THEOSOPHY-SCIENCE GROUP

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EDITORIAL NOTES

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THEOSOPHY-SCIENCE SEMINAR 2009

Preliminary Announcement (prepared by Convener; Dr. Victor Gostin)

A Weekend residential Seminar will be held near Adelaide, at the Douglas Scrub Enviromental Education, Conference and Camping Centre, Mclaren Flat, 45 km south of Adelaide. This flora and fauna reserve of 13 hectares is run by the Guides of South Australia, and accommodation has been booked for a weekend beginning Friday 2 October evening until Sunday 4 October afternoon. Because Thursday evening 1 October falls on the regular monthly meeting of the Adelaide Theosophy-Science Group. we wish to invite any interstate visitors to extend their stay by arriving earlier and participating in an extended 4-day programme.

Members receiving this Newsletter are urged to respond by indicating their interest in attending the Seminar. Formal registration with costs (that will be kept to a minimum) will be announced early in the year. All Theosophical Society members are invited to apply, but preference will be given to those currently receiving this Newsletter. All transport will be provided. Please respond to Victor Gostin by email victor.gostin@adelaide.edu.au or write to Victor c/- Adelaide Lodge, 310 South Terrace, Adelaide SA 5000. :

SEMINAR REPORTS FROM SPRINGBROOK , 16-18 May 2008

Vicki Jerome from New Zealand, who has been an enthusiastic participant in most of our seminars, presents below an excellent overall **Summary** of the 2008 seminar (with some help from Murray Stentiford and Rosanne de Bats). (**Rosanne** is the first to respond to the request for **individual summaries** with brief crisp summaries of each of her two talks). Hopefully this will inspire others to follow suit. Typical summaries have been about 2 to 4 pages.

THEOSOPHY SCIENCE SEMINAR, 16-18 May 2008 -- SUMMARY

This year's Theosophy-Science seminar, organised by Dr. Victor Gostin and held at Springbrook, the Theosophical Society in Australia's beautiful wilderness retreat centre on the rim of an enormous volcanic caldera on the Queensland-New South Wales border, with Mt. Warning at its core, was almost as much an environmental experience as an exchange of scientific knowledge and

ideas. Emerging from our rooms at dawn, the 26 members gathered for this memorable long-weekend were treated to the sight of pademelons (small wallabies) grazing on the lawn, an evenly spaced row of four kookaburras perched on a branch of one of the numerous tall trees, and finally as we arrived at the dining room for breakfast, a flock of red and blue small parrots, some green and yellow ones and a couple of butcher birds, all feeding on the delicacies provided by the property's kindly caretaker, Barry Hora.

The seminar programme was equally rich and varied. Dr Victor Gostin began the proceedings on Friday morning with his talk, 'The Cradle of Humanity in Africa', covering recently discovered information and the resulting developments in our understanding of the subject. In this fascinating presentation, Victor described the similarities and contrasts between mankind and the other members of our larger group, orang-utans, gorillas and chimpanzees, perhaps the most significant parallel being the intelligent use of tools. The latest theories suggest that the few ape species that evolved into humans could have been from Eurasia rather than Africa as originally thought, from times prior to the rising of the Himalayas and subsequent Asian monsoon, triggering the ice ages.

Victor also described the increase in brain size and innovation, particularly with Homo Erectus, possibly aided by improved nutrition resulting from the first known application of fire to food. Commenting that early ideas of a hidden polar continent have now been disproved, he outlined an alternative suggestion that Eden could have been in SouthEast Asia, and concluded with the story of the Toba volcanic eruption in Northern Sumatra around 73,000 years ago that almost wiped out humankind, at about the time that mutations not found in Africa began to occur, followed by the well-recognised migration along the Southern coast of the Middle East, India and down to Australia.

Associate Professor Lynne Hume followed on with 'Ways of Seeing Our World: cross-cultural perspectives'. Lynne, with a PhD in anthropology specialising in religion and spirituality, and author of the book *Portals*, described how events in our world can have a multiplicity of meanings, according to the varying perspectives of different ethnic groups, giving examples from the Dogon people of Africa, the Mekeo tribe of New Guinea, the Dere Tha in Canada and the Australian occult artist Rosaleen Norton, a Western witch, whom one of the members present knew personally. Lynne described the Dogons' verbal mythology, encompassing origin myths, shrines housing the spirits of ancestors and their amazingly accurate knowledge, dating from thousands of years ago, of the star Sirius and its companion star, although invisible to the naked eye. The Dene Tha derive knowledge from dreams, visions, the deceased and spiritual beings; the Mekeo gain esoteric knowledge through an independent 'hidden self' existing in the dream world; and Rosaleen Norton believes there are realms quite separate from our human consciousness.

