DAVID BOHMS WORLD pdf

1: "David Bohm and the Implicate Order" by David Pratt

David Joseph Bohm FRS (/ b oÊŠ m /; December 20, - October 27,) was an American scientist who has been described as one of the most significant theoretical physicists of the 20th century and who contributed unorthodox ideas to quantum theory, neuropsychology and the philosophy of mind.

The Implicate Order This article discusses the vision David Bohm intuited from his insight gnosis into the quantum world. This vision discerns the characteristics of an evolving cosmos in process; and, also, it ponders upon the implications for humanity. During his later years he linked a formidable knowledge of the history and philosophy of science to his keen experience as a physicist. In recent years, Bohm attempted to explain an ontological basis for quantum theory. The basis of quantum theory can be summarized in three propositions: In the subatomic world, few things can be predicted with percent precision; however, accurate predictions can be made about the probability of any particular outcome. One has to work with the probabilities rather than certainties, because it is impossible for an observer to describe all aspects of a particle at once speed and location. Electromagnetic energy such as light or heat does not always behave like a continuous wave--rather it is grainy, because energy can be transferred only in quantum packages. Therefore, light has a dual character. Under certain circumstances, it may display wavelike aspects; and in other circumstances, it may have the characteristics of particles. In principle, any individual element could reveal "detailed information about every other element in the universe. Bohm believes that the bizarre behavior of the subatomic particles might be caused by unobserved subquantum forces and particles. Indeed, the apparent weirdness might be produced by hidden means that pose no conflict with ordinary ideas of causality and reality. Bohm believes that this "hiddeness" may be reflective of a deeper dimension of reality. He maintains that space and time might actually be derived from an even deeper level of objective reality. This reality he calls the Implicate Order. Within the Implicate Order everything is connected; and, in theory, any individual element could reveal information about every other element in the universe. Holography relies upon wave interference. If two wavelengths of light are of differing frequencies, they will interfere with each other and create a pattern. Proceeding from his holographic analogy, Bohm proposes a new order--the Implicate Order where "everything is enfolded into everything. Bohm puts it thus: Such movement of light waves is present everywhere and in principle enfolds the entire universe of space and time in each region. This enfoldment and unfoldment takes place not only in the movement of the electromagnetic field but also in that of other fields electronic, protonic, etc. These fields obey quantum-mechanical laws, implying the properties of discontinuity and non-locality. The totality of the movement of enfoldment and unfoldment may go immensely beyond what has revealed itself to our observations. Within this milieu there are independent sub-totalities such as physical elements and human entities with relative autonomy. The layers of the Implicate Order can go deeper and deeper to the ultimately unknown. It is this "unknown and undescribable totality" that Bohm calls the holomovement. The holomovement is the "fundamental ground of all matter. Summarizing, Bohm uses analogies most ingeniously as he attempts to simplify his theory. Bohm suggests that instead of thinking of particles as the fundamental reality, the focus should be on discrete particle-like quanta in a continuous field. On the basis of this quantum field, Bohm breaks down the Implicate Order into three categories: The first category is the original, "continuous field" itself along with its movement. Bohm likens this continuous field to a television screen displaying an infinite variety of explicate forms. The second category is obtained by considering superquantum wave function acting upon the field. Bohm considers it to be similar to a computer which supplies the information that arranges the various forms--in the first category. Folling this analogy, Bohm sees the whole process as a closed loop; it goes from the screen to the computer to the Player and back to the screen. Bohm believes in a special cosmic interiority. Everything that is and will be in this cosmos is enfolded within the Implicate Order. There is a special cosmic movement that carries forth the process of enfoldment and unfoldment into the explicate order. This process of cosmic movement, in endless feedback cycles, creates an infinite variety of manifest forms and mentality. This Player, the Cosmic Mind, is moving cyclically onward and onward accruing an infinity of experienced being! For Bohm it is the plenum; it is an "immense

