The Search for Spock!

[Continued]

IV. The emergence of Paraphysics during the scientific era: 1970 to present

During the 1960s, while general relativity was becoming more popular among scientists and parapsychology more respectable, other changes in attitude within the physics community were also affecting research and theoretical work on psi. Quantum theory and quantum mechanics had always been plagued by seemingly unfathomable paradoxes such as the wave/particle duality, but the mathematical model presented by quantum mechanics gave the correct answers for phenomena that presented themselves in nature as well as those which scientists presented as experiments. So the prevailing philosophical interpretations of the Heisenberg uncertainty principle and other quantum mechanical concepts were very near to being universally accepted even though they were clearly problematic in the view of some scientists. In the 1930s, Einstein began a campaign to discredit the Copenhagen Interpretation of quantum mechanics, which was the prevalent viewpoint. The campaign resulted in the 1935 publication of a paper authored by Einstein, Boris Podolski and Nathan Rosen (the famous EPR paper) expressing Einstein's and other scientist's concerns with that particular interpretation of the quantum theory. In essence, they felt that quantum mechanics was 'incomplete' since it limited our view and knowledge of the physical world of nature. Their view implied that there existed underlying factors regarding physical reality that quantum mechanics did not address.

Although the ensuing debate was well known, the defeat of Fascism and the shackling of science by politicians and the military establishment for that purpose drew away the energies of science and the debate was left unsettled for many years. In 1951, David Bohm reopened the debate with a philosophical argument leading to the concept of 'hidden variables.' He reasoned that there could be unknown physical quantities, 'hidden variables,' which when discovered and taken into account would render quantum mechanics 'complete' in Einstein's sense of the term. The debate went even further in 1964, when John S. Bell offered a possible solution to the debate that is known today as Bell's theorem. Bell distinguished between the 'local' and 'non-local' properties of physical interactions. Since these philosophical arguments were made, a great deal of literature on these and similar subjects has appeared and affected experimental physics.

The EPR argument and its consequences were debated either by philosophers or by scientists in philosophical terms thereafter since the outcome of the debate would not affect the experimental results which were the primary interest of physicists. Yet the philosophical arguments themselves resulted in new experiments that the physicists had not considered. This trend reintroduced philosophy into physics in a very concrete

manner. While the ultimate relationship between these advances in science and the overall attitudes of physicists toward both their science and their priorities of research are beyond the scope of this study, the influence of this trend in physics on psi research cannot be ignored. Although she was only speaking of changes in the field of parapsychology itself, Heywood noted the change in 1967.

> **One key to this beginning of a change in the mental climate in relation to ESP may perhaps lie in the astonishing revolution in physics which is now going on, and which has already shown that the classical notions about the nature of time, space, and matter are not all-embracing when it comes to the realms of the very large and the very small. And now new research is revealing that in the realm of the very small the brain functions as a chemico-electrical instrument of surpassing delicacy and in a manner unsuspected in the days when it was ruled out as being in any way concerned with ESP. (Heywood, p.60)**

The revolution of which she spoke was that of the original quantum theory between 1900 and 1927 as well as relativity theory, a fact which she readily acknowledged.

> **The revolution in physics, of course, has been going on for over half a century, but new ideas need a lot of time to seep through and modify the general outlook, and the most fundamental change of all - to a concept of 'solid' matter as being convertible into elusive 'intangible' energy - is only now beginning to exert its influence in the outside world. In the early days of psychical research men could say that no mystery remained in the universe and that the subject of physics was exhausted. Now a pioneer of the new physics can write that 'the physics of the future a few centuries hence could well be as different from the physics of today as the latter is from the physics of Aristotle', and, again, that we must never forget how limited our knowledge must always be'. (The quote is from Louis de Broglie, *Nouvelles Littéraires,* 2 March 1950)**
>
> **n such a mental climate ESP is coming to seem less of an 'egregious logical sin', and psychical researchers are more able to continue their empirical observations undeterred by the dictum that what they observe has no business to be there. (Heywood, p.60)**

Heywood was correct in the idea that the new concepts take a long time to "seep" into the mainstream of science, but wrong in limiting the more recent changes in attitude in psi research to the original events of the Second Scientific Revolution alone. Heywood missed the point that radical changes in attitude toward both quantum theory and general relativity had occurred in the ensuing years and that these changes greatly affected psi research as well as the growing relationship between physics and psi. The state of physics was not static and unchanging during the decades after 1927, but it continued to evolve and progress. Debates on the philosophical interpretations of quantum mechanics were new to science, but they still reflected the same concerns as the age-old debates of 'continuous' versus 'discrete' in nature. The intimate interplay and cross-fertilization between the new physics and psi research does stem from the long duration "seeping" of quantum ideas into the field of parapsychology over the decades, but its timing and route of entrance coincides with the influx of still newer ideas in both quantum theory and relativity dating from the 1930s and thereafter.

While physical concepts such as the 'tunneling effect,' the possibility that 'hidden variables' might lead to an extended quantum theory, the existence of virtual particles and the discovery of neutrinos and other esoteric particles added to the pantheon of physical phenomena, these new concepts also became fodder from which new physical theories of psi could be constructed. The new philosophical views of physics which emerged from these debates introduced yet another quantity into the equation, thus precipitating a greater influx of physics into psi research. For the first time since the early seventeenth century when René Descartes inexorably severed mind from matter, the newest concepts of the 'new physics' returned human consciousness to the study of physics. Consciousness became as important in the newest concepts of physics as the concepts of matter and 'matter in motion.' Consciousness seems to have proven itself necessary as a fundamental ingredient in explaining the nature of physical reality.

According to the accepted philosophical interpretation of quantum mechanics, interaction with a consciousness is necessary to collapse the wave packet and thus establish physical reality. The reintroduction of mind into physics through this utilization of consciousness was fortuitous for psi research, which also drew correlations between mind, in the form of psi, and matter. Before quantum physicists and philosophers came to this conclusion, psychologists, psychiatrists, brain physiologists and occasionally biochemists conducted the majority of studies in consciousness, but consciousness studies now entered the realm of pure physics via the quantum theory. Psychologists and physicists began communicating in the same terms about the same things, so a large part of the theoretical portion of parapsychology is evolving into paraphysics. This does not mean that paraphysics supplanted parapsychology in any manner, but instead it has become evident that the two fields should complement and supplement each other in the study of psi.

Baron Albert von Schrenck-Notzing had coined the word ‘paraphysics’ more than a century earlier, but it had seldom been used during the previous half century. Certainly, parapsychologists would not have thought it necessary to use the term, even when they were building physical models or theories of psi, because they were still within the field of parapsychology. Nor would physicists have used the term since the few physicists who conducted psi research considered themselves to be working in parapsychology rather than physics. If anything, the term was corrupted by non-scientists who misused the term to account for all types of psychic, supernatural and occult phenomena, which are beyond the scope of psi. Psi itself was considered a parapsychological or psychological phenomenon rather than a physical phenomenon in spite of the attempts to develop a physical theory of psi. Yet in 1967, E. Douglas Dean, an engineer and president of the Parapsychological Association, mentioned and defined paraphysics in the annual presidential speech before the Association. After 1970, the word began appearing on a more regular basis. To offer a few examples, John White's 1974 book *Frontiers of Consciousness* included a section on paraphysics and Edgar Mitchell's 1974 book *Psychic Explorations* contained two articles on the "Emergence of Paraphysics as a Natural Science" as well as numerous articles that documented purely physical studies in psi without mentioning paraphysics. White and Stanley Krippner published *Future Science: Life Energies and the Physics of Paranormal Phenomena* in 1977. This book was filled

with articles on the physics of psi, rather than just the mental or parapsychological aspects of psi. The sudden and often appearance of the word can be used as a barometer of the changing attitudes toward physical research on psi. Other books, such as Andrija Puharich's *The Iceland Papers*, were purely physical in their dealings with psi, but did not use the word paraphysics.

However, there was some backlash from parapsychologists on this new development. In his review of Mitchell's book, J.G. Pratt wrote that

> **The claim that paraphysics is a new field of science seems to be based upon the existence of unsolved mysteries about the living organism and the hope that modern electronic technology will allow science to move more rapidly in directions in which progress until now has been very slow. (Pratt, p.69)**

As one of the foremost parapsychologists, Pratt might have felt a bit threatened by the thought that physics could take over his science. Yet it seems more likely that he was neither completely aware of the trends in physics which had been slowly seeping into psi research nor their consequences. Physics had always maintained an important, if not unrecognized, place in the study of psi, but the relevance of physics to psi research had also been increasing at a steady pace. Pratt even admitted this fact a few years later in an article on "the future Einstein for parapsychology." Einstein was the paramount icon of a physicist and the use of his name implied an intimate connection between psi and physics. Yet Pratt still qualified his opinion on any use of physics to explain psi.

> **I am among those who are skeptical that the solution to our most basic problems will be found in terms of quantum physics or field theory (in any sense that physicists would recognize today as relevant to their own scientific thinking). Parapsychology is not identifiably on the frontier of physics. And psi phenomena are not, in any useful sense of the word, "physical." (Pratt, p.142)**

Although it may sound as if Pratt did not think that physics was of any use in developing a theory of psi, Pratt was not denying the connection between physics and psi. Instead, he was giving a tacit recognition of the fact that physics, at least that portion of physics of which he had knowledge, was not up to the task of explaining psi.

It is questionable whether Pratt was even aware of all the most recent advances in physics when he made this statement in 1974. He went on further to state that

> **In this search (for explanatory principles) we are no more compelled to equate psi processes with known physical operations of either the classical or nuclear vintage than atomic physicists are compelled to explain their findings in terms of Newtonian principles. (Pratt, p.143)**

Perhaps this statement would be more valuable and accurate had a physicist made it, but Pratt was no physicist and he seems not to have known what physics was all about. The Newtonian principles of which he spoke are still perfectly valid and no physicist could accurately claim that they are not. Every physicist knows that it is necessary to show that any new theory of physics is compatible with Newtonian theory, at least as a limiting

case, because Newtonian theory still works for much of physics. Besides, physics had changed in the twenty years preceding Pratt's conclusions along lines that were already becoming evident to others if not to Pratt. So his statements must be taken with a grain of salt.

John Beloff, another parapsychologist, who considered the possibility of a physical theory of psi, but then rejected that possibility, supports Pratt's view. He noted that two questions often arise in parapsychology:

> **A question that constantly arises is where parapsychology rightly belongs in the array f the sciences. More particularly, could parapsychology be subsumed under physics, either as it exists or as it may yet become? (Beloff, p.2 of 9)**

In answer to these questions he considered the merits and otherwise of several of the physical theories that had been presented to that date, 1979.

> **What, then, are we to say about the so-called paranormal phenomena which are our special concern on this occasion? Are they the exception to the rule? Or are they anomalous in a provisional sense only, so that, after another revolution or so in science, they will cease to quality as paranormal and instead will take their rightful place in the natural order? Until recently I would have said that a case could be made for either point of view. However, I have come increasingly to the conclusion that the possibility of a physical explanation of psi phenomena is not just doubtful, in the sense that all the existing candidates look so unpromising, but is, from the very nature of the case, an absurdity that can be ruled out on *a priori* considerations. I am not alone, of course, in holding this view; for one thing most scientists who reject the parapsychological evidence do so primarily because they see no way of reconciling it with physical theory. However, my position is, in a sense, the reverse of theirs: they assume that what cannot be explained in physical terms does not exist; I believe that since psi phenomena do exist not everything in nature can be explained in physical terms. (Beloff, p.2 of 9)**

Beloff has not only rejected the pursuit of physical theories, but has emphatically rejected the possibility, *a priori,* that psi is physical in any sense. The very possibility that psi could ever be considered a physical quantity, even given advances in physics, has been reduced to an "absurdity." Seldom, in the history of science, has one individual been so grossly biased as to cut off any area of research for all of time.

In spite of these opinions, there is now ample evidence to demonstrate that a new era of psi research has evolved since 1970, that this new era is oriented toward physics as much as it is toward parapsychology and that the field of paraphysics is alive and under constant, if not slow, development. Simple evidence of this change of attitude in psi research can be found in a statement by Roll, also a parapsychologist albeit one who had developed his own physical theory of psi. In the 1975 introduction to his thesis *Theory and Experiment in Psychical Research*, originally written in 1959, he stated that he sometimes thought that it would have been better had he been trained in physics. Such training would have undoubtedly been helpful in developing his own physical theory of psi. He was convinced that "psi phenomena are field phenomena in the physical sense of the word" and they only seemed to be paranormal because they are "the effects of causes

which cannot be experienced in normal or ordinary states of consciousness." (Roll in Foreword to the Arno Edition).