Lynne warned against the tendency of scientists to ridicule anything that cannot be measured and to ignore or belittle 'knowledges' that do not fit the prevailing paradigms, as some realms of knowledge can only be accessed by relinquishing all critical distanced analysis. She told of the Metanexus Institute of religion and science in which people from many disciplines join in a spiritual transformation and research programme, and described NDE researcher Dr Pym van Lommel's view that human consciousness originates outside, and is independent of, brain function and exists in waves of energy which enter the physical particles of the body. She concluded with a mention of the concept of a 'multiverse' (multiple universes coexisting) and the Membrane theory of the interconnectedness of all matter in the universe.

After lunch, with time for a reinvigorating walk in the tropical rainforest, Rosanne DeBats gave a talk on 'Mind and Brain: the Science and Mystery of Consciousness'. She started by explaining the methods of studying the brain's activity, such as Functional MRI and Quantitative

electroencephalography (QEEG), and psychoneuroimmunology, the study of interaction between behaviour and emotion, neural activity and endocrine neuropeptides. She then presented evidence for an 'expanded universe' model of how things are, saying that the signals that we pick up from our five senses are only part of the information available. There is evidence for such experiences as: a shared field of consciousness which would explain ESP phenomena; expanded awareness following the use of entheogenic substances; and seeing, hearing and feeling things during near death experiences when the brain is not functioning. As we learn more about brain function, science is substantiating that brain activity does not cause consciousness, but rather is the instrument for the expression of both the material and non-material awareness.

This was followed by Murray Stentiford's presentation on the creative power of sound: 'Celestial Sounds in Stone'. Starting from its highly evocative title, this talk used the mysterious patterns on the 'cubes' of the Rosslyn Chapel to introduce the relationship between form and vibration. This is because the shapes carved into its stone 'cubes' are remarkably similar to the patterns of vibrating plates – more so than to almost any human system of hieroglyphics or symbols.

After a graphic demonstration of a vibrating glass plate showing different patterns in sand resting on it, the audience viewed the beautiful energy forms Geoffrey Hodson saw when certain music was played, to the accompaniment of excerpts from these pieces of music. The pictures from GH's *Music Forms* followed, similarly accompanied by excerpts from the eight pieces that evoked the forms illustrated, interspersed with Murray's explanations and resulting discourse on such topics as how nature spirits are attracted by music, the difference between physical forms and subtle energy forms, the Masonic aspects of Mozart's music, and the spiritual energies in music. The diverse threads of the talk were then pulled together into a vision of the profound relationship between sound, vibration and form in the creation and evolution of a universe.

In the evening Howard Gregg provided an interesting DVD by Jill Bolte Taylor, on 'Rebuilding your own mind'.

The next morning Alek Kwitko gave an entertaining presentation 'The Problem With Ethics'. He described the now problematic area of ethics in relation to science, and the way it can hold back the progress offered by the exponential growth of scientific knowledge. Ethics, once simply about etiquette, regulations and legal obligations, has not been able to keep up with the dramatic changes in science and medicine, such as organ transplants, in vitro fertilisation, genetic diagnosis and engineering, and therapeutic and reproductive cloning, and there has been an accompanying increase in medical malpractice claims. The most recent development is the possibility of hybrids, both human-animal and human-machine, and even artificial intelligence – should 'conscious' computers have legal rights? Alek questioned whether ethical decisions in these matters should be left to religious or scientific leaders, politicians, or… whom? He alerted us to coming dramatically life-changing scientific advances, allowing us to defy disease, ageing and mortality itself, and looked at ways of addressing related ethical issues such as individual higher consciousness, personal freedom of choice and responsibility. The current practice is inherently wrong – dogmatic, conservative, backward-looking and using externally imposed standards employing parliamentary or common-law legal force. He believes current ethics needs radical change, as it is perverting the natural pattern of societal and scientific evolution.

After morning tea, Rosanne DeBats spoke on a new subject: 'Using Scientific Methodologies to Explore the Transpersonal'. She explained that science involves reason-based analysis of observable reality, and then the development of a theory to explain it. The true scientific mind finds things interesting, and wants to know how best to explain them. While mainstream science has limited what is acceptable to look at and the theories which it will allow, there are reputable

scientific ways to explore all that can be seen to exist. This talk looked at modern scientists and methods of science for exploring such phenomena as mental messages causing changes in the structure of water, first-person data using introspection, anomalous and infrequent events such as miraculous healing and crop formations, extra-sensory perception, and global consciousness effects.

