body hair, there resides an identical lion. It follows that in each of the body parts of this inclusive lion there resides another in an infinite series. One is reminded here of the Mandlebrot plot, a well known fractal image given by a founder of Fractal geometry. The radical interdependency of the Jewel net and the Golden lion is that of a part containing the whole in a self-similar image in infinite inclusion. This is identical with the process which forms Fractal imagery.

If one begins with ideas of causal interdependency found in Hua-yen, it is not surprising that complex natural forms could be formed from simple Fractal processes. Natural forms, such as mountains or the leaf of a tree, could be drawn on a computer screen with rather simple algorithms. The algorithm represents process and the

leaf form. Thus, form is derived from process. We could have different variations on form by introducing randomness, thus individuality seems to be derived from both chance and purpose (algorithm). We have here an amazing interface of Mathematics and Art, with profound philosophical implications (Peitjen & Richter, 1992). The chief characteristic of a fractal process is that it is self inclusive, that is, it iterates upon itself in an endless feedback loop in modern mathematical terms, just as much as the Jewel net imagery does in its self inclusive reflections. Such a process is given as an algorithm below:



Science and Substance

Modern science studies forms and constructs ontologies. Whether they are made of particles, waves or of late superstrings, and are surprised when observation prompts these particles to turn into waves (Feynmann, 1989). A whole super structure is built on these fundamentals to describe the disciplines of Chemistry, Biology and the much abused Environment around us. There is nothing wrong with these ontologies if we do consider them to be ingenious constructions; whether they exist `out there' becomes a moot point. When one depicts these constructions as some sort of a Desecartian out-there reality we exclude other possible constructions that do not neatly fit into such an ontological hierarchy.

Let us examine a firm belief, which forms the bedrock of Chemistry.

A good scientist whose studies have been in the field of chemistry or in physical chemistry, would firmly believe that electrons, atoms, molecules, polymeric

compounds and things like this exist out-there, just as much as craters on the moon. Is it however correct to assign the same degree of reality to atoms, as to that of sensed objects? Both require scientific instruments and our senses for `observation' . Why not is the simple answer. However, any decent philosopher will shy away from assigning the same ontological status (degree of reality) to these differing observational constructs. A discerning physicist would point out that the model of an atom is a construct of indirect responses to instruments, using metaphors taken from every day experiences. In Quantum theory constructs, billiard balls and wavelets are metaphors taken from every day experience. It is entirely unsurprising that at times we have to use billiard ball type metaphors and in other situations wavelets to describe the same phenomena (light transmission through an ever narrowing slit). The ontological status assigned to these metaphors should be different from that of the craters that Galileo observed on the moon. Fancy images of atoms on the Internet formed of electron microscopy do not yield any new information, while a powerful telescope or the act of actually stepping on those moon craters may do so. The difference is clear observation of craters on the moon is a construction from sensory observation, with instruments containing theories different from those sense based observations. The telescope is different (i.e. there are no Geological theories on craters in the construction of a telescope). These observations have wider meaning, even those other than astronomers would agree that the moon is potted with craters. The Galilean observation would have wider acceptability than by a specialist in the field. The construction of an atom is very different, requiring metaphors and sophisticated mathematics. Further, its apparent observation requires instruments which depend on those very constructions for their operation; that is the theories required to construct and observe atoms through an electron microscope are the same as that which describes the behaviour of subatomic particles. A subtle exercise in casuistry and hence the rather unsurprising observation from electron microscopy, that the distance between some metal atoms are exactly as predicted! Theory agrees with observation simply because the constructions used in the theory and observing instruments are similar in their fundamentals. The telescope is merely an extension of the human eye, and its functioning dependent on optical theories, which describe the formation of an image on the human retina; not on geographical theories about the structure of the moon.

The confusion arises, firstly from a commonsensical philosophical position, which does not admit that our `out their' realities are sensed constructions from

contact with phenomena. Secondly, that technology has substantially changed the way we sense; scientists do not contact phenomena in the micro world or at a cosmological scale directly, they do so indirectly through artifacts which often contain theoretical constructions. The observational methods used by a modern-day scientist differ fundamentally from those used by his ancestors.