Roll's conviction that psi is basically a physical phenomenon is further supported by Brian D. Josephson, a Nobel Laureate physicist, who so ably assessed the situation more than a decade later. In rebuttal to a critic of Robert Jahn's published claim that psychokinesis does exist, Josephson stated that "psychic phenomena may be both consistent with physics, and conceivable in rational terms" and, as a corollary, "that many of the experiments on the paranormal may be measuring genuine phenomena, which it would be the goal of science to try and understand." (Josephson, 1992, p.15) These statements were published in *Physics Today*, a mainstream scientific journal. Several years later, he and Jessica Utts spoke more to the point of what psi may be.

> **What are the implications for science of the fact that psychic functioning appears to be a real effect? These phenomena seem mysterious, but no more mysterious perhaps than strange phenomena of the past which science has now happily incorporated within its scope. What ideas might be relevant in the context of suitably extending science to take these phenomena into account? Two such concepts are those of the observer, and non-locality. The observer forces his way into modern science because the equations of quantum physics, if taken literally, imply a universe that is constantly splitting into separate branches, only one of which corresponds to our perceived reality. A process of "decoherence" has been invoked to stop two branches interfering with each other, but this still does not answer the question of why our experience is of one particular branch and not any other. Perhaps, despite the unpopularity of the idea, the experiencers of the reality are also the selectors.**
>
> **This idea perhaps makes sense in the light of theories that presuppose that quantum theory is not the ultimate theory of nature, but involves (in ways that in some versions of the idea can be made mathematically precise) the manifestations of a deeper "subquantum domain". In just the same way that a surf rider can make use of random waves to travel effortlessly along, a psychic may be able to direct random energy at the subquantum level for her own purposes. Some accounts of the subquantum level involve action at a distance, which fits in well with some purported psychic abilities. (Josephson and Utts, 1996, p.2 of 3)**

From these statements, it should be quite clear that physics and psi are intimately related, and it is the belief of these scientists that a final explanation of psi will come through physics. A new period of scientific inquiry would thus seem to have dawned.

This new era is characterized by more intensive physical studies of psi, more physicists conducting basic research to find the physical properties of psi, new organizations dedicated to the physical study of psi phenomena and the development of physical theories by physicists rather than parapsychologists. Within the community of parapsychologists, the changes in attitude tend toward more theoretical work and a decline in experiments whose sole purpose lay in proof of the existence of psi. In either case, or discipline, the study of psi has evolved to the point where discovering the properties of psi and the physical and mental conditions by which it manifests now take precedence over experiments of proof.

The physicist Gerald Feinberg has suggested that two questions can be asked concerning any relationship between physics and consciousness. "What is the range of consciousness in the universe?" and "How is consciousness related to other aspects of the world?" (Feinberg, p.22) Although he is neither a parapsychologist nor actively conducted psi research, at the time Feinberg was at least open-minded enough to accept the possibility of psi. He assumed a link between consciousness and psi in considering these two questions and then reasoned that if psi phenomena are real, they may help in understanding the relationship between consciousness and the material part of the universe, which is the primary concern in physics. These considerations brought him to a conclusion regarding the direction the psi research should take.

> **I believe it would be appropriate for researchers to emphasize detailed studies of psychic phenomena rather than to concentrate on further efforts whose primary purpose is to convince others that the phenomena exist. I have two reasons for believing this. One is that a bare statement of the existence of a phenomenon is much less useful than statements about its detailed properties and its relations to other phenomena. Also, my impression is that scientists are much more likely to believe that something is real after its properties have been studied and delimited in this way, so that the strategy I am suggesting might even be a good way of convincing others. My other reason for proposing this strategy is that only by obtaining detailed information can we hope to answer questions of the sort that I raised earlier. (Feinberg, p.24)**

Feinberg proposes no less than a conditional acceptance of psi so that the time and efforts of scientists will not be wasted on a continuing to search for 'proof' of psi. Science could then concentrate on determining the physical properties of psi. Although he has not so stated, this course of action implies that a physical theory of psi is the next logical step in the process of psi research. Finding the physical properties exhibited during psi events will automatically lead to hypothesis making to explain the properties. The theory building that follows is a necessary step for physicists to accept psi. The very fact that Feinberg is willing to make such statements is a testament to the changing attitude of science toward psi. His statement also contains the implication that science will not totally accept psi in the absence of clear-cut proof that it exists until its theoretical basis is established. Like Feinberg, there are other physicists who are willing to accept the possibility of psi under these or similar conditions, but will go no further at this time. Within the framework of this new open attitude, several classes of theories have emerged. Electromagnetic theories of psi are still valid as are hyperdimensional, field and plasma theories, but new theories utilizing the existence of esoteric particles and/or quantum mechanical principles have also evolved. Other theories based on branching universes and alternate universes have also been proposed. Except for the branching universe hypothesis, which is an extrapolation from the quantum theory, all of these theories are either based on, or in some manner related to, field theory or quantum field theory.

A. Modern electromagnetic theories of psi

Electromagnetic theories may be the most contentious as well as the oldest class of psi theories, since they have been so effectively criticized from a scientific point of view. Yet, despite all of the difficulties and criticisms that they have faced in the past, attempts to explain psi using an electromagnetic framework are still being made at a higher level of sophistication which is harder to refute. Using the formulas of a standard communication theory, which entails a coupling of modern electromagnetic theory and modern information theory, I.M. Kogan has suggested "with a suitably devised formula we can posit a hypothetical wave yielding a 'telepathemic bit' (i.e. a binary psi unit) of information of specified duration at a specified temperature." (Chari, 1977, p.811) His theory not only reflects advances in electromagnetic theory, but it also reflects more recent advances in computer technology, terminology and attitudes toward the process of thought itself. This idea is intriguing since there is a definite transfer of information during ESP events, but it sheds no light on PK phenomena. Signal strength may decrease as the square of the distance from the source of an electromagnetic wave, but information loss does not depend on signal strength. This notion helps to support Kogan's theory as well as all electromagnetic theories of psi since it negates the emphasis that has been placed on the criticism that signal strength decreases too rapidly to support psi action. Kogan admits that his theory holds only over short distances, but there may be options or conditions under which it could be extended to longer distances.

Kogan's was not the only recent theory to make use of ELF (extremely low frequency) electromagnetic waves. There is a rule of thumb in physics that the most effectively absorbed waves have nearly the same wavelength as the size of the absorber. The waves produced by the human brain are about ten centimeters long and the brain has a cross-sectional diameter of roughly the same measurement. This would correspond to electromagnetic waves of extremely low frequency. So ELF waves seem to represent the ideal measurable physical quantity for interacting with the human brain producing psi. However, another factor has been completely missed by both the theorists and their critics. While the maximum amount of energy is absorbed from waves of this wavelength, small amounts of energy can be absorbed from waves of all wavelengths, with the amount of energy physically absorbed falling very rapidly the further the wavelength is from that of the ideal. ELFs already carry very little energy since energy is dependent upon frequency. Higher energy waves may not be as well absorbed, but since they have higher energy to begin with there may be an optimum value of energy that can be absorbed from waves of not quite so ideal wavelength. With the common radio, you can use an antenna of any size and still pick up all frequencies, even those that do not correspond to the antennas length, if you have a proper tuning circuit. So perhaps the brain contains a special tuning circuit, or acts as a tuning circuit itself, which can detect and interpret all electromagnetic waves. This idea is merely speculative, but it demonstrates that there is more to the electromagnetic theories of psi than most would care to admit.

In 1979, Michael Persinger added a new element to the ELF argument. He noted that ELF radiation is also emitted during geomagnetic disturbances, lightning and other natural processes. Since these ELF waves are natural, various forms of information could be imprinted on the common ELF background by the brain. Those who are especially sensitive such as telepathic agents could read this impression. Like other electromagnetic theories of psi, this particular theory suffers from clear-cut problems. For example, it "lacks plausible mechanisms and does not seriously address real psi expressions." (Rush, p.380) However, it does have predictive power and some predictions made by Persinger seem to have been validated. (Mishlove, p.309)

The physicists J.A. Wheeler and Richard Feynman have advanced a more sophisticated “absorber” theory of electromagnetic radiation. In this model a mixing of both 'advanced' (future) and 'retarded' (past) potentials was introduced. Feinberg and I.J. Good (Good, p.152) have hypothesized that the 'advanced' absorbers dealing with the future are not all canceled, thereby establishing a physical framework in which precognition is possible. Such a hypothesis has some experimental as well as cosmological support. However, the absorber theory is not a theory of psi, but of pure physics, and none of these physicists has conducted research on psi. It is not a theory of precognition nor does it say anything about other ESP or PK phenomena. So this idea can only account for a 'possibility' or 'framework' in which precognition may exist. The "absorber" theory represents one of the new discoveries in quantum field theory which readily lends itself to a hypothesis on the workings of psi. The origin of a psi hypothesis based on this "absorber" theory is unknown, but is seems to have been first mentioned by Chari in 1974. There are similar analogies and speculations based on recent advances in physics that have not been developed as theories, but remain as mere suggestions how a theory might proceed. The practice of stating such analogies denotes a cautionary approach by physicists and other scientists to psi who are still skeptical about psi.

Several decades earlier, Dobbs postulated a second time dimension to show the possibility of precognition, but Harold Puthoff and Russell Targ, in a similar theory, explain precognition with a single time dimension. They propose that "significant events create a perturbation in the space-time in which they occur, and this disturbance propagates forward and, to some small degree, backward in time." (Puthoff and Targ, p.526) Since the wave propagates both forward and backward in time, the theory is similar to Feynman's "absorber" theory as well as Good's theory of precognition. However, Puthoff and Targ's model is relativistic within a space-time framework rather than quantum mechanical. An event will not be a completely instantaneous occurrence in time but will extend backward and forward from the moment of occurrence in the direction of both negative and positive time. If an observer is close enough in time to the event, approaching the event as in his or her future, than that observer can become aware of the negative time extension of the event and thus precognize the event. This time extension of the event will be larger the larger the "magnitude" of the event for the observer, and fall off as the temporal distance from the event increases.

This theory should be open to many criticisms, but only a few will be sufficient here. To begin with, what determines the "magnitude" of the event to the observer? In

order for the "magnitude" to be determined by the observer, the observer must cognize the event before he precognizes the event, since the precognition must depend upon the "magnitude" of the event for the observer. What is the "magnitude" of the event? If the "magnitude" of the event means the meaning or consequences of the event for the observer, then the observer will not only have to precognize the event to evaluate its "magnitude,' but will also have to precognize the effects and consequences for which the event 'was' the cause. Also, how can the "magnitude" fall off the greater the temporal distance from event? This could possibly mean that there is a time rate of change in the temporal direction. This would be either nonsensical or suggest a higher dimension of relative time, a super-time, also be postulated. These considerations, among others, seem to make this theory untenable. Yet the fact that this theory raises questions is not grounds to reject it. The theory is still valid as a simple model and the fact that it closely resembles other models lends it some small amount of credibility.

M. Ruderfer handles precognition in a different manner. In 1973, he further elaborated upon the electromagnetic theory by the addition of neutrino and tachyon interactions with electromagnetic waves. Igor Shishkin, a physicist in the Soviet Union, advanced similar ideas in the late 1960s. In what Ruderfer terms a "phasor-neutrino derivation," neutrino interactions are used to explain ESP and PK, while tachyon-neutrino-tardyon interactions explain precognition. Neutrinos are particles with proper (or rest) mass of zero, which very nearly defy detection and travel at or near the speed of light, while tachyons are purely hypothetical particles with imaginary masses traveling beyond the limiting speed of light. On the other hand, tardyons are normal particles which travel below the speed of light as described in special relativity. There are so many neutrinos in the universe that they are quite common, a fact which would seem to make them ideal for psi transmission. However, they don't normally interact with matter. They seem to have no mass and are uncharged, so they seldom interact with ordinary matter. For example, the vast majority of free neutrinos would travel completely through a planet without interacting with the planet's constituent particles.