Dr. Hugh Murdoch started the afternoon session with his talk 'The Mysterious Number Phi', also known as the Golden Ratio. Hugh explained Leonardo of Pisa's Fibonacci series (each number in the series being the sum of the previous two numbers), outlined in his historic book written in 1202, *Liber Abaci* (meaning 'the book of calculation'), which also introduced to Europe the Arabic numerals he had learnt while living in North Africa. Hugh clarified the Golden Ratio as the number phi, obtained by dividing each number in the Fibonacci series by the previous one, which in the limit approximates to 1.618, and went on to describe the numerous occurrences of this ratio in human civilisation and nature, in areas from the pyramids of ancient Egypt (of which another was discovered in November) to the molecule Buckminsterfullerene, C_{60}, an allotrope of carbon, named because of its shape, after the similar design of the architect Buckminster Fuller's geodesic dome.

Dr. David Allan followed Hugh with the intriguing subject 'Astrophysics and Metaphysics, Hidden Meanings in New Discoveries', mentioning Dark Energy and Dark Matter. He reviewed modern scientific knowledge of the vast distances of scale from the micro- to the macro-universe, and some of the surprising discoveries relating to quantum mechanics at the subatomic level, which have readily discernible metaphysical implications not yet paralleled in the macro-universe. Turning to astrophysics he reviewed the Big Bang theory with its expanding universe of galaxies, and the challenges surrounding this concept, also considering its similarities to, and differences from, metaphysical ideas such as Christian and Hindu creation beliefs.

While the Big Bang theory is currently overwhelmingly accepted, there are many strange anomalies, and David drew an analogy between its status and that of subatomic theory a century ago. He enlarged on these anomalies relating to each of the three scientific pillars of the Big Bang theory – cosmic microwave background radiation, the red shift in the spectra of galaxies and the composition of the elements of the universe – and went on to discuss attempts to address these using the concepts of Dark Energy and Dark Matter, and their metaphysical implications. Dark Energy is the proposed answer to the puzzle of why the expansion of the universe appears to be accelerating rather than slowing after the Big Bang, while Dark Matter addresses the problem of missing gravitational mass within the universe, required to maintain the tight spiral structure and speed of rotation of galaxies – the implication being that only 0.5% of the mass of the universe is visible, 99.5% invisible. David described attempts to detect Dark Matter using the Large Hadron Collider and also enlarged on String Theory, with its prediction of parallel universes and shadow particles, supported by theosophist-scientist Dr I. K. Taimni. He suggested some possible metaphysical implications, maybe supporting such concepts as an Astral plane, astrology, and enlarged on another of these, the idea of a plasma universe as suggested by author Jay Alfred – plasma makes up around 99% of our visible universe – and its possible explanation of such ideas as auras.

In conclusion, David discussed the accelerating expansion of the universe, and its possible metaphysical interpretation and consequences.

After dinner, Murray Stentiford led a discussion on 'Global Consciousness and Action'. How can humanity mobilise the intelligence to deal with the problems facing it on a global scale? If individuals feel overwhelmed by the size of even one problem, is there a way to harness the collective intelligence and wisdom of large numbers of people? in this session, Murray showed how the answer to this latter question is a definite "yes", introducing some massively efficient

group techniques for dealing with large-scale problems. These techniques were Open Space Technology, Appreciative Inquiry and World Café. These all engender an explosion of creativity and action plans, in their own way. Discord and group schisms are usually healed, and something greater than a single person emerges – the presence of Spirit, enveloping all. Participants are left feeling energised for new action.

A discussion followed on areas of need and possible applications. The session ended with everyone chanting a prolonged, resonant Om.

On Sunday morning Chris Pangway explored 'Interconnectiveness', as it relates to theosophy, science – in particular, analytical chemistry – and synchronicity. With regard to theosophy, he suggested that HPB's 'three propositions' imply interconnectedness, as do the ideas of karma and dharma. He described some areas of science where interconnectedness is generally acknowledged, e.g. gravity, and the four ancient elements – earth, the air we all breathe, water and fire – and went on to explain the procedures of analytical chemistry and how correlations can be made by calculations, by reviewing historic data and expected conditions, by location, and based on the analytical procedures of turbidity and Total Suspended Solids. Finally he considered synchronicity and quoted examples from Ed Abdill's book *Synchronicity, the Gateway to Opportunity*, concluding that synchronicity is an observable fact and probably occurs naturally, even though we don't know why. He closed with some intriguing examples of synchronicity.