The limits to this atomistic ontology is now somewhat obvious; whether it is the inability of biology and chemistry to holistically deal with the environment or the failure of modern medicine to comprehend other more holistic curative strategies in *Ayurveda* (De Zoysa and Palitharatne, 1992). We need to, in building new pathways to scientific constructions, abandon the absolute character of present scientific ontologies. To put it plainly, as Ernst Mach (Mc Cormack, 1943) once said, we do not have to `believe' in the reality of the atom, rather consider it to be merely an economic construction. May I add that such an economy may be so for one field of knowledge, but not universally efficient.

Quantum Reality and Consciousness

Quantum Mechanics or the observations at a micro level and its scientific constructs should have shaken the modern scientific world, but unfortunately it hasn' t. Some of the outstanding physicists of the day such as Heisenberg (1989), Bohr (unpublished manuscript) and Von Neumann (1955) understood the significance of Quantum constructions, but latter thinkers, with few exceptions, have taken a different view. Their interpretations are mechanical and consider it to be a mere working model; Stapp a modern quantum physicist (Stapp,1993), takes a different view and I draw much inspiration from his work.

When we move along the upward hierarchy of scientific knowledge, the situation worsens, and there is a clear shift to a materialistic, `out-there' realism. That is that the foundation blocks of all phenomena are a material substance, little particles of molecules, atoms and sub atomic quanta which move around and are able to albeit accidentally organize themselves into the complex thinker we know of today (i.e. Humans). The neuro-biologist creates the pathway through which consciousness is explained, and Charles Darwin with his accidental mutations, explains how it all happened. Personally, I find neuro-biology to be an incomplete theory and Darwinism quite implausible. The rise of Darwinism has more to do with the enormous battles between the Church and Science which occurred at the

end of the nineteenth century and the neglect of Lamarckism as an evolutionary theory is more to do with the defeat of Napoleon at Waterloo and the demise of French science, than on evidence and plausibility. To add to this evolutionary confusion, we have a resurgence of creationism in countries like North America. This is not surprising given the fact that the sequence of creation given in the Bible agrees with current fossil records, and was compiled at least 400 years before Darwin's voyage on the Beagle (King James' version).

Drawing your attention back into Quantum realities, we have the well known Heisenberg's uncertainty principle, which states that the momentum and position of a quantum `particle' cannot be known exactly, only an upper limit set for its multiple. This definitely signifies the end of a deterministic future which was created by Newton and even defended by revolutionary cosmologists such as Einstein; when Einstein did not like Quantum realities, he so famously said that `God does not play dice with the universe' . Bohr's response was "Einstein, Stop telling God what do". The linkage between theism, determinism and hierarchical ontologies comes out in this statement by Einstein. It is not surprising that scientists trained in the Western tradition cannot seem to take science further into the uncertain terrain of process philosophies and holistic maps of reality. Non-deterministic futures definitely allows for the action of the volitional (free will). The perceived incompleteness of Quantum theory (Einstein et al, 1935) may lie with its shyness to formally allow for the action of forces independent from the material world.

A quotation from Henry Stapp, a leading Quantum physicist and a well known commenter on Quantum realities is appropriate at this stage, He says,

> The first great twentieth-century change is the dethronement of determinism. Determinism is the idea that each stage of the coming into being of the physical universe is completely controlled by what has already come into being
>
> Stapp, 1993: 212

> The most important consequence of this altered vision of nature is the place it provides human minds. Consciousness is no longer forced to be an impotent spectator to a mechanically determined flow of physical events.

> Contemporary science certainly allows human consciousness to exercise effective top down control over human brain processes.
>
> Stapp, 1993; 212-213

Two principles in Quantum physics allows for the operation of non-determinism and the intervention of consciousness: as mentioned earlier, the Heisenberg's uncertainty principle and secondly the mysterious `action at a distance' between interacting particles. In Bohr's scheme of physics, if two electrons for an instant had touched at some time `0' and position `p', they would interact in some mysterious manner at time `t' and position `p + q', however large `q' or `t' could be. That is, even if they were far apart. Further, this interaction occurred on the observation by a conscious observer. For instance, an observer may measure the spin of one electron and as a consequence instantaneously the other electron will acquire a measurable complementary spin. Einstein did not like this conclusion, and suggested an experiment (E-P-R) which if conducted would show this to be untrue (Einstein et al, 1935). However, the experiment has been conducted and action at a distance is now an experimentally verified phenomena. To explain this interaction, David Bohm postulated an implicate order at a more fundamental level than at which material behavior was manifest (Bohm:1980). This implicate order could be, in my view, a field of consciousness, not necessarily restricted to individual neuronal activity. So consciousness could be said to enter physics in two ways: through directed neuronal activity in the individual or through a collective field action.