Neutrinos are so difficult to detect that their properties have not been completely determined and a debate concerning the possibility that they might actually have some small mass is currently being waged. Their elusiveness makes it highly unlikely that neutrinos could interact in any manner that would allow them to pass information to the brain for psi stimulation. Chari also argues against this theory of precognition by questioning if neutrinos can ever cross the 'barrier of the future' (travel faster than light) and noting that tachyons exist only on a speculative basis. Tachyon interaction with our tardyon universe has never been detected. (Chari, 1974, pp.1-2) Since the existence of tachyons is merely speculative, this and similar theories may eventually prove useful if the existence of the hypothetical particles is ever confirmed, but at present they raise more questions than answers. The same can be said of neutrino theories of psi, but for different reasons, even though the existence of neutrinos is well established. "While a neutrino theory of ESP cannot be positively falsified or verified at present, we must entertain many misgivings about it." (Chari, 1977, p.811)

B. Field theories of psi

Like the electromagnetic theories, hyperspace theories of psi have also weathered the changes in physics. In fact, they are more popular with scientists than ever before. The first such theory during this new era was offered by Gertrude Schmeidler in 1972. She used a model of "topological folding" in which she contended that our four-dimensional space-time continuum was somehow folded on itself. Distant points or events in space-time are actually quite near for any signals that could travel out of our physical space-time envelope, from one fold to another. If psi could travel unhindered between folds, then ESP and other such phenomena could be easily explained. Several basic and unstated assumptions are hidden in this theory, the first being that our four-dimensional space-time must be embedded in a fifth dimension for such folding to occur. This assumption may not be so far-fetched as one might imagine in light of the latest theoretical advances in physics. Einstein abandoned physical theories utilizing this concept during the 1940s, but other scientists continued to develop the notion. In the late 1970s, the Kaluza-Klein five-dimensional theory again gained popularity and now many physicists theorize that as many as ten dimensions are needed to explain the various phenomena that are evident on the quantum scale. Within this context, Schmeidler's notions are not so radical as they might seem at first glance. However, she provided no explanations, in the form of mechanisms, of how signals could travel between different points in space-time beyond exiting and reentering different folds.

The primary difficulty with any hyperspace theory, whether of pure physics or psi, is our inability to sense or otherwise detect the extra dimension or dimensions. Current theories postulate that the fifth dimension is compactified or curled up in a cylinder of nearly infinitesimal width, which circumvents any normal physical detection. The overall extension in the fifth and higher dimensions shrunk to such small sizes during the "Big Bang," giving our four-dimensional space-time its present characteristics while guaranteeing that the higher dimensions can only be detected at extremely high states of energy. The enormous amounts of energy needed to detect the higher compacted dimensions are at present and for the foreseeable future unobtainable. In spite of such difficulties, the hyperspatial/hyperdimensional theories do have a potential for explaining psi. The most obvious advantage comes by way of the fact that these theories utilize a space-time model in which time acts as an extended dimension similar, after a fashion, to our normal spatial dimensions. This model thus allows an easy explanation of precognition in that precognitive events reduce to the same explanation as ESP phenomena. This particular advantage of the space-time model has already been used by other theorists of psi such as Dunne, as well as physicists and philosophers within a purely physical context.

Karl A. Brunstein has given the arguments supporting a hyperspatial theory of psi. In 1979 he published *Beyond the Four Dimensions: Reconciling Physics, Parapsychology and UFOs,* which essentially offered philosophical support for a five-dimensional explanation of psi and linked psi to the observation of UFO's. The debate over UFO's is beyond the scope of this paper since they do not represent a specific psi

phenomenon. They are mentioned here solely because of Brunstein's theory. Brunstein accepts the reality of both psi phenomena and UFO's as a working hypothesis. By so acknowledging them, he can use their known and suspected properties to theorize on their explanation. In the case of psi, he states "ESP phenomena can today be viewed as quite firmly, if not yet comfortably, scientifically established." (Brunstein, p.150) He further believes that paranormal phenomena are "indicative" of an "extradimensional force" which can "relativize and distort space and time" in a manner that could be expected to account for psi phenomena. A physical force is needed to bind our normal three-dimensional space with the time dimension. Brunstein identifies this binding force as electromagnetism. By analogy then, a fifth dimension would necessitate another force to bind it to our normal four-dimensional space-time continuum.

> **What is connoted is that if this fifth dimension is to be tacked onto the other four, orthogonally or otherwise, it - like time - requires some kind of associated force, or effect, to go along with it, for basic definitive, dimensional, and normalization purpose.**
> **... For want of a better term for it, and for largely historical reasons, we dub this unparalleled kind of force and its effects "extrasensory." (Brunstein, p.150)**

This new "force" is structural and it is first identified as "extrasensory." We only sense physical events within our space-time continuum. Therefore, anything that exists outside of that continuum is beyond our normal ability to sense it, and thus "extrasensory" by definition.

Although he dubbed this new physical quantity a "force," Brunstein qualifies his use of the term, but not until he related his "force" to UFOs and other types of paranormal phenomena which are not related to psi. Brunstein eventually identifies his new "force" with consciousness itself.

> **In man, we found ultimately the manifestation of *another* natural force, a new force - an uncomformable kind of force. We call this new force finally "consciousness," or "intelligence." Just as with the four physical forces, the new force springs directly from matter. It springs from discrete lumps of it we call "human." This new force, as the others, manifests itself by effecting physical changes within reach of the material lumps that form its seat. Sometimes these changes can be vast. Again, this is just as with the other forces.**
>
> **We say the new force is "unconformable" because it does not fit the accepted definition of a physical force; that is, it cannot be equated to a product of mass times acceleration. In this sense, it is in the physicist's neat world most definitely not a force. (Maybe *force* is not the best word to describe it, but the parallel is otherwise good, so we continue.) Yet its ability to accomplish purely physical change is, in certain cases, clearly an important aspect of nature. Also, this ability to effect events physically clearly touches upon the central feature of the concept of force.**
> **It is in this one important respect, however, a force entirely transcendental to those of the *F=ma* variety: Consciousness (in its ordinary, everyday function of which we here speak) operates essentially through the *agency* of the other four forces. That is, through the discrete lumps of matter we call "human," consciousness operates by directing the roles the other four forces play in the subsequent unfolding of natural events. (Brunstein, pp.197-198)**

This particular identification of consciousness with the fifth dimension is unique, but not unprecedented. The derivation by Brunstein follows a pattern established many decades earlier by Charles Hinton, Robert Browne, and several others who have associated consciousness with the fifth dimension. Brunstein's concept is unique and different from these others in that he quantifies consciousness as a binding "force" of sorts and thus relates it to physics. In other words, Brunstein more 'forcefully' binds (please forgive the obvious pun) the concept of consciousness and thus psi to physics.

While Brunstein's derivation is philosophical and qualitative, a problem facing nearly all of the physical theories of psi, Saul Paul Sirag has proposed a more precise mathematical model relating consciousness to hyperspace. Sirag proposes that our physical reality is only a "subrealm of a larger reality" in which all physical forces are unified within a hyperdimensional structure. Using Wigner's interpretation of quantum mechanics whereby consciousness "projects the state vector onto the eigenvector" during the act of measurement, the non-locality expressed in Bell's theorem suggests the existence of a "universal consciousness." (Sirag in Mishlove, p.329) This consciousness can be represented by a mathematical structure known as a "reflection space." While mathematical reasoning cannot choose between the number of reflection spaces that can be used to represent the "universal consciousness," physics can. The particular reflection space that Sirag envisages "exists in the intersection of the McKay group algebra and the Lie algebra." (Sirag in Mishlove, p.341) In fact, it mediates between these two algebras and is therefore identified with the "universal consciousness."

The physical characteristics of our reality and the causal affect of consciousness on that reality indicate that an "E_7 reflection space C^7" offers the correct mathematical model of the universal consciousness and physical space. This reflection space is subject to analysis by the McKay group to yield physical reality and by the Lie group to yield mental reality. The "universal consciousness" which evolves from the intersection of the two, an analysis by both algebras, is a superstructure of which our individual consciousnesses are a small part. It is implied that psi events will eventually be explained via the interaction of the individual consciousness with the "universal consciousness." There is certainly a potential for such a model of psi. Sirag's theory is quite complex and highly technical, so any verdict on its validity is far from concluded.

Bob Toben and Alan Wolf have taken yet another path to relating hyperspace and consciousness. If anything, their theory is disjointed as presented in the 1979 book of hand drawings entitled *Space-Time and Beyond*. The theory is more a list of statements than a coherent and logical explanation of either psi or consciousness. In their own manner and after their own style, they state that consciousness is hyperspatial, beyond normal space-time, while normal space-time follows the physical model presented in general relativity. The four-dimensional space-time continuum is itself constructed of quantum foam, which is linked to consciousness via gravity (curvature in a higher dimension), while gravity is the "master field." "Vibrations of thought patterns in specific harmonics structure all 'matter' and light as we experience it" (Toben, p.61) and the human mind acts as a "filter" which focuses our thoughts on specific physical events. (Toben, p.62) Psychokinesis is an effect of consciousness influencing energy/matter

fields (Toben, p.67) while ESP or telepathy occurs when signals travel through "wormholes" in "the sea of space." (Toben, p.78) Living beings generate "biogravitational" fields, which allows them to manipulate space-time curvature to various ends. It is through this manipulation, carried out by consciousness, that other paranormal and psi phenomena are manifested. Therefore, the higher a being's consciousness, the better the being can utilize consciousness to affect psi. Toben further postulates many higher levels of consciousness than humans have yet imagined or detected.

Toben came to these conclusions in conversations with certain "visionary physicists," in particular, Fred Wolf and Jack Sarfatti. Sarfatti authored the "Scientific Commentary" portion of Toben's book, which is itself more informative and complete than Toben's efforts. He relates Toben's ideas to the previous work of other philosophers and scientists and describes psi processes more exactly, although they are still not rendered in a quantitative model. In the case of telepathy, Sarfatti's explanation is only slightly more forthcoming than Toben's.

> **Telepathy can be understood as messages traveling through biogravitational wormholes of space-time within a given universe. The wormhole connections constitute only one possibility for a cosmic "telephone" network. In addition, the "feeling" or tachyonic model of gravitation that breaks through the wall of light also accounts for telepathic communication. In either case, the strength of telepathic communication should not be affected by distance. (Sarfatti in Toben, p.154)**

Sarfatti has also suggested a second possible method of telepathic communication based on the hypothetical existence of tachyons. Such an uncertainty of explanation further renders this 'theory' as tentative. His explanation of other psi phenomena is no more enlightening.

> **I believe the gravitational distortion of space and time predicted in Einstein's general theory of relativity provides a possible scientific explanation of precognition, retrocognition, clairvoyance, and astral projection, provided we accept the additional postulates that individual consciousness can alter the biogravitational field of a living organism and that the biogravitational field distorts the local subjective space-time of the conscious observer. Thus, a participator in a high state of consciousness can artificially create blackholes and whiteholes in his local biogravitational field. This would produce very high curvatures leading to very large distortions in his local subjective space-time environment. I conjecture that distortions can be manipulated in such a way that the rate of time flow at the location of the participator does not match the corresponding rate of time flow at the object being observed and influenced (either inside or outside the light cone). The differential in the time flows of participator and object can in principle be so adjusted that the participator working within his local light cone 'sees" into the probable future or past of the object (that is, he samples universe layers). This is the likely biogravitational mechanism for precognition and retrocognition. The participator can also make use of the tachyonic "feeling" modes of the biogravitational field that act outside the light cone. In this way he can transmit at a distance actions of the type reported in experiences of astral projection and clairvoyance. Astral projection would be an active function and clairvoyance a passive function of the tachyonic mode of the biogravitational field. (Sarfatti in Toben, p.153)**

The main problem with this speculation can be found in the fact that no real quantitative information is given regarding either the biogravitational field or how it is capable of manipulating space-time curvature. The same is true with Sarfatti's explanation of psychokinesis.

> **The possibility of psychokinesis flows immediately from the postulate that consciousness controls the biogravitational field, which in turn interacts with the ordinary gravitational field of Einstein. It is related to the cosmic bootstrap picture in which the biogravitational, atomic, and nuclear resonances (levels of organization) in the response of the turbulent sea to gravitational waves codetermine each other.**
> **Specifically, I suspect that the tachyonic action of the gravitational field (reviewed by Sciama, see note F) can be connected with the quantum potential (discussed by de Broglie and Bohm). The quantum potential exerts quantum forces that act in addition to the more familiar electromagnetic forces.**
> **The stability and strength of matter depend on the interplay between the quantum and electromagnetic forces. For example, quantum tunneling of a particle through an electromagnetic energy barrier occurs because the quantum force momentarily cancels out the electromagnetic barrier. If consciousness controls the biogravitational field and if there is a significant coupling of biogravitation to ordinary gravitation, then there is a direct contribution of consciousness to the quantum potential. (Sarfatti in Toben, p.151)**

No real mechanisms or physical processes have been offered to support this theory.

The very concept of a biogravitational field is not new with the work Toben, Wolf and Sarfatti. Alexander P. Dubrov first suggested biogravity in 1973 as a “field-energy system”. (Dubrov, p.231) It could be transformed into any type of field or energy, a feature that he developed as the cornerstone of unified field theory of the future. This field was thought to exist in all living beings, but especially in humans. It was called biogravitational because its properties are akin to both living organisms and gravitation. Dubrov suspected the field played a role in such biological processes as cell mitosis as well as physical processes such gravitational waves. Between these two extremes came biological effects of the whole organism such as "psi photography and levitation." (Dubrov, p.234)

Dubrov spelled out the properties of the biogravitational field rather explicitly. They represented a combination of biological and gravitational properties.

