

Ram Ravichandran
Albert Stetz
PH 407H
May 25th, 2004

Om Mani Padme Hum

-Mantra Of Avalokiteshvara

'What is that by knowing which all things are known?' 'What makes my mind think, my eyes see, my tongue speak, my body live?' 'What happens when this body dies?'

- Upanishads

The ideas and theories of modern physics have altered the foundations of physics since its birth in the early 19th century. Scientists such as Edward Schrödinger, Werner Heisenberg, Niels Bohr many others probed the intricate universe of sub atomic particles and uncovered a sort of mystical world. Ideas such as the wave-particle duality, Schrödinger's equation, EPR paradox have amazed scientists and inspired students to seek an alternate reality. On our quest to explore the universe, are we discovering that we are a part of an infinite web of interconnectedness?

The philosophies of the Eastern religions- Hinduism, Buddhism and Taoism are as mystical as they are poetic. The philosophies contained in the texts of these religions can be interpreted in more ways than one, and applied to a number of contexts. One such context is modern physics since modern physics has hinted certain ideas, and used certain terminologies which correspond to Eastern philosophy.

1. Existence of ether in Hinduism

The Upanishads say:

First, with regard to the worlds. The earth is the former element, heaven the latter, ether

their union.

Hindus believe that the ether is a composite mixture of the elements of wind and the sky.

Devout Hindus believe that the ether is a part of the 'Brahman'- The Ultimate Being.

According to the Taittiriya Upanishad:

He who knows Brahman, which is conscious, which is without end, as hidden in the depth (of the heart), in the highest ether, he enjoys all blessings, at one with the omniscient Brahman.

2. Unity and Interconnectedness

According to Fritjof Capra, author of *The Tao of Physics*, the most important characteristic of Eastern Culture is the awareness of the unity and interconnectedness of all things and events and the experience of all phenomena in the world as manifestations of the basic oneness. As we explore the sub-atomic world, we observe that particles and all phenomena involving them are inter-connected. They cannot be studied as isolated parts of the whole. High energy collisions of subatomic particles are the prime method of study used by physicists to study properties of these particles. The collisions are recorded on Bubble Chamber photographs which reveal properties of particles. These photographs are taken when particles are accelerated around a circular track until a desired energy level is reached. Then they are made to leave the accelerator and sent into a bubble chamber where they collide with other particles making visible tracks which are photographed. Capra writes, 'Matter has appeared in these experiments as completely mutable. All particles can be transmuted into other particles; they can be created from energy and vanish into energy.'

Hindus believe the *Brahman* to be the unifying thread in the cosmic web. The

Upanishads ask, 'What is the cause of the cosmos?', and answers, '*Brahman*'. It is written in the Upanishads that:

He on whom the sky and earth, and the atmosphere

Are woven, and the wind, together with all life-breaths,

Him alone known as the one Soul.

In Buddhism, the idea of a cosmic web plays a greater role. Capra writes that the essence of the Avatamaska Sutra, one of the scriptures of Mahayana Buddhism is the description of the world as a perfect network of mutual relations where all things and events interact with each other in an infinitely complicated way. The scriptures of Tantric Buddhism, called 'tantras'. Tantra – Sanskrit meaning 'to weave', a reference to the unity and interdependence of things and events.

The EPR paradox and Bell's theorem explain the idea of interconnectedness of electrons. In 1935, Einstein, along with two other colleagues, Boris Podolsky and Nathan Rosen published a paper arguing that the quantum theory was incomplete. Imagine a particle disintegrating into two electrons A and B in such a way that their spins total zero and they are separated some distance. The instant we perform measurements on particle A, B acquires a spin up or down opposite to that of A, as if implying a sort of interconnectedness between the mutually exclusive particles, A and B. In 1964, John Bell devised a theorem to test and confirm the EPR experiment in a laboratory. In 1976, the experiment was performed and the paradox was experimentally confirmed. This brings an interesting question; If the quantum theory is correct, the particle should be 'correlated' even if they are separated by light years. How can the two particles be inter connected?

According to the Hoa Hu Ching:

The Tao gives birth to One.

*One gives birth to yin and yang.
 Yin and yang give birth to all things...
 The complete whole is the complete whole.
 So also is any part the complete whole...
 But forget about understanding and harmonizing and
 making all things one. The universe is already a
 harmonious oneness; just realize it."*