background of energy. He calls this the "holomovement. Bohm also refers to a law in the holomovement. Holonomy, through a wide range of aspects, can be considered a "movement in which new wholes are emerging. It is the interplay between the implicate and the explicate orders. It is the flow of matter, manifested and interdependent, towards consciousness. He considers the particle, fundamentally, to be only an "abstraction that is manifest to our senses. It flows out of the law of the Implicate Order, a law that stresses the relationships between the enfolded structures that interweave each other throughout cosmic space rather than between the "abstracted and separate forms that manifest to the senses. Bohm also declares that the "implicate order has to be extended into a multidimensional reality. Thus we have to say that the holomovement enfolds and unfolds in a multidimensional order, the dimensionality of which is effectively infinite. Thus the principle of relative autonomy of sub-totalities--is now seen to extend to the multi-dimensional order of reality. What is seen is that there is a certain "relationship between the images appearing on the two screens. The same can be said of all living matter. There is no dichotomy. For Bohm it is the development of consciousness! For Bohm consciousness "involves awareness, attention, perception, acts of understanding, and perhaps yet more. Consciousness, Bohm notes, can be "described in terms of a series of moments. Bohm considers the human individual to be an "intrinsic feature of the universe, which would be incomplete--in some fundamental sense" if the person did not exist. He believes that individuals participate in the whole and consequently give it meaning. Because of human participation, the "Implicate Order is getting to know itself better. The individual is in total contact with the Implicate Order, the individual is part of the whole of mankind, and he is the "focus for something beyond mankind. The collectivity of individuals have reached the "principle of the consciousness of mankind," but they have not quite the "energy to reach the whole, to put it all on fire. In the depths of the Implicate Order, there is a "consciousness, deep down--of the whole of mankind. It is this collective consciousness that is truly one and indivisible, and it is the responsibility of each human person to contribute towards the building of this consciousness of mankind, this noosphere! That is absolutely what has to be done and nothing else can work. Referring to all the elements of the cosmos, including human beings, as projections of an ultimate totality, Bohm notes that as a "human being takes part in the process of this totality, he is fundamentally changed in the very activity in which his aim is to change that reality, which is the content of his consciousness. But what is it doing? Meditation means "to reflect, to turn something over in the mind, and to pay close attention. Possibly Bohm is considering the infinite potential of what he terms "multidimensional reality. It is a Player who operates in a feedback universe. Bohm provides the analogy of the "continuous field," the information, and the Player of the whole game. This process is ever endless, ever expanding or evolving, as the Player gathers all to itself. The player continuously grasps itself. ORDER Bohm believes that a special cosmic energy holds the All together, and this cosmic energy follows a cosmic law order. Bohm refers to it as the law in the holomovement. His viewpoint is that of "wholeness. These new holistic aspects may appear possibly to have some autonomy, but ultimately they are all aspects of the All. What makes the mechanical thought process relevant is intelligence. The "ground of intelligence must be in the undetermined and unknown flux, that is also the ground of all definable forms of matter. So it will be ultimately misleading and indeed wrong to suppose, for example, that each human being is an independent actuality who interacts with other human beings and with nature. Rather, all these are projections of a single totality. As a human being takes part in the process of this totality, he is fundamentally changed in the very activity in which his aim is to change that reality which is the content of his consciousness. Consciousness is part of the play of the cosmic process, grasping itself through its sub-totalities into higher and higher levels of consciousness. Logically, if cosmic sub-totalities such as human beings can be considered to be persons of which only a few are developing toward higher levels of Personhood , than through the feedback interchange, the cosmos is becoming progressively personalized as well. It is a Person. And this Player is also creative! It is a Presence within cosmic energy. The Bohm cosmic model also suggests that this "holiness" has existed since the foundation of the cosmos. It is present in the cyclical process of the universe. It is pure, active intelligence from which all that is manifest in the cosmos comes. It acts through an inwardness in consciousness. It enfolds information into the many levels of consciousness, into all of life. What does Bohm have to say about the human condition? For Bohm there are the evils of disorder which causes suffering and death. Bohm does not

believe that there is disorder at the level of the non-human universality, rather it is at the level of humanity--mainly because of ignorance. Nature has allowed humanity the luxury to make mistakes, because humankind must have the "possibility of being creative. He uses the analogy of a live oak tree.

2: David Bohm Society: Quantum Theory

David Peat is a theoretical physicist and a friend and colleague of David www.enganchecubano.comer they wrote Science, Order and Creativity and were working on The Order Between and Beyond until Bohm's death in