Chris was followed after morning tea by Maikel Annalee speaking on 'Theosophy in Science'. Maikel can always be relied upon to bring a refreshing and original view on a topic, and this occasion was no exception. He initially referred to a paper he had written on primordial and esoteric aspects of Mandaean philosophy (a Gnostic sect hostile to Christianity, surviving in Iran) and continued with a wide-ranging discussion of various philosophies, touching on areas as diverse as Nazar Utha philosophy, a cognitive cosmogony, a view of the Aboriginal 'Dreaming' as the opposite side of reality and their concept of dual mirror-image existences; and cognitive cosmology – "neurosurgery without a scalpel" – where we sculpt our brains with our thoughts.

In the afternoon, Murray Stentiford enlarged on the subject of 'Energy Psychology', describing the process of EFT. Under the umbrella term of Energy Psychology, which embraces various combinations of traditional Chinese medicine with western science, EFT – Emotional Freedom Techniques – is one of many new ways to empower people to help themselves and achieve release from troubling thought and behaviour patterns. An introduction to this fast-growing field, with the dramatic story of how it was discovered, a description of the process and examples of its success, was followed by an opportunity to try out some of the basic techniques.

A practical session explored what effects EFT might have on a light-hearted example: the experience of attraction to chocolate! The process illustrated many of the points made earlier, and enabled much enjoyable group interaction to occur. Some definite shifts in attraction to chocolate were achieved, with the notable exception of those who preferred to have their chocolate 'addictions' untouched!

To end the afternoon, we were given two short talks. First, Audrey Brimson spoke on 'Peak Experiences or Cosmic Consciousness', relating her personal experience of this state when she was baptised in Sri Lanka and giving this definition: "profound moments of love, understanding, happiness or rapture, when a person feels more whole, alive, self-sufficient and yet a part of the world, more aware of truth, justice, goodness, harmony…". She looked into what qualifies as cosmic consciousness and categorised its four levels or types as: shamanic; beauty and love; Eureka moments; and Bliss/Ananda/Moksha – only the last-named being really life-changing. She explored

the four levels of peak experience – bodily ones of the physical, emotional and mental, and non-bodily at the intuitional or Buddhic level – and looked at HPB's concepts of Lokas and Talas, divine and terrestrial states, and the seven levels of consciousness.

Finally Janet Blake presented slides on 'The Being Project' – using the Internet, this is a highly creative, 'alternative' project, of a wide intellectual sweep and transformative in intent.

The seminar concluded after dinner with a video by Suzuki and a review of the seminar and discussion of future plans.

MIND AND BRAIN: THE SCIENCE AND MYSTERY OF CONSCIOUSNESS

Rosanne DeBats

(a psychologist with a particular interest in the intersection of mind and brain).

The following points summarise a few of the areas explored in this Seminar Talk:

- Recent developments in neuroscience, such as fMRI and full head EEG, allow the measurement of brain function. The brain is more malleable than it was previously thought to be. Thinking about an action, such as playing the piano or playing tennis, causes an increase in the area of the motor cortex involved in such actions. Changing our thoughts through psychotherapy for such problems as depression affects brain function very differently than taking anti-depressant drugs. Thoughts are things – they have a physical effect on the brain.
- Recent research is finding that the brain is wired for mimicry and empathy. Mirror neurons are engaged not only when we personally experience something, but when we observe someone else experiencing it. They provide a web of connections that link neurons in motor and sensory systems to the limbic centres that process visceral and emotional reactions. And so they can facilitate altruistic and compassionate behaviors, letting us feel what someone else is feeling.
- Michael Persinger's work has associated temporal lobe sensitivity with the experience of "not being alone". A "materialist" philosophical position would conclude that it is the sensitivity which causes the experience. An "expanded universe" philosophical position would conclude, instead, that the temporal lobes act as an aerial to pick up the subtle signals which mark a spiritual presence.
- The signals which we are usually able to pick up with our physical apparatus is only a small part of the information "out there". Animals use other sources, such as infra-red, electromagnetic and sonar information. What we see depends on our previous experience and expectations. What more is it possible for the human mind to perceive? Altered states of consciousness from either decreasing, increasing, or otherwise affecting sensory inputs, as well as ingesting enthoegens, can lead to experiences of expanded awareness.
- Near death experiences in about 15% of people lead to another expanded awareness, with repeating themes of a white light, spiritual beings, a feeling of great peace, and then coming back into the body. In a number of cases these mental experiences occur even though the brain is devoid of function. The most reasonable explanation of the facts requires an expanded universe philosophical position – the brain as a vehicle for consciousness, not the producer of consciousness.
- Recent work has also looked at the support for a shared field of consciousness which could explain phenomena labeled "extrasensory" such as clairvoyance, telepathy, non-local mental influence and presentiment. Taking this to another level, the Global Consciousness Project is