> **(a) They must act at close or long range; (b) they can be directed and focused; (c) they can be positive or negative (and cause attraction or repulsion, respectively); (d) they can carry information; (e) they are able to convert the energy of the field into matter with weight; (f) a field of such forces can persist in the absence of the source which originally gave rise to them; (g) they can undergo transition into any form of field and energy; and (h) they are closely bound up with change of symmetry groups and with distortion of space at the submolecular level of biological structures. (Dubrov, p. 234)**

Biogravitation suffers from the same severe problems that plague other theories. In spite of this detailed list of properties, the theory is admittedly qualitative and lacks

mechanisms or processes to accomplish the stated results. These properties simply beg for an explanation and further clarification before any use can be made of this theory.

Like similarly invented entities, such as bioplasm and biomagnetism, biogravitation is a quantity that was invented merely to describe psi and other paranormal phenomena. It is always dangerous to invent hypothetical quantities to explain hypothetical circumstances. This theory is the product of "representatives of the exact sciences - engineers, mathematicians and physicists" in the Eastern block countries who entered the field of parapsychology during the late 1960s without any special training in parapsychology. (Zinchenko, p.549) As a biophysicist, Dubrov had some qualifications to develop such a theory, but claims such as levitation are quite beyond the norm in parapsychology. According to Chari, such theories "seem to be cast in a holistic framework (the anomalous effect shows not in the individual living cells, but in the organism as a whole) and remain obscure for even the limited purposes of experimental testing and replication." (Chari, 1977, p.807) In other words, it is quite unlikely that Dubrov's biogravitational theory can be confirmed. Whether Toben and Wolf based their hyperspace theory on Dubrov's earlier work is unknown, but there are certainly similarities between their concept of biogravitation and Dubrov's. However, the work of Toben, Wolf and Sarfatti has still more problems than this dubious association.

Toben's theory represents too many things to too many people. While the theory is all encompassing and broad enough to cover all sorts of paranormal phenomena, it does more to fit all types of claimed phenomena to speculations and theories in modern physics then to explain psi works. It is too general and not specific enough. In one sense, it is necessary to relate Toben's theory to other purely physical theories since any theory of psi must ultimately prove compatible with accepted laws of nature and the theories that express these laws, but in another sense it is bad. While Toben and Wolf's theory seems to be a unified theory of the four fundamental forces (or interactions) of physics, it also appears to be more of a philosophical argument derived from relating seemingly unrelated worldviews and physical theories to each other. Sarfatti draws analogies to everything from Eddington's fundamental theory to Bohm's holographic universe. These are vastly different theories, which have never proven to be compatible. This in itself is not bad, but he draws analogies to these other theories without specifically showing how they interact with each other or relate to Toben's model. The analogies to other physical theories of unification that are cited by Sarfatti are purely intuitive or qualitative rather than quantitative. Toben's ideas sound good but can do no more to further science until formal quantitative relationships are derived. In other words, this theory loses validity due to its own generality. The one element in this theory that seems to draw all the concepts together is the biogravitational field, yet it has never been discovered let alone defined and measured. The true significance of this model lies in the fact that it offers important hints and clues for future theorists and demonstrates various ways in which psi could be explained using existing physical theories.

Two other hyperdimensional theories are worthy of note. Elizabeth Rauscher in 1977 and Puthoff, Targ and Edwin May proposed these in 1979. Rauscher's theory is simple and elegant, as well as mathematically supported. She contends that our four-

dimensional space-time is only a portion of a larger eight-dimensional space-time. Each of the four dimensions in normal space-time can be represented by a complex number having a real and an imaginary part. Therefore, an imaginary four-dimensional space-time exists alongside our normal four-dimensional space-time. The imaginary space-time acts as a realm for transfers of signals during psi processes and an individual's consciousness "is free to access information in the entire complex space." (Rauscher, p.69)

This model addresses an important problem that plagues many other theories. It has never been adequately explained how energy transfer between remote positions in space-time occurs during the psi process, but this is no problem for an imaginary space-time.

> **Instead of hypothesizing a model which involves energy transmission, and associated problems of energy conservation, we chose to develop a model in which remote information is accessed in four space as though it was not remote in a higher dimensional geometry. The relativity theory formally describes the relationship of macroscopic events in space-time and, in particular, their causal connection is well specified. Higher dimensional geometries appear to reconcile precognition and causality and define a formalism in which the special and temporal separation of events (in four space) appear to be in juxtaposition in the higher dimensional geometry. (Rauscher, p.56)**

In this manner, Rauscher's theory shares some of the same advantages as Bohm's model. In a sense, there is no distance between psi events, at least in so far as distance is measured between points in normal space-time. So the normal laws of physics, such as the limit to velocities imposed by special relativity, need be of no concern in this paraphysical model. Therefore, there is no energy transfer between points in space-time during the psi process.

While a subject's normal senses are limited by his or her location in normal space-time and the normal laws of physics, some type of "least action principle" would still be necessary to govern signal transfer through imaginary space-time. Therefore, it would be logical to conclude that there is a special signal speed in the imaginary realm although that signal speed would not necessarily be the same as signal speed in normal space-time.

> **It is possible that this connecting velocity will be something other than the velocity of light. We might say that the subject's consciousness has a "sphere of influence," in which remote information can be accessed which extends out from S (the subject's position) into the complex eight space. To carry out the function of remote perception involves accessing information from an event, E, from the S' frame of reference. It appears that the least-action principle may apply. Certainly it does for physical systems, and perhaps also for goal-oriented tasks, such as remote perception, which appear to be carried out in the most efficient manner available. Let us assume that this is so and much more elaborate paths in eight space are not utilized unless simpler ones are in some way prohibited. (Rauscher, pp.69-70)**

The application of a least-action principle allows a mathematical model to be developed. Rauscher's model thus offers a mathematical formalism that is missing from other

theories. Also, other areas of physics have successfully used complex numbers to explain physical phenomena, so Rauscher's method is not without precedent. She has taken great pains to relate her theory to other purely physical theories of space-time and thus demonstrate that "the main body of physics" can be used to explain psi. Psi phenomena need not contradict the other results of modern physics as many researchers, theoreticians and scholars contend. The care that Rauscher takes in relating psi theories to the theories of normal physics seems to be unique from other approaches to psi.

The short theory offered by Puthoff, Targ and May also utilized an eight-dimensional manifold and is quite similar to Rauscher's theory. The similarity should be expected since Rauscher acted as a consultant at Stanford Research Institute where Puthoff, Targ and May developed their theory. They also stated that their theory was developed "in conjunction with Gerald Feinberg." (Targ, Puthoff and May, p.100) Their theory is more a suggestion of how an eight-dimensional geometry can be used to explain remote viewing than it is a complete theory of psi phenomena, but it does have the potential to account for other phenomena.

They have made the same assumption as Rauscher regarding the possibility of modeling an eight-dimensional space-time using complex numbers to represent our normal four-dimensional space-time. In the normal Minkowski space-time, the distance between two points is represented by the formula

$$s^2 = x^2 - c^2t^2 ,$$

but in the eight-dimensional manifold the distance between two points is more complicated,

$$s^2 = ss^o = x^2 + x'^2 - c^2t^2 - c^2t'^2 .$$

The primed terms represent measurements in the imaginary part of space-time. These new elements add a special distance factor of s^o to the formulation. Remote viewing could occur when the element t goes to zero and the other terms are fixed so that s also goes to zero. In this case, there would be neither time nor spatial distance between remote physical events. This situation could be explained such that the primed terms are accessible to consciousness only when the separation is not limited by the properties of physical space-time. Using this model, the main task of scientists would become a search for the physical conditions that would give rise to this situation.

The model provides "a geometrical interpretation of the quantum interconnectedness principle, by which events remote in space-time are nonetheless connected by nonlocal correlations or, in this interpretation, by the nature of the space-time fabric itself." (Targ, Puthoff and May, pp.100-101) While this theory of remote viewing has a lot to offer, it needs far more development than is evident in the proposal made in the article by Puthoff, Targ and May. Taken with Rauscher's own theory, the potential of the eight-dimensional model seems a serious contender for a proper physical theory of psi. However, given that these theories were presented nearly two decades ago,

the lack of further work to develop these ideas indicates the lack of success of these theories.

Both the hyperspace and electromagnetic theories are in essence field theories, although the non-field aspects of electromagnetism seem to have been exploited to a far greater extent in the electromagnetic theories of psi so far developed. Modern physics is dominated by either field or quantum theories, which generally reflect different sides of the ancient debate of whether reality (and/or matter) is continuous or discrete. In turn, this debate is intimately related to the mind-matter question. Quantum theory has so successfully dominated physical and theoretical research in the recent past that most attempts at unification were made by explaining fields in terms of the quantum theory, yielding quantum field theories. But renewed interest in relativity theory, the icon of field theories, has allowed attempts to base quantum theory on the field perspective. This was a fortunate happenstance for psi research since many experimental results as well as spontaneous events indicate that psi is a field phenomenon. This fact also bodes well for hyperspatial theories of psi, which are ultimately founded upon one or another form of general relativity after its unification with electromagnetism and the other fundamental forces in several recent theories. Some scientists believe that new advances in physics, especially those dealing with these new unified field concepts, will eventually precipitate a paradigm shift if not a new revolution in physics. Any such revolution in thought would surely be significant for psi research since "consciousness" would have to play a central role in any new theories of physics.

While the hyperspace theories seem to fit the emerging field theoretic worldview, the later theoretical work of Bohm has developed into a "holographic" view of the world that also fits the field view of psi. Bohm's unique worldview evolved from his 1951 work on 'hidden variables.' Bohm came to the conclusion that a new kind of field must exist at the quantum level of reality to completely explain quantum phenomena. This field, which he called the "quantum potential," pervades all of space, but its influence does not diminish with distant like other fields. By assuming the existence of this field, Bohm was able to account for experimental quantum effects as well as interpret quantum mechanics itself in a new manner. Within the quantum potential field, all material particles are non-locally connected in a manner that seems to violate the normal laws of nature. About the same time that Bohm developed this new view of nature, the psychologist Karl Pribram developed a "holographic" theory of the human mind. Bohm then came to the conclusion that his field also had the same characteristics as a hologram. Thus arose the concept of a holographic universe as mind and matter were unified in this newly evolved worldview.

The existence of the quantum potential implied an unsuspected "wholeness" in the universe. Classical physics had assumed that the whole could only be explained by the sum or interaction of its parts, but Bohm concluded that the parts are organized by the whole as represented by the quantum potential field. This idea solidified the non-local interconnectedness of individual material particles in a manner that had not been predicted by either quantum mechanics or classical physics. This view was akin to the simple relativistic view that the position of particles and thus the rate of change of position of particles depended on the other bits of matter scattered throughout the

universe, except that space must have some potential of substantiality (or potential substantiality) that it did not have in the relativity theory. The very concept of location in space disappeared at the level of the quantum potential where all points of space became equal to all other points of space. This interpretation presented yet another view of the concept of non-locality. Within this framework, it was found that distant particles in normal space-time were connected in a manner such that a change of state in one particle would immediately affect a change of state in another particle without a signal passing between them. The immediacy of such twin or coupled changes of state would occur in direct violation of special relativity's ban on communications traveling faster than the speed of light. So, not only did this concept offer an alternative interpretation of quantum theory, but also it resolved the EPR paradox and predicted new experimental results.

In 1982, Alain Aspect and his colleagues performed a series of experiments whose results indicated that signals between separate photons either traveled faster than the speed of light, in violation of special relativity, or were connected in some manner that is not limited by the tenets of normal science. These and other experiments indicate that photons and other particles are non-locally connected in some unspecified manner if not in the specific manner that is indicated in Bohm's theory. While these experiments do not prove Bohm's theory, they at least render it far more credible than otherwise. Aspect's and similar experiments may also support theories where the interconnectedness of particles is an element or aspect of hyperspace. As yet, Aspect's results do not provide a method of testing between the different theories that feature interconnectedness.