3. Inseparability of the human observer and the observed

One of the fundamental ideas of classical physics is that the observer must not influence the factors involved in the experiment. The quantum world forces the observer to be a part of the measured universe of the experiment. Physicists studying sub atomic particles in the bubble chamber found it impossible to observe the experiment without affecting it. The choice of what to observe affects the outcome of the experiment. The Schrödinger's cat paradox gives a clearer idea. Schrödinger proposed the famous cat paradox which involves a cat stuck in a box with a nuclear device. The device contains a single atom of a radioactive material which would decay into a different element and an alpha particle. The device is arranged so that when it detects the alpha particle, it releases a poisonous gas which kills the cat. The box contains a peephole, so that we can look to determine the state of the cat. There are basically two states the cat can be in, the live state or the dead state. When we look into the peephole a minute later and find the cat dead, then the state describing the cat live disappears. So, by looking into the peephole, we have killed the cat. When we look into the peephole and see that the cat is alive, then the dead state disappears and the cat has a 50% probability of surviving the next minute, and so we

have extended the cat's life by looking into the peephole. Some years later, E. Wigner added to the argument by supposing that he couldn't bear the thought of seeing the cat dead and so arranges for his assistant to look into the box and telephone him in his office and let him know if the cat is alive or dead. If we regard the assistant and the telephone as a part of the measuring apparatus, then Wigner killed the cat by lifting the phone and listening to the voice of his assistant.

In Eastern mysticism, the universal inter-woven ness has always included the human observer and his or her consciousness, and this seems true for atomic physics. From the cat paradox we understand that in the atomic level, particles can be understood in the interaction between the process and measurement. Capra quotes Heisenberg who says, 'Natural science does not simply describe and explain nature; it is part of the interplay between nature and ourselves.' In atomic physics, not only it is necessary for the human observer to be a part of the observation of properties of a particle, but is even necessary to define these particles. We cannot talk individually about these properties, but they are meaningful in the context of the objects relationship with the observer. The observer is never separate from the observed world. The Upanishads say:

Brahman is life. Brahman is joy. Brahman is Void...

Joy, verily, that is the same Void.

The Void, verily, that is the same joy.

4. Complementarity and the Union of opposites

Complementarity exists in quantum mechanics in a way that the physical properties of particles do not always possess determined values. The Uncertainty principle was put forth by Werner Heisenberg in 1927. It states that it is not possible to make a

simultaneous determination of the position and momentum of a particle with unlimited precision and also, it is not possible to make a simultaneous determination of the energy and the time coordinate of a particle with unlimited precision. We can only calculate the probabilities of finding a particle at a given position with a certain momentum or at a given time with a certain energy level. The principle indicates the interrelation between velocity and position as well and energy and time. This sense of 'oppositeness' is similar to the idea of the 'Yin-yang' in Taoism. According to Capra, Buddhism teaches that since all opposites are interdependent, their conflict can never end in the total victory of one side, but will always be a manifestation of the interplay between the two sides. The principle being the *Yin-Yang* is divided into two opposites, two principles that oppose one another in their actions *yin* and *yang*. All opposites one perceives in the universe can be explained by one of the opposite forces. The Chinese call the unity lying between the *Yin* and *Yang* as the *Tao*, and the dynamic interplay of the *Yin* and *Yang* as the essence of all natural phenomena and all human situations. In the second paragraph of the Tao Te Ching:

...having and not having arise together

Difficult and easy complement each other

Long and short contrast each other

High and Low rest on each other

Voice and sound harmonize each other

Front and back follow one another.

Capra writes that in modern physics, examples of the union of opposites include the sub-atomic level where matter is both destructible and indestructible; and force and matter are different aspects of the same phenomena. The Union of opposites is also displayed in

electrons where they have either spin up or spin down, but can never have both up or down. The ability of a particle to behave either as a wave or as a particle is another example of the complementariness that exists between particles.

As a Hindu myself, the topic was of great interest and forced me to understand some of the Hindu philosophy, as well as some of the religions surrounding it. The philosophies of these Eastern religions revolve around age-old knowledge that cannot be expressed in words. The texts of Rig Veda, Upanishads, I-Ching and others provide metaphors in a beautiful colorful sense that seem to reflect the ideas of modern physics, but not confirm the ideas, nor support the ideas. The Sages of the East saw an infinite interconnected universe from one Supreme being, be it *Brahman*, *Tao* or *Tathata* and expressed it as creatively as ever. The ideas of these sages may be correct. Maybe we are trapped in an infinite web of interconnectedness and to break from the web is to gain complete consciousness, attain *nirvana*. Peace, finally.

Om purnamadah purnamidam

purnaam purnam udacyate

purnasya purnam aadaaya

purnam eva avashishyate.

That is infinite, this is infinite;

From That infinite this infinite comes.

From That infinite, this infinite removed or added;

Infinite remains infinite.

Bibliography:

Bussey, J Peter. Eastern religions and modern physics.

www.cis.org.uk/scb/articles/bussey1.htm

Fritjof, Capra. The Tao of physics. Berkeley: Shambhala. 1975.

From New Physics to Hinduism.

www.vishalmagalwadi.com/NewAge/Appendix.htm

Krane, Kenneth. Modern Physics. New York: Wiley. 1996.

Zukav, Gary. The Dancing Wu Li Masters. New York : Quill. 1979