exploring the effect of world events affecting large number of people on random number generators.

- As we learn more about brain function, many neuroscientists have made the assumption that it is brain activity which produces mental experience. However this is not substantiated by the facts, which suggest that brain activity may be associated with mental experience, without being causal. While mainstream science prefers to avert its eyes and look the other way, the evidence is mounting which supports an "expanded universe" model of how things are. A strictly materialist view has too many holes to provide the most plausible hypothesis.

USING SCIENTIFIC METHODOLOGIES TO EXPLORE THE TRANSPERSONAL

Rosanne DeBats, Psychologist

Summary of a talk at the Springbrook Seminar

The great divide between science and spirit which marked the 20th century is dissolving in this 21st century. Some aware scientists and scientific research organisations are exploring some of the most interesting questions of our time which lie outside of a materialist paradigm.

Science involves reason-based analysis of observable reality, and then the development of a reasonable theory or story to explain it. The engine driving all science is curiosity – the scientific mind finds things interesting, and wants to know how best to explain them.

"Scientism" is a philosophical position which limits hypotheses to material explanations. It is actually counter to true science, which looks at all data and creates the most simple and elegant theory to explain it. "Fringe science" refers to unusual theories which are based on scientific principles, but are not accepted by the mainstream. "Pseudoscience" refers to work which does not adhere to the methodological requirements of science. "Protoscience" refers to hypotheses which have not yet been tested by the scientific method. And "junk science" refers to work carried out for political or financial motives, to "prove" what is advantageous.

Some very interesting "fringe science" is being carried out by curious and brave scientists, whose work I hope will eventually make it to the mainstream. We explored the scientific methodologies used by scientists looking at:

* Effect of Blessing on Water – Testing out Dr Emoto's claims using a rigourous double blind experimental method. Results were statistically significant and published.
* Science of Introspection -- Combining first person and third person observations, using standardized scales of near death experiences and altered states of consciousness.
* Anomolies and Infrequent Events – Miraculous healing, messages from the dead, and crop formations. These required intensive study of individual events, not statistics.
* Meta-analysis of Extrasensory Perception Experiments - Pooling many studies, when effects are inconsistent, to determine the probability of the total of observations.
* Small Effects in Large Amounts of Data – the Global Consciousness Project's massive data analysis.

Different methods are appropriate for establishing the existence of an effect, and working out its method of operation. When mainstream science continues to turn a blind eye to effects for which there is much data, it impedes the movement to the explanatory phase of study.

Science is changing. In addition to the mainstream university work which is often limited to the accepted stories in a field, there is growing cutting edge research and publication by specialists willing to take more chances, and at least a few privately funded research organizations interested in such areas. And finally there is a large community of interested people, connecting via the internet, willing to consider a wide range of possibilities and talk about their implications -- to entertain the possibility of new story lines.

As more thoughtful people expand their stories, as fringe science moves to the mainstream, we can imagine a transformation of the recent divide between science and spirituality, to a mutual recognition and reintegration.

BOHM'S QUANTUM PHYSICS RECOGNISED AT LAST

Many theosophists will know of Bohm as a close associate of Krishnamurti, and also as a unique philosopher. However his primary role was as a quantum physicist. He had a unique realistic interpretation of quantum physics (see below) which was either rejected or ignored by virtually the entire physics community from 1952 when he first developed his approach until his death in 1992. I surmised at the time that perhaps he might be appreciated in the new century although I was not optimistic.

Indeed there has been a revival of what is now being referred to as Bohmian Mechanics, including emphasis on **REALITY** as distinct from the unreality of the traditional approach of Bohr, emphasizing the "Unreality"of whatever happens in a quantum experiment prior to the resulting observation. There is a feature article on "Bohmian Mechanics" in *New Scientist* for 22 March, 2008. Clearly what is being discussed is Bohm's interpretation of quantum mechanics. On the cover of the issue, there is the word **UNREALITY** with UN shaded almost out. A search on the internet discloses a lengthy article on Bohmian mechanics from the *Stanford Encyclopedia of Philosophy*. This is a 2006 revision of an original article in 2001. Much of it is mathematically sophisticated.