The holographic worldview adopted by Bohm at first offered a metaphor for understanding the new level of order within the universe. According to Bohm, this order is not apparent at our physical level of perceiving events and phenomena, but is "enfolded" in the field. So the order behind the probabilistic chaos presented in quantum mechanics, a physical reality that Einstein had suspected beyond the limits to knowledge set by the Heisenberg uncertainty principle, were implied by phenomena and events in our space-time. This is the "implicate" order of the universe. What quantum theorists saw as a wave packet of probability collapsing when an event was consciously observed to yield our physical reality is in Bohm's view an "enfolded" possibility in the "implicate" order that has been "unfolded" and thus made "explicate." Through "unfolding," the "implicate" order becomes part of the "explicate" order, our physically sensed portion of reality. These views were presented in Bohm's book *Wholeness and the Implicate Order* in 1980. The concept of a holograph is static while Bohm's model of reality is dynamic, so Bohm developed the concept of a "holomovement" to describe the flux of "enfolding" and "unfolding" within the "implicate" and "explicate" orders which gives rise to our physical reality.

Within the "holomovement" from which our physical reality arises, space is no longer empty. Space is filled by the superposition of all types of waves and fields while position of material particles in space (the "explicate") remains relative to the position of other particles of matter. Since the observer is part of the system and interacts with all parts of that system at all times, there is no need to speak of consciousness interacting with matter to 'collapse the wave packet.' The observer is the observed, an integral part of

the experiment. Since there is no need for consciousness as part of the interaction of material bodies in the sense defined by quantum mechanics, consciousness is not a necessary part of Bohm's model. However, Bohm still believes that there is a necessity for consciousness as an awareness of the holomovement. Consciousness is then rendered as a subtler form of matter which interacts with normal matter deep within the "implicate" order, rather than when the "implicate" unfolds to create the "explicate," as in the collapse of the wave packet in quantum mechanics. Bohm further suggests that empty space is filled with infinite energy as the result of the superposition of waves and fields, so space has a reality and richness beyond the relative position of the bits of matter that fill it. Space is not an empty void, but a plenum of quantum potential, ripe with energy. The physical universe is a ripple moving through this plenum, Bohm's holomovement, and matter is itself constructed from space.

> **Bohm believes the same is true at our own level of existence. Space is not empty. It is *full,* a plenum as opposed to a vacuum, and is the ground for the existence of everything, including ourselves. The universe is not separate from this cosmic sea of energy, it is a ripple on its surface, a comparatively small "pattern of excitation" in the midst of an unimaginably vast ocean. "This excitation pattern is relatively autonomous and gives rise to approximately recurrent, stable and separable, projections into a three-dimensional explicate order of manifestation," states Bohm. (In *Wholeness*, p.192) In other words, despite its apparent materiality and enormous size, the universe does not exist in and of itself, but is the stepchild of something far vaster and more ineffable. More than that, it is not even a major production of this vaster something, but only a passing shadow, a mere hiccup in the greater scheme of things. (Talbot, pp.51-52)**

Bohm and Pribram's theories lead to some very interesting and controversial conclusions. According to Michael Talbot,

> **Considered together, Bohm and Pribram's theories provide a profound new way of looking at the world: *Our brains mathematically construct objective reality* by *interpreting frequencies that are ultimately projections from another dimension, a deeper order of existence that is beyond both space and time: The brain is a hologram enfolded in a holographic universe.* (Talbot, p.54)**

It has long been argued in the philosophy of science that our brains construct our reality. At the very least, science accepts the view that reality could ultimately prove to be something different from our present perception of it, since the physical nature of our brains limits how we perceive physical reality. Even if our reality is not a construction of our brains, the physical limits of our brains at least bias our perception of reality. Through their development of a holographic worldview, Pribram and Bohm have shed new light on this aspect of the mind-matter controversy. And even this view pales beside Bohm's independent conclusion that "we even construct space and time." (Bohm quoted in Weber, p.73)

This holistic and holographic view of reality offers innumerable avenues for the explanation of psi phenomena. Since consciousness interacts with matter within the wholeness of the "implicate" order, both prior to and after the moment of physical materialization of the present moment inherent in the "explicate" order, every point in

space-time is in contact with every other point in space-time. Everything exists within the "implicate" order, so psi phenomena such as ESP, PK, clairvoyance, precognition, remote viewing are reduced to conscious human interaction with consciousness in the "implicate" order. Consciousness and matter are in direct contact in the "implicate" order and humans need only find how to be aware of that contact to utilize psi. Bohm's theory is purely physical, such that it is not a theory of psi *per se*, but the potential it offers for an application of psi is quite obvious. The application of Bohm's theory to psi phenomena has been documented in Talbot's book *The Holographic Universe* among other publications. Some physicists, such as Russell Targ, who are interested in a physical theory of psi believe that Bohm's theory of the "implicate" order offers the best chance for science to explain psi.

Bohm's theoretical work evolved from quantum theory, but it was based upon a field interpretation of the experimental evidence. In quantum theory, consciousness creates the discrete nature of reality according to the limitations placed on our knowledge of reality by the Heisenberg uncertainty principle, so the background of reality is either directly or indirectly related to, if not a function of, consciousness. Bohm's theory is therefore a hybrid theory which allows a continuous field of a certain type, the quantum potential, as the reality underlying the discrete nature of reality as described by quantum mechanics. Continuity in the hologram supercedes the normal present scientific view that matter is discrete. While matter is discrete in the "explicate" order, it is continuous in the "implicate" order. This view of reality would seem to have important consequences for the physical concept of wave-particle duality, a feature that has been addressed in the scientific literature. The holographic component of reality is completely inanimate in Bohm's view, yet he could not deny the importance of the role of consciousness. So, in the end, he designated a role for consciousness in his purely physical theory. It is through this consciousness that psi enters the theory.

C. Quantum theories of psi

In the meantime, theories based wholly on quantum theory have also been developed; Rush and others have classified these theories as “observational” theories. They are so designated because the role of the observer is crucially necessary to bring about the physical reality described by quantum mechanics. These theories are also intimately related to the concept of consciousness, whether human or otherwise. Within this category, several independent theories have been developed such as those by Evan Harris Walker in 1974, Helmut Schmidt in 1974 and Richard Mattuck in 1977. Robert G. Jahn and Brenda J. Dunne offered further insights along this line during the 1980s. The relative importance of these theories can be discerned in the fact that they are based directly on psi experiments and have themselves led to the development of new experiments. Therefore, unlike other theories, these theories have proven quite popular. There is a good deal of literature on both the experimental and theoretical development associated with these 'observational theories.'

Walker has undertaken the introduction of consciousness into physics in a completely different manner. Consciousness enters physics directly, assuming the Copenhagen interpretation of quantum theory, when measurement causes the 'collapse' of the wave packet. The act of measurement therefore forms a link between the consciousness and the physical world. Walker postulates that "consciousness is a nonphysical, but real, entity, ... Physical reality is connected to the consciousness by means of a single physically fundamental quantity" (Walker, p.547) and notes that "there exists at least one physical quantity that connects the consciousness to the physically real world." This connecting physical quantity cannot be gravitational fields, nuclear forces nor weak interactions because their magnitudes in the brain are too small thus leaving only electromagnetic forces. The electric currents in the brain are extremely localizable and brain waves fail because of superposition so electromagnetic waves are likewise ruled out as connectors. This leaves only the single possibility of association by Schrödinger's wave equation. Here it is found that "consciousness is a nonphysical entity connected to the physical world by means of the state vector for a quantum mechanical process linking the synapses of the brain." (Walker, p.549)

A new variable is introduced that tends to make the system causal thereby representing the consciousness of the observer in the Copenhagen Interpretation. This variable is actually the 'hidden variable' which was introduced by Bohm in quantum mechanics to make the 'collapse of the wave packet' both continuous and determinate. While Bohm passed beyond the concept of a 'hidden variable,' the notion of a 'hidden variable' has still remained popular with some scientists who are not willing to accept Bohm's whole theory. Walker's theory need only make use of the 'hidden variable' without invoking Bohm's greater theory. It has two properties. First, the 'hidden variable' must interact physically only be means of the measurement process, and secondly, Bell has shown that it must be nonlocal in quantum mechanics. Non-locality means that the 'hidden variable' is independent of time and space and is thus not dependent on physical processes while still affecting the 'collapse of the wave packet.' Even though Bohm moved beyond the concept of the 'hidden variable' to his quantum potential, others have not been willing to go so far and still utilize the 'hidden variable' in their own theoretical work. Walker's theory makes use of just this aspect of Bohm's original hypothesis.

The properties of the 'hidden variable' have far reaching consequences because they immediately bring about an explanation of psi due merely to this physical concept of consciousness. Telepathy can be explained as an intersubjective agreement in consciousness or rather a mental act by both the "sender" and "receiver" which constrains the wave packet to collapse into a single state. Therefore, a message is no longer sent telepathically and information is no longer conveyed between two or more people. A "sender" and "receiver" are no longer needed since nothing is "sent" nor "received." Only two or more conscious beings are needed. Since no message is sent, but a future state is being agreed upon at a mental level, no sender is needed and clairvoyance becomes the same process as telepathy and precognition. PK involves the same basic process as clairvoyance, only the selection no longer occurs as a quantum mechanical brain process. Instead, it is an accompanying divergent effect of the relevant physical or energetic

system. All the aspects of psi are due to the properties of the 'hidden variable' that was introduced into physics to explain consciousness.

There are several problems with this theory. The existence of 'hidden variables' is speculative and not universally accepted by the scientific community. Their existence was based upon a need to render quantum theory deterministic and continuous. Many scientists argue that they cannot be "validly and consistently introduced into the postulates of quantum mechanics." (Chari, 1977, p.813) Using them to explain psi therefore becomes tantamount to introducing an unknown physical quantity, which has been a problem for other physical theories of psi. Since psi becomes a side effect of consciousness, questions can be raised whether organisms lacking a central nervous system can exhibit any type of psi and which living organisms are capable of having a 'consciousness.' Although this system seems convenient, in order to test the hypothesis, it becomes necessary to know under which conditions, both physical and mental, this simultaneous collapse takes place. How do two or more people come to an agreement to simultaneously 'collapse the wave packet' and why do only certain characteristic events (traumatic crises) seem to invoke spontaneous ESP? So, despite its simple derivation and explanation, this theory, like others, is also open to many criticisms. On the other hand, it explains a variety of different aspects of psi.

There is another aspect of the 'hidden variable' theories that has not been fully explored. Since the 'hidden variable' theory was first developed by Bohm and later extended, there is a real possibility that Bohm's complete theory is still compatible with Walker's and the other theories based on 'hidden variables.' The criticisms against Walker's theory pertaining to questions of two people acting to collapse a single wave packet would certainly disappear in Bohm's more complete theory. The 'hidden variable' theories may present no more than a limited quantum mechanical interpretation of Bohm's "explicate order." Furthermore, there is also a possibility that Bohm's theory corresponds to a hyperspatial theory as well as Walker's 'hidden variable' theory. The 'hidden variable' theory may be no more than an explanation of a hyperspatial phenomenon in quantum mechanical terms. In other words, a higher dimension or dimensions might provide the 'hidden variables' upon which such theories are constructed.

A novel attempt to develop a mathematical model of psi "which permits a logically consistent discussion of a world with psi" (Schmidt, p.302) rather than establishing a physical theory into the nature of psi was made by Schmidt. His basic concept utilizes a break between psi and physics due to the goal-oriented character of psi in PK tests. Random number generators and computers replace the experimenter and psi sources. The computers are programmed to mimic the properties specified by the 'psi axiom,' allowing Schmidt to electronically duplicate some aspects of PK and ESP. "Psi sources are, generally, devices with a signal input through which the source can be stimulated." The psi-axiom is an equation, $p'/q' = (p/q)$, which states the source at time t. (Schmidt, pp.306-307) It is the key to understanding psi.

In other words, the ratio of probabilities of a 'hit,' on electronically successful telepathic message, p'/q', is the same as the ratio of the probabilities of the message being sent by the psi source, p/q, and their strength, . The 'psi-source,' an electronic random number generator, is set up to act in a way similar to a PK subject while the 'psi-axiom' defines how the experiment can simulate space-time independence. The different forms of psi appear as logical consequences of this single psi axiom within this experiment. The strength of Schmidt's model is derived from the fact that it has "a large number of testable implications and may serve as a useful basis for future theoretical and experimental studies." (Schmidt, p.301) His electronic systems don't actually send or receive ESP messages, just as they don't move objects by PK, but they simulate psi events in a manner that leads to the construction of a mathematical language to describe psi. In other words, by mimicking psi events with a computer, a standard by which real psi phenomena can be judged is established. A major problem with any psi experiment is the corruption of the results by the subjectivity of the experiment and the subjectivity can not be precluded since the experiment depends on the human mind. By contrast, 'scientific' experiments must be made as 'objective' as possible. If psi experiments could be developed in such a manner that the subjectivity could be accounted for, then the objective quantity psi could more accurately measured. The subjectivity, a major problem for most other psi experiments, is thus removed from the psi experiment while the experiment becomes wholly objective.