A field of consciousness underlying material phenomena is a distinct possibility and individual consciousness leading to brain activity an epi-phenomena of the same.

Entering an Abyss of Nothingness

Allowing for consciousness as apart from materiality is an important development within Quantum physics. Unfortunately it does not pervade upwards in the hierarchy of knowledge in science. Instead, outside of Quantum physics, a tight deterministic materialism reigns supreme. Eastern philosophers, particularly within Buddhism, have always advocated a subconscious stream of phenomena (*Vinnana)* which when it links with materiality becomes conscious. Thus, although

death is not welcome, it does not constitute[24] the terror for the materialist or the escapism of eternal bliss for the non-secular. The faring on of individualized consciousness is termed *Sansara*, a term and concept derived from *Vedic* thinking.

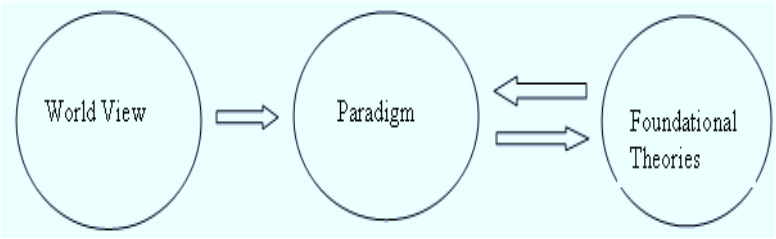
Let us now examine the modern conception of thought. A good description of this is given by David Bohm, physicist and philosopher, whose interpretation of QM is, in my opinion, the most open and outstanding. To quote him,

> Similarly, thought is a system. That system not only includes thoughts, `felts' and feelings but it includes the state of the body; it includes the whole of society as thought is passing back and forth between people in a process by which thought evolved from ancient times. A system is constantly engaged in a process of development, change, evolution and structural changes… although there are certain features in the system which becomes relatively fixed. We call this the structure… thought has been constantly evolving and we can't say when that structure began. But with the growth of civilization it has developed a great deal. It was probably very simple thought before civilization, and now it has become ramified and has much more incoherence than before (Bohm,1992).

The above top down approach, from consciousness to the material world, is very different to the `scientific' notion of the human mind, which is that the mind is an outcome of neural activities inside an organ such as the human brain. Consciousness, when thought of as David Bohm envisages, opens up a whole vista of experiences and observations. Let me add a cautionary note. Quantum physics allows for the action of non-material phenomena on the material world; it certainly does not propose it. Individual physicists such as Henry Stapp, David Bohm or Niels Bohr, could now legitimately do so. The Buddhist concept of *`Vinnana'*, carrying information from death to birth which influence the human mind with mental tendencies and memories from another life, becomes a distinct possibility. There is no longer a need to ignore a plethora of evidence (Stevenson,2000) which give rise to the possibility of life after death or before birth.

Changing World Views – a Rebirth of Science?

Science functions within paradigms (Kuhn, 1970) and these paradigms contain beliefs and view points which are culturally and socially conditioned. These culturally conditioned viewpoints and beliefs constitute a World view *(Chintanaya)*, formed through historically traceable pathways. Such a broad scheme is depicted in the sketch below;



Paradigms determine theory constructions in science. There are, as Kuhn and others have shown, paradigm shifts as was the case in modern physics, but whether these paradigm shifts effects theory formations in other disciplinary areas is a moot point. It appears that the science of life (Biology) remains unchanged in its paradigmatic structure from earlier Newtonian Descartian structures, with its objective world independent of the observer and deterministic in its outcome, driven by the incessant motion of `material' substances. Such a structure is built on belief and liable to deny any observations which contradict its overriding paradigm, either condemning such observation or at best ignoring it. The inability of sciences to build a research program on observations such as rebirth phenomena means that they will remain a curiosity to be either ignored or debunked. The careful research observations of rebirth phenomena by persons such as Stevenson (2000) are convincing enough; but science at present cannot assimilate these into its theory making. Worse still is that it has usurped the role of the Church, and the modern Galileo now waits patiently outside the main portals of science. The time will come when an individual as bold as Einstein will come and propose a new research program; I do not see it however occurring amongst those educated and subjugated by the western traditions of scholarship. Neither are societies seduced

by materialism able to generate a healthy response to any form of what are marginalized as `paranormal' phenomena.