Bohm was born at Wilkes Barre in Pennsylvania in 1917 and obtained his PhD under Oppenheimer at Berkeley in 1947. He then held various positions there.until 1961 when he was appointed as an assistant professor at Princeton University. He had a number of discussions there with Einstein who was at the Institute of Advanced Studies. They agreed on their disapproval of Bohrr's concept of the nonreality of the quantum world prior to observation of the results of an experiment. However, they disagreed with what was then known as nonlocality (or distant interconnectedness) but is now often referred to as entanglement. Einstein referred to it as "spooky action at a distance". For Bohm it is not only an essential feature of quantum physics but is also an integral part of his philosophy of universal imterconnectedness

While at Princeton, Bohm was called to appear before the Un-American Activities Committee of parliament to testify against Oppenheimer and others. It was a time of paranoia in America about communism. The Committee chaired by the infamous Senator McCarthy behaved like an inquisition. Oppenheimer had been in charge of the atom bomb but refused to work on the hydrogen bomb on ethical grounds and was suspected of communist sympathies. Bohm refused to testify and he was indicted for Contempt of Congress. Although this indictment was subsequently withdrawn, he was ostracised and asked to stay away from the University. That gave him more time to concentrate on writing his book. However when he came up for reappointment, his position was terminated and, in the climate of the day, he was unable to obtain a position anywhere in America. However, he obtained a professorship at the University of Sao Paulo in Brazil from 1951 to 1955. He then took up a position for two years at Haifa in Israel where he married in 1956. The following

year he obtained a Research Fellowship at Bristol, followed after a few years, by appointment as Professor of Theoretical Physics at Birkbeck College, University of London, where he spent the rest of his life. He retired in 1983, becoming Emeritus Professor, and died of a heart attack in 1992.

At Bristol, Bohm's wife brought home a book which she thought might interest him as it talked about the observer and the observed.. The book was by Krishnamurti: *The First and Last Freedom* and Bohm found its philosophy very interesting indeed and compatible with his. He contacted Krishnamurti and they become close associates. In due course Bohm became a member of the Krishnamurti Foundation. They had many discussions on matters of common interest relevant to Bohm's unique philosophy of wholeness which were recorded on tape, sometimes including also other participants. Dr. Geoffrey Miller at Springbrook accumulated a complete set of the tapes and they are preserved at the library of the Springbrook Theosophical Retreat Centre.

Bohmian Mechanics- --- The *New Scientist* Article

The *New Scientist* article is headed "Quantum Randomness may not be random," an extract says:: "The mainstream view is that uncertainty is a fundamental feature of everything ... and quantum researchers celebrate the notion that pure chance lies at the foundation of the universe; However, a sizable minority of physicists ... remain unconvinced that quantum theory depends on pure chance and they shun the philosophical contortions of quantum weirdness. The world is not inherently random they say. It only appears that way. "Sheldon Goldstein of Rutgers University in New Jersey and other like minded physicists have been pursuing an alternative quantum theory known as Bohmian Mechanics in which particles follow precise trajectories through space and time. "It's a reformulation of quantum theory which is not at all congenial to supposedly deep quantum philosophy' says Goldstein. 'It's precise and objective," It is clear that what is being discussed is Bohm's version of quantum mechanics. (See below).

The fundamentals of quantum physics are usually discussed, as here, in terms of an experiment where a series of fundamental particles such as electrons is sent through an apparatus with two closely spaced parallel slits, toward a detecting screen which records a typical "interference pattern" with a central peak image of a slit and lesser peaks (with gaps between) tapering off in intensity on either side. "While mainstream quantum theory insists that you can't give **any** account of how each particle moves, Bohmian mechanics can," thus replacing the fuzziness of the standard theory according to Bohr with certainty. "The wave function choreographs the motion of the particles". [Note: An extreme view of Bohr even contends that the pattern on the screen only becomes real when observed. Bohr has been cited as saying "There is no quantum world; only a quantum mechanical description."]