Mattuck, a Danish physicist, developed his own theory by freely borrowing ideas from Walker. In the 1976 exposition of his theory, Mattuck stated that

> **Since PK phenomena generally resemble those produced by ordinary forces, most of the attempts to explain them have postulated some new type of force coming from the mind. This paper presents a different approach, based on a proposal by E.H. Walker. In this proposal, mind makes use of the energy which is already present in matter in the form of random fluctuations or "noise," reorganizing this energy in such a way as to achieve the desired PK effect. In this work I will not only discuss thermal noises, but the general ideas apply to any kind of random fluctuations. (Mattuck, p.191)**

His theory is based on the notion that "consciousness (or "mind") can influence a physical system directly by utilizing the quantum mechanical fluctuations in the system properties." (Mattuck and Walker, p.112) Consciousness actually selects how the wave packet collapses during any PK event, so that the event takes place as determined by consciousness. Energy to sustain the PK event is taken directly from "quantum fluctuations arising from thermal motions of (local) molecules." (Mattuck and Walker, p.112) The amount of this energy can be calculated and compared to the amount of energy necessary to move or even levitate an object. Mattuck's calculations indicate that enough 'local' energy is available to accomplish PK phenomena on the macroscopic scale, (Mattuck, p.194) not just the sub-microscopic level as in Walker's theory. Since the energy in quantum fluctuations is "uncertain" before the wave packet is collapsed, all mind or consciousness must do is "select" or "reorganize" the "fluctuations in a non-random way so as to produce the PK effect." (Mattuck and Walker, p.114) By utilizing the energy that is available locally, there is no need for an extraneous "force" to transmit

energy from the subject initiating the PK event to the object acted upon under the influence of psi, thus circumventing one of the major arguments against the existence of PK as well as preserving the conservation of energy.

Mattuck's theory offers an improvement on Walker's theory. In the newer theory, Mattuck proposes a "*pulsed* information processing rate" (Mattuck and Walker, p.114), which can affect large scale PK power rather than a constant information process rate as did Walker's theory. Walker considers unconsciousness a real but non-physical entity; acting through 'hidden variables,' while Mattuck's concept of consciousness is capable of acting non-locally as a direct part of reality itself. His model therefore goes beyond quantum mechanics in that consciousness has a new and elevated position as an active component in the construction of physical reality. Yet, he is still able to use quantum mechanical principles to build a mathematical model of his theory. Mattuck has also pointed out that his theory has not been finalized, but is merely the first step toward a more complete theory.

W. Von Lucadou and K. Kornwachs of Germany have also suggested a quantum model that has not yet been finalized. Their model was suggested in the same issue of the same journal as Mattuck's theory. They have taken the normal function of quantum mechanics that "describes the condition and the development of a quantum mechanical process" (Lucadou and Kornwachs, p.187) and added a new probabilistic function, which describes complex quantum systems. The quantity $|\varphi|^2$ represents the probability of the appearance or transfer of information during a physical event. φ itself would represent a complex material system such as the human brain and its value would depend upon the complexity of the system it represents. Any physical event described by quantum mechanics would therefore need to take into account both and could thus be represented mathematically as $\Psi = \psi + \varphi$. Ψ is the state vector ψ and φ are constants. ψ and φ actually account for the wave packet and the conscious act of collapsing the wave packet, respectively. They are mutually dependent, making them difficult to specify.

In the case of psi, the quantum mechanical wave function would represent a psi event such as PK. This model is quite simple, but not without basic problems. In particular, we "cannot expect a direct derivation of the fundamental equation for the function." (Lucadou and Kornwachs, p.191) According to Gödel's theorem, the validity of a mathematical system cannot be confirmed from within that system so cannot be precisely defined by the brain (mind or consciousness) to which it refers. Further experimental work is needed to establish the parameters, relationships and conditions necessary to derive an equation to represent von Lucadou and Kornwachs' function, so their model is still quite tentative.

Robert G. Jahn and Brenda Dunne's approach to explaining PK phenomena is also based on the common viewpoint of quantum theory. In the 1987 book *Margins of Reality*, they announced that the human mind could psychokinetically affect the operation of machines. Jahn had come to this conclusion after nearly a decade of research, most of which was conducted at the Princeton Engineering Anomalies Research (PEAR) Laboratory, which he founded in 1979 to study these phenomena. PEAR is one of several

physical laboratories which were either established to study paranormal phenomena or deemed it wise to add such phenomena to their research programs during the 1970's and thereafter. These also include the Stanford Research Institute, the Cognitive Sciences Laboratory the Mind-Matter Unification Project at Cavendish Laboratory in Cambridge and the Paraphysical Laboratory in Downton, England. Various journals either dedicated to paraphysical questions, such as the *International Journal of Paraphysics* and the *Retro psychokinesis Project Journal*, or dedicated to a wider variety of new science questions, such as the *Journal of Scientific Exploration*, have been founded while more mainstream scientific journals, such as *Foundations of Physics*, have published articles regarding the physics of psi. All of these trends are characteristic of the early development of a science.

Jahn and Dunne do not believe that subatomic particles are real until consciousness interacts with the "environment." In this respect, they reflect a common viewpoint within the scientific community of physicists that is a fundamental aspect of the Copenhagen interpretation of quantum mechanics. However, they part with the majority of scientists in their definition of consciousness. They believe that consciousness is "anything capable of generating, receiving, or utilizing information." (Talbot, p.146) By defining consciousness so broadly, neither human consciousness nor any intelligent consciousness is necessary to establish either our physical environment or physical reality itself.

Jahn and Dunne's views establish the possibility that human consciousness can create (or distort) physical reality within certain limits, but their main focus is the application of this human ability to either PK or remote viewing, or rather what they call "precognitive remote perception" (PRP). They have focused on these two types of phenomena since there is an overwhelming block of evidence to support their existence. (Jahn and Dunne, pp.x-xi, 90) Their own experiments in these two areas have gone beyond the work of other researchers. They have even discovered PK "signatures" for different test subjects. When combined with their own philosophical interpretation of quantum mechanics, these results have led to an explanation of psi phenomena. Psi is explained by assuming that consciousness, like matter, exhibits a wave-particle duality.

They reasoned that if consciousness "finds wave mechanics a useful complement to particulate physics" then "consciousness may also find a wave-mechanical metaphor to be conceptually and functionally useful for representing itself." Since the quantum theoreticians, or rather the "Copenhagenists," make use of a "probability-of-observation" wave, Jahn and Dunne have postulated a similar "probability-of-experience" wave to be associated with consciousness. (Jahn and Dunne, p.219) Consciousness should then be represented quantitatively by "generalized consciousness coordinates" just as normal physical quantities are represented in various coordinate systems. The "consciousness waves" range freely over space and time, but "if a particular consciousness wave is confined to some sort of "container" or "potential well," representative of the environment in which that consciousness is immersed, characteristic patterns of standing waves, or eigenfunctions, will be established that represent the experiences of that consciousness in that situation." (Jahn and Dunne, p.242) These waves could then escape the potential well in which they are bound, just as ordinary matter waves escape potential

wells in quantum physics. In this manner, "consciousness waves" would not be restricted to act only within the confines or physical limits of the human brain and human consciousness could interact with matter as well as other "consciousness waves" beyond the normal physical limits of the human body and its five senses, extrasensorally.

Explained in this manner, Jahn and Dunne seem to have built a physical model of psi that corresponds to the present physical model of reality. Physical reality has itself been reduced to “interference between the wavelike aspects of consciousness and the wave patterns of matter." (Talbot, p.125) The particle nature of consciousness would correspond to the physical seat of consciousness, such as the human brain, and physical reality would not require the conscious thought of human or other intelligent beings. When the "consciousness wave" interacts directly with matter, PK is attained, and when it interacts with other "consciousness waves," PRP or remote viewing is accomplished.

PK and PRP could thus be considered resonances between the mental and physical natures of consciousness and matter. There is absolutely no need to rely on an active "force" or a transfer of energy, both views of which lead to serious problems in physics. In this explanation, there is also a great deal of potential for explaining other psi phenomena. Although their theory is independent of other theories, there are a number or similarities or correspondences with other theories. In particular, some of their ideas are similar to Bohm's holographic model while the idea that consciousness must be represented in a manner similar to matter within the quantum theory sounds vaguely like von Lucadou and Kornwach's quantum model. And, like these other theories, Jahn and Dunne's needs still more work and verification, especially a broadening of their theory to include ESP and other psi phenomena.

Still other variations of the quantum theory lead to ever more unique hypotheses and models, some even more astounding than the existence of psi itself. Whereas field theories may ultimately lead to the reality of unsuspected and unsensed hyperspaces, the quantum theory may lead to an infinite number of branches of this universe or perhaps an infinite number of universes branching from each event in a single universe. The many worlds interpretation of quantum mechanics was first proposed in the late 1950s by Hugh Everett and followed by the hypotheses of N. Graham and B. DeWitt. Together. They proposed the possibility that there is no single 'collapse' of the wave function in quantum events. All of the infinite possibilities within the wave function are equally real. The measurement, which is generally thought to cause the wave 'collapse,' might actually only choose which reality of all the possible realities will be observed and a branching of universes takes place. Good has applied this view of quantum theory to psi by arguing that "we may be dealing with various superpositions of the observer and the observed systems" during various ESP events. (Chari, 1977, p.814) A person sensitive to psi may gain knowledge from the infinite number of branched universes which leads to ESP. Abner Shimony argues that all other branches are undetectable so there is no difference between the philosophy of a 'branching' universe and the 'collapse' of the wave function. This theory also suffers from an extreme violation of Ockham's principle because it adds unnecessary complications to the quantum theory. (Chari, 1972, p.201) Within this last context, this theory is no different from many other theories of psi that suffer from the

fact that they add new hypothetical entities to science even though psi needs simplifications rather than complications.

Another possibility of applying new revelations from the physics of the quantum comes from a suggestion made by Richard Feynman in 1949. He noticed that a positron was mathematically equivalent to an electron traveling backwards in time, so he suggested that a positron was actually just that, an electron moving back in time. There is no physical law or principle that would prohibit this assumption on the sub-atomic level of reality. Just as Feynman's positron hypothetically travels backwards in time, its mathematical counterpart, as derived by P.A.M. Dirac, can be interpreted as displaying a negative energy. Both of these ideas could, and have provided explanations for various aspects of psi. From this basis, Pearson derived a hypothesis upon "which energy densities of brain chemicals are supposed to be high enough to permit some anomalous manifestations (telepathy, clairvoyance, and precognition) of the 'non-zero properties' of the 'perfect vacuum'." (Chari, 1977, p.815) Others have also postulated negentropic explanations of psi events.

The French physicist O. Costa de Beauregard has come to a similar conclusion through an entirely different evolution of thought. His own personal changes in attitude began as early as 1951, but he felt it unwise to voice his "rational conversion" to a belief in psi until 1975. Once again, this reflects the changing attitudes of the scientific community in general and the physics community in particular prior to and during the decade of the 1970s. He contends that human "conscious awareness" has "two faces" in that our conscious knowledge of reality springs from two procedures, "decoding a message (that is, an ordered structure) *and* emitting a message (that is, producing order) by means of one's *information, ...* ." These quantities (or qualities) are commonly known as cognition and volition (or will), respectively. Consciousness, an "attention to life," is comprised of both cognition and volition, in a broad sense, which is "tightly bound to corresponding symmetries in the real world." (Costa de Beauregard, pp.177-178)

The two faces of human consciousness are cognition and will and it would be expected that both should show up during the process of quantum measurement. The transfer of information, which is the key to knowledge, is essential to quantum measurement. In these processes, the flow of information is actually "negentropic." In physics, entropy is commonly represented by quantified as the logarithm of a probability and represents a measure of disorder of a system. The thermodynamical fact that entropy always increases in a system marks what is called "time's arrow." Alternately, negentropy could then be thought to represent an increase in order, which could or could not be related to time reversal.