A new world view, where consciousness and materiality work in tandem, has far reaching consequences. It would then be possible to take account of a plethora of observations which science at present ignores. The other direction in which science should change is to adopt a more holistic world view. That is, its constructions should incorporate multiple interconnected causations. For example, a holistic science should include many more observations to even much studied phenomena like the common cold, and heat, wetness and cold as causative conditions. The virus theory could stay, but the incompleteness of an invading pathogen theory should be made obvious. Even more stunning would be the inclusion of a plethora of paranormal phenomena into mainstream science; death would no longer be regarded as an entry point to an `abyss of nothingness' , but rather a dramatic change in the station of existence, mitigating much of the terror and sadness which now pervades this event.

The awakening of science in the west was unfortunately accompanied with a break between ethics and knowledge, creating a terrifying void in human societies, from which we suffer today. One stunning development of this divorce led to the development of nuclear weapons, which threatens now the very existence of humanity. This particular instance of the pursuit of knowledge for its own sake was led by scientific genius of a kind (Albert Einstein). A combination of factors, a horrendous war (World War II), genuine fear of the `enemy' and power hungry politicians added to this background of science sans ethics. It led finally from Science and Technology in the use of politics to the extermination of around 300,000 humans and the destruction of two cities in Japan, one of which was purely cultural, with not even a single soldier to defend (Nagasaki) it. We must, in the rebirth of science, never carry this divorce forwards; knowledge must remarry ethical norms, if not revealed ethics, as earlier then an ethics based on reason must be sought. I believe a middle ground has already been mapped out by a sage who gently tread the dusty sands of India, more than two millennia ago.

The rebirth of science requires a new world view; I call it a rebirth and not a new science purposefully, as the encompassing world view would not be new, it would be as old as the hills. Let us be aware of its origins but not argue whether it was Heraclitian, Vedantic or Buddhist.

After all, the future is infinitely more important than the past.

> Mysterious in the light of day,
> Nature retains her veil, despite our clamours,
> That which she does not willingly display,
> Cannot be wrenched from her with levers, screws and hammers.
>
> Goethe (Faust)

Notes

The Author wishes to thank the following people:

Prof. Sriyananda who had the foresight to include the Philosophy of Science in our undergraduate curriculum.

Prof. R.D. Gunerathne who taught us the fundamentals, without which nothing would be possible.

Prof. Sandra Harding whose classic book, `Whose Science, Who's Knowledge', made me take a second look at what passes on as modern knowledge.

Kamini, who gave me an insider's view of science, signifying both its success and limits.

Ven. Soratha and Prof. Guanpala Dharmasiri whose studies on the most abstruse developments in Sanskrit Buddhism gave me valuable insights into the `*suchness of the being*'.

Nalin, `Chubby' and Champika whose bold and original thinking made me reflect in unusual ways.

References

Arseculeratne, S.N. (2000). *The Scientific Approach to Research in Parapsychology*, paper presented at a Research seminar on Rebirth, March Peradeniya, Sri Lanka.

Bell, J.S. (1987). *On the Einstein, Podolsky, Rosen Paradox*, *`Quantum Theory and Measurement,* reprint. pp. 403, `Physics' , 1, 195-200, 1964.

Bernal, M. (1987). *Black Athena*. London : Free Association Book.

Bohr, N. *"Atomic Physics and Human Knowledge"*, University of New York: (Unpublished manuscript).

Bohm, D. (1980). *Wholeness and the Implicate Order,* London: Routledge

Cambridge Dictionary of Philosophy (1995). Robert Audi ed., United Kingdom: Cambridge University Press. pp. 619-624.

Chown, M. (2006). *Review-Where Mind Meets Matter.* In, New Scientists, (18 Aug. 2006) pp.47.

Dharmasiri, G. (1997). "Sunyata in Early Buddhism and Mahayana", pp.34-38. In, *Beyond the Metaphysics of Commonsense*. De Zoysa, Y Karunadasa, C. Ranawaka & A Thilakarathne (Eds). Colombo: Vidyarata and Postgraduate Institute of Pali and Buddhist Studies. pp.34-37.