There is acknowledgement of just one area, (of no great consequence), where standard Bohmian mechanics does not work; i.e. at ultra high speeds necessitating the use of special relativity. However, the article reports that, during the last decade, Goldstein and others at the University of Genoa have developed Bohmian models giving a consistent view of relativistic particle processes while mirroring the accurate predictions of quantum field theory. The main objections have now either been addressed, turned out not to be serious, or shown to also represent the same problems for the standard theory.

Even so most physicists are not willing to adopt the new models because they don't make any predictions which differ from the standard model. Thus ideological objections rather than technical concerns have been mainly responsible for reluctance to adopt new models such as that of Bohm. Surely the realism of Bohm's approach should win out over the unreality of the standard Copenhagen approach of Bohr. The final statement of the article is that "according to the Bohm

theory, uncertainty arises from the interactions between the measuring device and the particle. It is not inherent in the universe".

The Birth (and early struggles) of what is now called Bohmian Mechanics.

At Princeton Bohm lectured on Quantum Mechanics and wrote a book on it from Bohr's traditional point of view to help himself understand it. This book was long regarded as a classic. However, having written the book, Bohm was dissatisfied. He was soon, however, to publish his own very different interpretation.

In 1952 (while in Brazil), he published in an important theoretical physics journal, papers developing a mathematical modification to the fundamental equation of quantum physics, the Schrodinger equation. This produced a term that he called the quantum potential which took account of the instantaneous effect on the particles of the surroundings, It was this work which work enabled him to calculate the actual paths of the particles in the double slit experiment discussed in the *New Scientist* article, in defiance of the claim according the so called "Copenhagen" interpretation of Neils Bohr of their 'unreality'. In the strict Copenhagen view, nothing is real until the pattern on the screen is observed.

In his later work he refers to the quantum potential as a "quantum information potential". A particle is influenced by its surroundings through the "quantum information potential". Its influence is immediate and does not necessarily fall off with distance, as do typical physical influences. This is a much more subtle effect than is allowed in the standard theory. It provides what Bohm refers to as "active information" about the surroundings. As an aid to understanding the concept of active information, he uses an approximate analogy of a ship in a fog using radar to avoid obstacles. The return radar signal gives information about the surroundings to enable the ship to avoid the obstacles but the radar does not drive the ship. The signal is "active" insofar as the information it provides about the surroundings affects the course of the ship, but it is the ship's engines which actually drive the ship.

The concept of such a 'pilot wave' as an explanation of quantum mechanics had been flirted with in 1927 by Louis de Broglie but he quickly discarded it following strong opposition. He is even sometimes clamed as the first proponent of Bohmian mechanics.

Bohm's Battle for Recognition

Bohm's work was ignored at the time or misrepresented and spurious reasons were found for rejecting it. However, in the early days of QM there was discussion of whether there might be some 'hidden variable' [read as 'hidden. factor'] which could explain the puzzling implications of QM. Bohm at first cast his theory as a form of a 'hidden variable theory' and he became stuck with the epithet of 'the hidden variables man'.

Prominent theoretical physicist, Von Neumann gave a mathematical proof that no 'hidden variable' theory could be consistent with the experimental predictions of quantum theory. The existence of von Neumann's theorem was a major reason Bohm was not taken seriously by the main body of physicists. A more aggressive character than Bohm might have fought harder against the prejudice concerning his theory but that was not his style.

Von Neumann's criticism was later refuted by an even more influential quantum theorist, and a major figure in the ongoing development of the theory, John Bell, who stated in relation to Bohm's work, "I saw the impossible done." He showed that certain of von Neumann's assumptions were not

valid, especially as applied to the type of theory espoused by Bohm. The whole concept of hidden variables has been one mighty great red herring as far as consideration of Bohm's interpretation is concerned.

In 1964, Bell published an important theorem which proved that "No **local** hidden variable theory could be consistent with quantum physics". In the introduction to that paper, Bell stated: "A hidden variable interpretation of elementary quantum theory has been constructed," and gave a reference to Bohm's 1952 paper. Bell went on to say "That particular interpretation has a grossly non-local structure [i.e. it incorporates entanglement] This is characteristic, according to the result to be proved here, of any such theory, which reproduces exactly the quantum mechanical predictions." In other words Bell is both asserting the crucial importance of nonlocality, (entanglement) and supporting Bohm. Yet perversely, he was widely misinterpreted as condemning Bohm.

Bell went on the attack in paper after paper supporting Bohm, inventing some interesting and even amusing analogies, and producing a book: "Speakable and Unspeakable in Quantum Mechanics.". Instead of talking about 'observables' to describe physical quantities, Bell preferred to speak of what he called "be-ables", thus emphasizing their physical reality. This is an important book. Bell regarded it as tragic that Bohm's interpretation (now known as Bohmian mechanics) was not taught in university courses at least as a possible alternative explanation of quantum phenomena.