On the one hand, biological systems exhibit negentropy because they order matter, they give bits of matter which are randomly positioned a complex structure. Since probability is the "hinge about which mind and matter" interact, biological systems are probability-decreasing processes. Advanced wave processes are also probability-decreasing processes. The mathematics of electromagnetic theory allows solutions that propagate both forward and backward in time, but the backward propagation portion of

electromagnetic waves is normally discarded. This backward propagation of waves is the advanced wave process. In Costa de Beauregard's opinion, these advanced waves actually exist: "*Of course*, they do exist; they must be at work in the very heart of biological phylogenesis and ontogenesis, not to speak of human activity." (Costa de Beauregard, pp.181-182) So, the advanced wave process can provide a physical model of the ordering process or negentropic aspects of biological systems and the transfer of information from the future to the present can account for psi phenomena. In fact, "under appropriate conditions, information as an organizing power should act as a sink of advanced waves, just as information as a gain of knowledge acts as a source of retarded waves." (Costa de Beauregard, p.182) Thus, the whole process is quite natural and a consequence of accepted physical theories and laws. Psi phenomena should therefore be viewed as a "*very rational"* consequence of relativistic quantum mechanics rather than an "irrational" speculation. (Costa de Beauregard, p.186) Costa de Beauregard arguments and the physical model or theory that they represent are philosophical in nature and offer no mechanism for interaction with the physical brain. However, a model for such an interaction already exists.

Eccles had earlier postulated a physical theory of the brain (as mentioned above) in relation to quantum mechanics. His model can easily account for psi events at the level of an interaction between psi and the human brain. Eccles found that neurons in the brain could be fired by subtle "influences," but made no references to what type of physical quantities could account for these "subtle influences." It could be assumed that psi carriers would have extremely small energies since they have not yet been detected. So they could act as Eccles' "subtle influences." Eccles' neurophysical hypothesis could easily be combined with any of the above quantum mechanical interpretations to explain how the human mind, will or even consciousness acts on the neurophysical level, at least partially explaining their interaction with the physical brain. If they exist, psi carriers can cause a neuron to fire within the limits of the Heisenberg uncertainty principle, which may cause a chain reaction of neuron firings in the brain to bring the subtle psi influence into awareness. Although this is one way of addressing the problem, it does not satisfy the needs of the scientific community to explain psi phenomena. None of these theories is complete in its explanation. They tend to tell how psi manifests itself in the receiving brain, while leaving the question of transmission and conveyance of psi open to speculation. The later quantum mechanical theories and models of the present era forego hypothesizing 'psi carriers' and opt to explain the physical transmission of psi information as the interaction of consciousness, which is not bound by normal physical laws, and either the collapse of the wave packet or some other mode of mind-matter interaction.

What Eccles' purely neurophysiological theory of the will has done, is to set psi free from psychological and physiological considerations to be studied and explained by physicists. If one assumes a purely mental theory of psi, then physics is unnecessary in psi research. But all evidence points to the necessity of physics at some level to explain psi. This raises the problem of demarcation between the physical and mental aspects of psi. The physical aspects deal with the transmission of a signal carrying information as well as the sending and receiving of that signal while the mental aspects deal with how the brain processes and utilizes that information, bringing the signal to a conscious

conclusion such as telepathy, clairvoyance, precognition and so on. Between the mental and physical process there must be a clean-cut boundary over which the two are separated but also linked. Eccles' theory seems to offer the best explanation of that combination of boundary and linkage. By setting a boundary between what is parapsychological and what is paraphysical, Eccles' work has freed physics to pursue its own explanation of information transfer without becoming entangled in unnecessary speculations on the interaction of mind and brain.

D. Recent developments during the 90s

Even though quantum theory introduces the concept of consciousness into physics and consciousness is somehow related to psi, the field concept cannot be ignored in the development of physical theories of psi. The present historical trend of physics is toward a major unification of quanta and field, discrete and continuous, so the trend in the explanation of psi within the context of physics is following the same path. With this in mind, perhaps the best contender for such a unification is Bohm's quantum model which utilizes a quantum potential field as the substructure of the space-time continuum. So, it is Bohm's model that presently seems to be the main focus for a physical theory of psi. However, whether a physicist prefers Bohm's or any other physical model, it is certain that consciousness has become an integral part of the present as well as any future physics paradigm.

More mainstream physicists have entered the debate over psi and many have accepted either the possibility of psi or its reality. However, most just remain silent on the issue. At the very least, it has become very difficult for physicists to totally ignore psi functioning since it is so intimately related to consciousness. In some cases, physicists and other researchers are using more neutral phrases and terms, anomalous phenomena (AP) or anomalous cognition (AC), in place of the terms psi phenomena and psi. The names AP and AC do not carry the same mental artifacts or connotations as the term psi, so they are more acceptable to physicists. The very use of these new terms marks a sharper turn toward research into the physical aspects of psi. Before any new science can become established, a new language must be developed for the use of that science.

Brian Josephson and the Greek physicist Fotini Pallikari-Viras recently authored a paper on the "Biological utilisation of quantum nonlocality," firmly committing themselves to a physical explanation of psi. They first considered the normal case of quantum mechanics whereby consciousness is restricted to local action because the special probabilistic distribution functions for any given event cancel or average out at increasing distances from the seat of the event. This special distribution function in phase space assures the statistical equivalence of the causal interpretation with quantum mechanics and thus disallows action-at-a-distance. The direct influence of one particle on another ensemble is averaged away. Therefore, any telepathic or other psi interaction would become totally random and unusable within the formal apparatus of quantum

mechanics. This interpretation of quantum mechanics also renders a Bohm style of non-locality useless.

However, they further point out that these special distribution functions need not be the only functions that represent any given physical event.

> **One may ask, however, why only these special distribution functions should apply. Is there anything absolute about the ignorance implicit in the use of these particular distribution functions? The argument will be made in the following that other distribution functions, with different statistical properties, are relevant in other contexts, especially those associated with life.**
>
> **Situations where a change in context leads to a new kind of statistical distribution becoming relevant are indeed commonplace in science: they occur for example whenever a phase transition occurs that leads to a breaking of symmetry. As a result of symmetry breaking, statistical distributions that are *asymmetric* with regard to this symmetry may come into existence in situations where previously only symmetric distributions were observable or relevant. Analogously, it can be anticipated that special situations will exist whose natural description involves probability distributions other than the particular ones that arise in the quantum formalism. (Josephson, 1991, p. 4 of 8).**

If various physical events can be represented by other more general probabilistic functions than just those functions that average out at greater distances, consciousness can act non-locally. Psi functioning has the same characteristics as consciousness when consciousness acts non-locally, so a quantum mechanical explanation of the non-local action of consciousness would amount to a physical explanation of psi. Bohm's theory of the implicate order explains just such non-local actions and Josephson has indicated that he believes Bohm's concepts represent the actual case of physical reality. (Josephson, 1993, p.2)

In the past, those studying science have made it a point to study nature in the context of form rather than meaning, thus emphasizing quantity at the expense of quality. But life itself is concerned with meaning rather than form. Life emphasizes the qualitative nature of reality. So, life cannot easily be placed within a scientific model even though it has its own "potentialities" which must eventually be included in any physical model of reality.

> **But the self-consistent and completely logical multiple-description view of knowledge advocated here, an alternative to the conventional view that all knowledge may be reduced to quantum mechanical knowledge, allows life to have its own potentialities, beyond what the constraints of "good scientific method" will allow, for knowing and for acting on the basis of such knowing. Included in these categories of acting and knowing are psychic functioning. (Josephson, 1991, p.7 of 8)**

Life itself would thus seem to correspond to a quantum mechanical system or ensemble that could be represented by a non-standard distribution function which would allow for the action of consciousness non-locally. Under such conditions, living organisms would have access to information and thus knowledge that is far more detailed than that specified by quantum mechanics. This information could be accessed psychically by

intelligent life forms. So psi could have a scientific as well as a physical basis since it emerged directly from a specific interpretation of the quantum theory. Unfortunately, including living organisms in a valid quantum mechanical model presents great difficulties, a problem with which Josephson and Pallikari-Viras are quite aware.

> **The theories discussed here have the feature, in contrast to that of quantum mechanics, of being qualitative rather than quantitative. This may be an unavoidable correlate of such aspects of nature, stemming from a fundamental irreproducibility of biology and of the phenomena connected with the indeterminism of the quantum domain. (Josephson and Pallikari-Viras, p.7 of 8)**

Finding the proper distribution function (or functions) to describe living organisms will be extremely difficult, but not as difficult as finding the valid function for intelligent life exhibiting consciousness.

Although their work has not yet been concluded by an actual theory describing the mechanics of psi functioning, some conclusions can be drawn.

> **These arguments lead us to the conclusion that, because of the different kind of perceptual and interpretative processes characteristic of life compared with those of science, living organisms can possess knowledge that is more detailed in certain aspects than is the knowledge specified by the quantum theory. ...**
> **Our assumption in relation to psi functioning is that here also the relevant probability distributions are highly focused in relation to goals, in a way that may become more effective over time as development through learning takes place. (Josephson, 1991, p.5 of 8)**

The idea of goal directed thought fits well with a field theoretic view of physical reality, rather than the discrete description of reality as studied in an event-by-event manner through quantum mechanics. So it further seems that quantum mechanical descriptions of consciousness and psi would reduce quantum mechanics to a field theory.

Sarfatti's ideas on the subject are similar, but his 'theory' is more mechanical in nature. He favors a concept of "back action" at the quantum level to describe both consciousness and non-local interactions as well as psi. According to Sarfatti, Bohm's physical model posits a "mind-like quantum force," or rather a force-like quantity that is not a force in the traditional Newtonian sense. This quantum force can be represented mathematically, so Sarfatti's ideas seem more amenable to the development of a comprehensive mathematical model.

> **The quantum force is the negative spatial gradient of a context-dependent quantum potential that appears in the Hamilton-Jacobi equation for the particle derived from the linear Schrödinger wave equation. The quantum force's context-dependence explains the wave-like guidance of the individual particle in the famous double slit experiment which the late Richard Feynman called the "central mystery of quantum mechanics." (Sarfatti, p.2 of 35)**

However, Sarfatti does not believe that Bohm's theory addresses all of the issues pertaining to a unification of mind (or consciousness) and matter. Bohm does not account for what Sarfatti terms "back action."

> **The guidance of the mind on matter is already there in Bohm's theory. What is missing for perception and our immediate awareness of the *arrow of time* is the modification of the state of mind by the particles that compose the brain. This is back-reaction. Now we see that such back-reaction is required for the familiar role of conservation laws in physics. However, such back-reaction violates the statistical predictions of quantum mechanics ... . Bohm's theory shows why the world divides naturally into *elemental matter* and *elemental mind.* (Sarfatti, p.17 of 35)**

Whether this assessment of Bohm's theory is valid or not, it must be remembered that Bohm's theory is a purely physical theory, and not specifically a theory of mental action or consciousness.

However, Bohm's theory as well as other interpretations of quantum mechanics still remains compatible with Sarfatti's concept of "back action," or "back reaction," as he sometimes calls it.

Sarfatti's model follows from the most basic concepts of physics. According to Newton's third law of motion, every action generates an equal and opposite reaction, so the "mind-like quantum force" described by Sarfatti must generate a "quantum back action."

> **We now come to "back-action" which is the main idea of this paper. The origin of this idea is Newton's third law that for every action there is an equal and opposite reaction. We now know that this is a consequence of translational symmetry in physical space.... It can also be shown that quantum spontaneous emission of real radiation by virtual zero point vacuum fluctuations can be explained as advanced wave effects from the future that are classically associated with radiation resistance. Feynman also used the term "back-action" to explain the generation of quantized vortices in superfluid helium. (Sarfatti, p.2 of 35)**

And,

> **By the term "back-action" I mean that the quantum wave field is "directly affected by the conditions of the particles". It is qualitatively obvious that such a direct dependence is the counter-force or reaction to the quantum force. The combination of the quantum force of wave on particle with the counter-force or back-action of particle on wave forms a feedback control loop which is able to control the formerly uncontrollable guidance of the particle by its wave. This results in a distortion of the statistical patterns of orthodox quantum mechanics. This is the mechanism of intent or free will. (Sarfatti, p. 4 of 35)**

In other words, Sarfatti agrees that consciousness collapses the wave packet to realize or materialize a solid particle as in the normal quantum mechanical point of view, but he has further added the idea that the particle reacts equally and oppositely to the collapsing wave in the form of a "back action." Just as consciousness acts physically through an exchange of information which causes the wave collapse, the particle reacts through its

"back action" to pass information on the state of the collapse back to consciousness. Therefore, the solid particle must affect the consciousness that collapsed the wave to create it.

Sarfatti implies that his theory of "back action" can serve to explain psi effects by a mutual exchange of information at the quantum level rather than a one-way exchange of information from consciousness to physical particle. He ultimately associates his "back action" with perception and consciousness,

> **The back-reaction, not found in orthodox quantum mechanics, completes a feed-back control loop between particle and wave which explains the matter-mind connection in which mind is the quantum wave that not only moves living matter but is, in turn, moved by living matter. The latter is the basis of perception and consciousness. It is how sensory data from neuron pulses and bio-chemical messenger molecules transform their information into meaningful subjective experience (i.e., qualia) (Sarfatti, p.8 of 35)**

as well as intent, free will (as described above) and the *elan vital* or life-force upon which scholars speculated over two centuries ago.