David, Bohm, (1992). Thought as a System (transcript of seminar, 1990). London: Routledge. Digha Nikaya (long discourses of the Buddha), *Agganna Sutta*. Trans.

De Zoysa, A. (2001). "Cross-Cultural Influences on Einstein's Early Theory of Relativity". In *OUR Engineering Technology.* Nugegoda: Open University of Sri Lanka: V.6:1, pp.6-15.

De Zoysa, A. & Palitharatne, C.D. (1992). "Models of Scientific Expansion, A Comparative Description of `Classical' Medical science at the Time of Introduction of European Medical Science to Sri Lanka and Subsequent Development", P.

Petitijean et al (Eds). In, *`Science and Empires'* Boston: Kluwer Academic Press. Trans. pp. 111-120.

De Zoysa, A. (1997). "Change and Reality", In, *Beyond the Metaphysics of Commonsense*. De Zoysa, Y Karunadasa, C. Ranawaka & A Thilakarathne (Eds). Colombo: Vidyarata and Postgraduate Institute of Pali and Buddhist Studies. pp.57-92.

De Zoysa, A., Karunadasa, Y., Ranawake, C. & Tillakaratne, A. (1997). *Beyond the Metaphysics of Commonsense*. Colombo: Vidyartha and Post graduate Institute for Pali and Buddhist Studies.

Dupre, J. (1993). *The Disorder of Things, Metaphysical Foundations of the Disunity of Science*, USA: Harvard University Press.

Einstein, A., Podolsky, B. & Rosen, N. (1997). *Can Quantum-mechanical description of Physical reality be considered complete?* Reprint. `Quantum Theory and Measurement' , pp. 139. Physical Review, 47, 777 .1935.

Feynmann, R. (1989). *Lectures on Physics* USA: California University Press.

Francis, H.C. (1991). *Hua-yen Buddhism*, USA/London: Pennsylvania State University.

Genesis I & II. *The Bible.* King James Version, compiled circa 16th century.

Harding, S. (1991). *Whose Science? Whose Knowledge*, *`Thinking from Women's Lives'* New York: Cornell University Press.

Heisenberg, W. (1989). *Physics and Philosophy.* London: Pelican Books London.

Kuhn, T. (1970). *Structure of Scientific Revolutions*. (2nd Ed.) USA: University of Chicago Press.

McCormack, J.J. (1943). *Popular Scientific Lectures.* IIIinois: Open court.

Neumann, J.V. (1955). *Mathematical Foundations of Quantum Mechanics*' . Trans. by Bayer, R.J. New Jersey: University of Princeton.

Open University of Sri Lanka, 2003 Lesson Material, *`Fractal Geometry'*, *Discrete Mathematics*. Nugegoda.

Peitjen, H.O. & Richter, P.H. (1992). *Fractal Frieze* London : Penguin.

Peter, B. (2000). *Zigmunt Bauman, Dialectic of Modernity*. London and New Delhi: Sage.

Ranawake, C. (1997). "Differing Views on Quantum Reality", In, *Beyond the Metaphysics of Commonsense*. Vidyartha and Postgraduate Institute for Pali & Buddhist Studies, Colombo, Sri Lanka, p.106-125.

Silva, N. (2003). *úoHdfõ l ; dkar (Narrations in Science)*. Borallesgamuwa: Visudunu Prakashakayo.

Stapp, H.P. (1993). *Mind Matter and Quantum Mechanics*, Berlin-Heidelberg: Springe-Verlage.

Stevenson, I. (2000). *Cases of Reincarnation type, Ten Cases from Sri Lanka*, v.11. Kandy: Buddhist Publication Society

Tauber, A. (1997). *The Immune Self, Theory or Metaphor?* United Kingdom: Cambridge University.

Ven.Soratha, K. (1997) *Hua-Yen Reality*, `Beyond the Metaphysics of Commonsense', Colombo : Vidyartha and Pali & Buddhist Studies Institute. pp. 49-56.

Vinay, L. 2002. *Empire of Knowledge*, *`Culture and Plurality in the Global Economy'*, USA: Pluto Press.

Walshe, M. (1995). "*Digha Nikaya"* Kandy: Buddhist Publication Society, pp.407-15.