While Bohm was largely neglected, if not openly disbelieved, he did have some support, for example from Holland and Vigier of the Pierre and Marie Curie University in Paris. Peter Holland published in 1993 a very substantial tome *The Quantum Theory of Motion*, [Cambridge University Press], consisting largely of what would now be called *Bohmian Mechanics*. The same year *Undivided Universee* by Bohm and Hiley [Routledge, London] was published, largely on the same topic but with also some examples of philosophical thought. Both books are highly mathematical but Bohm, in particlur includes some philosophical statements (for which I do not have room here). Bohm died suddenly of a heart attack in November 1992 just as the proof reading was completed, and Hiley saw the book through to publication. It is remarkable that two such comprehensive treatments of what is now known as *Bohmian Mechanics* should be published independently and concurrently. Could it be that that those two books became the impetus for the final recognition?

Prominent physicist,.Henry Stapp, says on the back cover of the Bohm and Hiley book: "This book will, I believe, change the way quantum physics is taught," Unfortunately, Bohm, after all his efforts, did not live to see that day.

Bohmian Philosophy

The philosophical implications of entanglement are momentous. Entanglement was first verified experimentally over short distances by a subtle experiment in 1982 and has been extensively studied since. It means the distant objects can be connected instantaneously in subtle ways by subtle influences.. No signaling is possible at greater than the speed of light. but more subtle distant interconnections are possible. Bohm was the first to seize on the wider implications and it permeates both his physics and his philosophy. Indeed the two are closely intertwined. Apply over and over again many times the subtle interconnection of a pair of distant objects and this ultimately leads to the subtle interconnection of everything at some deep level. This is the physical basis of Bohm's concept of the holomovement or the implicate order, a higher level of order than everyday 'explicate order'. It meshes very well with his interest in Krishnamurti's philosophy. He also suggests the possibility of even higher levels of order – rather like the theosophical concept of higher planes but less mechanistic.

Bohm wrote numerous articles in scientific Journals, in common with his main collaborator, Basil Hiley and others; especially in *Foundations of Physics*, a Journal which specializes in fundamental conceptual issues. In 1975, Bohm and Hiley began one such article with the following statement:

- "What we are proposing is that we be ready to explore a new notion of physical reality, in which we start from **unbroken wholeness** of the totality of the universe....We have reversed the usual classical notion that the independent 'elementary parts' of the world are the fundamental reality and that the various systems are merely particular contingent forms and arrangements of these parts. Rather, we say that inseparable quantum interconnectedness of the whole universe is the fundamental reality and that relatively independently behaving parts are merely particular and contingent forms within the whole.

- Individual human beings may be considered as subsystems in a system consisting of a social group. Evidently the relationships of any two individual human beings depend crucially on the state of the immediate social group to which they belong, and ultimately on that of the larger social group. Similarly, the interactions of any two cells in the body depend on the state of the whole organ of which they are a part, and ultimately on the state of the organism as a whole..... In this way we see that there is accessible to us a very wide range of direct intuitive experience in the form of wholeness. What quantum theory as understood through [our] interpretation, shows is that this form is appropriate, not only biologically, socially, and psychologically, **but also for understanding the laws of physics.** And so we are able to comprehend the whole world in all its aspects through the one universal order of thought, thus removing an **important source of fragmentation between physics and other aspects of life". [emphsis mine]**

This canvasses just one aspect of Bohm's comprehensive philosophical thought. What I find remarkable is that it should be published in a Journal which typically publishes sophisticated articles on topics in theoretical physics.

There have been many eulogies for Bohm:

Prominent physicist, Max Jammer says in an article celebrating Bohm's 60th birthday: "Even those who do not share his point of view, admire the originality and independence of his thought, as well as the outstanding intellectual honesty and uncompromisability of his personality".

Renee Webber (Lecturer in philosophy at Rutgers University, and incidentally a member of the Theosophical Society) who interviewed Bohm for her book *Dialogues with Scientists and Sages* says::"I was quite unprepared for the unusually modest and unassuming, gentle person he turned out to be".

Robert Temple says in an article based on his interview with Bohm for *New Scientist* in 1982: "Bohm's complete lack of ego or any air of importance completely disguises the enormity of his intellect"

Regards to you all,

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