> **I suspect that the proper understanding of the biophysics of living matter requires this two-way dialectic between local particle and nonlocal wave which is beyond quantum mechanics. The back-action of the particle on its wave, missing in quantum mechanics, is the origin of the *elan vital.* That idea, rejected by modern science, was a correct idea introduced too soon in the nineteenth century. It is an idea whose time has finally come. (Sarfatti, p. 8 of 35)**

He even associates his back action with the Chinese concept of *chi* and the Japanese *ki*, although he mistakenly identifies *ki* as Chinese.

> **For example, a classically "free" particle has a nonlocal quantum potential energy in addition to its local classical kinetic energy. These nonlocal quantum wave properties are what the Chinese call "Ki" or "Chi". (Sarfatti p.18 of 35)**

And finally, he associates "back action" with several other characteristics, quantities or qualities of cognitive thought.

> **Purpose, meaning, intention, intuition all are beyond orthodox quantum mechanics. All require violation of the statistical predictions of such quantum mechanics. All require not the violation but the transcending or leapfrogging over Eberhard's theorem which assumes the statistical predictions of quantum mechanics cannot be violated. All require a direct *non unitary back-reaction* of the particle on the shape of its guiding quantum potential in a feed-back control loop which is the elan vital, the distinguishing mark of life relative to non-life. (Sarfatti, p.13 of 35)**

These associations may well prove true, if not for Sarfatti's "back action" then for some other physical explanation of psi since all of these quantities are either associated with consciousness or some level of thought itself. However, Sarfatti gives no further physical mechanisms that can help to distinguish between these various types of mental activity. It was perhaps unwise for Sarfatti to have associated his "back action" with so many

different things before he has more fully developed his theory and provided some further verification of his ideas.

Sarfatti's concepts are well taken, but so many unsubstantiated claims lend a distinct air of speculation to Sarfatti's theory, rendering his theory, as are so many others, tentative and incomplete. He has even referred to the speculative nature of these associations.

> **The astute reader may recall at this point that I have been arguing the unorthodox hypothesis that quantum mechanics is not a complete theory of the world because it lacks this *back-reaction,* indeed, I speculate that life in general and conscious "qualia" in particular require back-reaction in order for perception to be possible. The particles compose the "brain" while their quantum potential is the "mind". (Sarfatti, p.17 of 35)**

In fact, this quality and other problems have led Edwin May to criticize the theory, as Sarfatti has himself pointed out, commenting that "theories that do not quantitatively describe data are not just wrong, they are bad theories." Yet Sarfatti claims in rebuttal that his theory "gives a theoretical candidate for qualia [subjective mental experiences] in qualitative agreement with May's experimental findings." (Sarfatti, 1996, p.4 of 7) The "experimental findings" to which Sarfatti refers have been used by May and James Spottiswoode to develop their own theory of psi, called the Decision Augmentation Theory or DAT for short.

According to DAT, "humans interpret information obtained by anomalous cognition into the usual decision process. The result is that, to a statistical degree, such decisions are biased toward volitional outcomes." (May and Spottiswoode, Abstract) So DAT is a theory of information transfer between object and subject rather than a theory of a subject initiating a force to cause a change of state in the object. May has stated unequivocally that he does not believe PK exists. (May, Interview, p.3 of 4) What psi researchers normally detect as PK phenomena is just a precognition of an event.

May and his colleagues have come to this conclusion after extensive experimentation with Random Number Generators (RNGs) as well as considering previous experimental results dating back to 1969. The May group considered four possible explanations to account for anomalous effects in the RNG experiments. They could have been caused by: (1) Mean Chance Expectations (MCEs) which are simply random statistical fluctuations; (2) True Anomalous Phenomena (APs) which result from a psi-related force initiated by the subject; (3) Decision Augmentation (DAs) in which psi has biased the normal decision making process; or (4) A combination of DA and AP.

By considering these four possible explanations of anomalous results, they derived a statistical formula and model to analyze the data. Any random ensemble would demonstrate a normal probability distribution with zero mean and a variance of one. If the randomness of the RNG events were affected psychokinetically, such as by the application of a psi controlled force, then the variance would be disturbed. The group's measurements demonstrated a distinct change in the mean rather than the variance, so PK

was ruled out as the cause of the anomalies. The only solution left available was the precognition of the results by the subjects, which affected the choice of states, i.e., decision augmentation. May believes that psi exists, but merely as information transfer across time and space, while there is neither a "force" nor energy transfer during psi related phenomena.

Whether scientists are talking about an information transfer during the collapse of a wave packet or decision augmentation, there seems to be a trend away from explaining psi as a transfer of force or energy between separate and distinct minds as well as between mind and matter. This trend corresponds with recent attempts to extend quantum physics to cases of non-local interactions at the quantum level. It also conforms to science's increasing reliance on field theories which were originally developed as a counterpoint to physical explanations involving action-at-a-distance. DAT is compatible, to an extent, with other recent physical theories of psi since all of these explanations seem to have many elements in common. But DAT, like other theories, offers no 'mechanism' for explaining psi phenomena or the nature of psi. The word 'mechanism' must be qualified when used in this sense since a classical notion of 'mechanisms' would entail the inclusion of terms for force and/or energy. Still, it must be remembered that at some point or level of reality, a 'mechanism' of the classical type must come into the picture since psi affects a real physical world in which Newtonian mechanics and the relationship F = ma are still valid.

E. Conclusions

Many of the older theories of psi thus far discussed, such as Marshall's, Wasserman's and Berger's, have had to resort to either hypothetical new structures or a new formalism as yet unrecognized (Marshall's eidopoic influences) by physicists. Some of the newer theories are similar in that they depend upon hypothetical particles such as tachyons or new formalisms such as hidden variables, hyperspaces or the quantum potential. Even Feynman's notion of a positron traveling backwards in time and Dirac's negative energy fall into this category since they are hypothetical physical concepts suggested by the mathematic models describing physical situations. However, there is a major difference between these new theories and the older theories, which derive hypothetical entities to explain psi.

The newer theories are based upon sound physics rather than the mere inventions of new entities or immeasurable quantities for the sole purpose of explaining psi. Hyperspaces, quantum potentials, tachyons and all the rest are theoretical quantities, variables and entities which exist independent of a theory of psi, if they are proven to exist at all. These were first developed to further theories in physics and physicists will eventually determine the valid use of these new ‘things’ in mainstream physics through a regular application of the scientific method. Should they prove to either exist or become necessary in purely physical theories, and then their connections to psi must be seriously discussed. For this reason, physical theories of psi based on these 'things' tend to be

somewhat semi-physical depending on how broadly we define "physical" and whether we limit "physical" to its present conceptual form denying that physics may itself change in the future. The electromagnetic theories of psi do not fall into this class since they are based upon physical quantities and variables that are already known to exist, rather than hypothetical concepts within physics. Yet the electromagnetic theories have other problems with which to contend and they fare no better. So, the science of paraphysics is still in its infancy and no clear-cut theory has emerged as the front-runner to completely explain psi.

It would be nice to think that science has progressed far enough during the past two millennia so that questionable ideas such as those offered by psi phenomena could be handled with the respect that all of nature deserves, but the existence of psi still raises emotional and unscientific responses from its critics. The physicist Henry Stapp recently agreed to run a special series of experiments with Helmut Schmidt. Schmidt hoped to demonstrate to Stapp that anomalous phenomena associated with PK do actually occur at the quantum level of reality. Stapp's portion of the experiment yielded null results, contradicting Schmidt's previous results, and Stapp published his findings. He published a paper on the subject entitled "Theoretical model of a purported empirical violation of the predictions of quantum theory," in *Physical Review*, a mainstream professional journal of physics. In this paper, Stapp used a generalization of Steven Weinberg's nonlinear quantum mechanics to demonstrate how "a reported violation of the predictions of orthodox quantum theory" could account for Schmidt's anomalous effects. (Stapp, p.1) In other words, Stapp offered a physical theory of PK, which is completely compatible with modern thinking in quantum theory.

While Stapp's model was offered as a purely physical and scientific model in accordance with the prevalent views and attitudes of the scientific community, Jonathan P. Dowling, a U.S. Army physicist, attacked his paper in a letter to Physics Today magazine. Dowling claimed Stapp's model represented "pseudoscience" and "pathological science." He further suggested, "Articles dealing with parapsychology should not be published in PRA [*Physical Review A*] - period." (Dowling, p.2 of 11) Although this statement was couched in terms that would make it seem that he was only suggesting the outright censoring of physics journals as a possible alternative, Dowling clearly implied that such was his position. In his own defense, Stapp answered the criticisms against his science and scientific method by stating that a refusal "to look at such physical evidence on ideological grounds would [itself] be pseudoscience." Although he did not fully agree with Schmidt's interpretation of the experimental results, Stapp certainly defended both Schmidt's and his own interpretation of the physical data as scientific until science could prove one theory or another. As Stapp stated,

> **The procedure that I myself carried out was purely a "physics experiment." ...**
>
> **It was within the specific context of simple and clean physical experiments of this particular kind that I put forth my quantum mechanical model of how results of the kind predicted by Schmidt could be explained by merely making a small change in the Schrödinger equation that would produce no observable effects in any purely physical experiment heretofore performed by physicists. Because of the existence of this model we cannot rationally rule out the possibility that the**

> **"Schmidt effect" exists merely on the grounds that this effect is incompatible with what we already know about the laws of nature. I believe it would now be useful to perform additional experiments of the kind described here to resolve the discrepancy between the null result that I obtained and the positive combined result of the five experiments reported by Schmidt. (Stapp, p.3 of 11)**

Stapp has taken and defended the position that science cannot *a priori* rule out PK or similar anomalous phenomena when plausible physical models can account for them. The fact that the "Schmidt effect" can be accounted for in quantum mechanics if it is found necessary to do so implies that science must search for and either verify or repudiate the claimed effect. So, while Stapp is neither a supporter of psi research nor inclined to accept the existence of psi without further verification, he certainly maintains a position that the existence of psi cannot be automatically precluded from physics. Other scientists are not as liberal minded as Stapp and the attitude expressed by Dowling is still endemic in a large portion of the scientific community.

Dowling represents one segment of the scientific community while Stapp represents another. No one knows how many scientists, let alone physicists, fall into either category. There exists a large silent majority whose opinion on this subject has been neither voiced nor solicited and it has been assumed, perhaps without justification, that that majority is against paraphysical research. Most physicists are just not willing to discuss the subject of psi for fear of being subjected to either censure, ridicule or bias, whether that fate is perceived or imagined. However, as has been shown above, some well-known physicists are willing to entertain the possible existence of psi while others are willing to go further and accept its existence in some as yet undetermined shape or form as well as publicize their views. The number of scientists in this category is growing and psi is slowly, if not begrudgingly, merging into mainstream physics.

The burning question then becomes "Is a consensus regarding the reality of psi developing?" This question cannot yet be answered with any precision so an alternate question should be considered, "Is the pre-paradigmatic period of psi drawing to a close with the development of a new paradigm in physics which may be more amenable to psi?" The historical evidence indicates that the answer to this second question is yes. This evidence can be found in the association of psi effects with the consciousness/matter interaction, the flowering of contending theories, the development of a specialized language with terms such as PRP, anomalous cognition and anomalous phenomena as opposed to PK, ESP and psi phenomena which still carry psychological connotations, as well as debates whether psi is fundamentally mental or physical. These trends indicate a coming change of scientific attitude toward psi research that would be part of a larger paradigm shift in physics. The debate over the physical nature of psi is itself a measure of the success of the incursion of physics into psi research since it seems to upset some parapsychologists who believe that physics might be taking over their discipline. There is no evidence that paraphysics will replace parapsychology. On the contrary, they seem to complement each other even though the border between them is still vague.

What can be concisely discerned is that consciousness acting non-locally is intricately related to the physics of psi, if it is not psi itself, rather than the psychological

aspects of psi. So, physical theories of psi that account for the non-local action of consciousness at the quantum level seem to be in the offing for the coming paradigm shift. In the meantime, psi seems to be a field effect as opposed to the discreteness of traditional quantum theory, so a field theory of psi also seems to be in the offing. Perhaps even the question of quantum versus field has reached a level indicating that it may soon become irrelevant, both in pure physics as well as paraphysics. The future paradigm in physics will be neither field nor quantum, but both and neither.

Return to PART II

Go to the BIBLIOGRAPHY

Last Updated 21 March 1998
E-mail comments and suggestions to Jim Beichler, editor, *YGGDRASIL*, at *jebco1st@aol.com*

Top of Page
YGGDRASIL Homepage