Quotes[edit] There is no reason why an extraphysical general principle is necessarily to be avoided, since such principles could conceivably serve as useful working hypotheses. For the history of scientific research is full of examples in which it was very fruitful indeed to assume that certain objects or elements might be real, long before any procedures were known which would permit them to be observed directly. Physical Review 35 2: Of course, we must avoid postulating a new element for each new phenomenon. But an equally serious mistake is to admit into the theory only those elements which can now be observed. For the purpose of a theory is not only to correlate the results of observations that we already know how to make, but also to suggest the need for new kinds of observations and to predict their results. In fact, the better a theory is able to suggest the need for new kinds of observations and to predict their results correctly, the more confidence we have that this theory is likely to be good representation of the actual properties of matter and not simply an empirical system especially chosen in such a way as to correlate a group of already known facts. We have reversed the usual classical notion that the independent "elementary parts" of the world are the fundamental reality, and that the various systems are merely particular contingent forms and arrangements of these parts. Rather, we say that inseparable quantum interconnectedness of the whole universe is the fundamental reality, and that relatively independent behaving parts are merely particular and contingent forms within this whole. It gradually emerged that something more important was actually involved â€" the awakening of the process of dialogue itself as a free flow of meaning among all the participants. In the beginning, people were expressing fixed positions, which they were tending to defend, but later it became clear that to maintain the feeling of friendship in the group was much more important than to hold any position. Such friendship has an impersonal quality in the sense that its establishment does not depend on a close personal relationship between participants. A new kind of mind thus begins to come into being which is based on the development of a common meaning that is constantly transforming in the process of the dialogue. People are no longer primarily in opposition, nor can they be said to be interacting, rather they are participating in this pool of common meaning which is capable of constant development and change. In this development the group has no pre-established purpose, though at each moment a purpose that is free to change may reveal itself. The group thus begins to engage in a new dynamic relationship in which no speaker is excluded, and in which no particular content is excluded. Thus far we have only begun to explore the possibilities of dialogue in the sense indicated here, but going further along these lines would open up the possibility of transforming not only the relationship between people, but even more, the very nature of consciousness in which these relationships arise. The individual is universal and the universal is the individual. The word "individual" means undivided, so we could say that very few individuals have ever existed. We could call them dividuals. Individuality is only possible if it unfolds from wholeness. Ego-centeredness is not individuality at all. Yet at a deeper level [matter and consciousness] are actually inseparable and interwoven , just as in the computer game the player and the screen are united by participation. As quoted in New Scientist February , p. Yet, in spite of this world-wide system of linkages, there is, at this very moment, a general feeling that communication is breaking down everywhere, on an unparalleled scale Why does thought require attention? Every thinking requires attention, really. If we ran machines withinout paying attention to them, they would break down. Our thought, too, is a process, and it requires attention, otherwise its going to go wrong. But then, we went on to consider the general disorder and confusion that pervades the consciousness of mankind. What he was seriously proposing is that all this disorder, which is the root cause of such widespread sorrow and misery, and which prevents human beings from properly working together, has its root in the fact that we are ignorant of the general nature of our own processes of thought. Or to put it differently it may be said that we do not see what is actually happening, when we are engaged in the activity of thinking. This field is basically that which is manifest, or tangible. The essential quality of the infinite, by contrast, is its subtlety, its intangibility. This

quality is conveyed in the word spirit, whose root meaning is "wind, or breath. This energy, or spirit, infuses all living beings, and without it any organism must fall apart into its constituent elements. That which is truly alive in the living being is this energy of spirit, and this is never born and never dies. As quoted in Infinite Potential: Wholeness and the Implicate Order [edit] I would say that in my scientific and philosophical work, my main concern has been with understanding the nature of reality in general and of consciousness in particular as a coherent whole, which is never static or complete but which is an unending process of movement and unfoldment Then there is the further question of what is the relationship of thinking to reality. As careful attention shows, thought itself is in an actual process of movement. That is to say, one can feel a sense of flow in the stream of consciousness not dissimilar to the sense of flow in the movement of matter in general. May not thought itself thus be a part of reality as a whole? If he thinks of the totality as constituted of independent fragments, then that is how his mind will tend to operate, but if he can include everything coherently and harmoniously in an overall whole that is undivided, unbroken and without border for every border is a division or break then his mind will tend to move in a similar way, and from this will flow an orderly action within the whole. My suggestion is that at each state the proper order of operation of the mind requires an overall grasp of what is generally known, not only in formal logical, mathematical terms, but also intuitively, in images, feelings, poetic usage of language, etc. This kind of overall way of thinking is not only a fertile source of new theoretical ideas: The quantum theory, as it is now constituted, presents us with a very great challenge, if we are at all interested in such a venture, for in quantum physics there is no consistent notion at all of what the reality may be that underlies the universal constitution and structure of matter. If on the other hand we apply the world view in which the world is regarded as a continuous field, we find that this field must also be discontinuous, as well as particle-like, and that it is as undermined in its actual behaviour as is required in the particle view of relation as a whole. In relativity, movement is continuous, causally determinate and well defined, while in quantum mechanics it is discontinuous, not causally determinate and not well defined. Each theory is committed to its own notions of essentially static and fragmentary modes of existence relativity to that of separate events, connectable by signals, and quantum mechanics to a well-defined quantum state. One thus sees that a new kind of theory is needed which drops these basic commitments and at most recovers some essential features of the older theories as abstract forms derived from a deeper reality in which what prevails in unbroken wholeness. The notion that all these fragments are separately existent is evidently an illusion, and this illusion cannot do other than lead to endless conflict and confusion. Indeed, the attempt to live according to the notion that the fragments are really separate is, in essence, what has led to the growing series of extremely urgent crises that is confronting us today. Thus, as is now well known, this way of life has brought about pollution, destruction of the balance of nature, over-population, world-wide economic and political disorder and the creation of an overall environment that is neither physically nor mentally healthy for most of the people who live in it. Individually there has developed a widespread feeling of helplessness and despair, in the face of what seems to be an overwhelming mass of disparate social forces, going beyond the control and even the comprehension of the human beings who are caught up in it. Changing Consciousness [edit] Full title: For both the rich and the poor, life is dominated by an ever growing current of problems, most of which seem to have no real and lasting solution. Clearly we have not touched the deeper causes of our troubles. It is the main point of this book that the ultimate source of all these problems is in thought itself, the very thing of which our civilization is most proud, and therefore the one thing that is "hidden" because of our failure seriously to engage with its actual working in our own individual lives and in the life of society. Suppose you have two religions. Thought defines religion â€” the thought about the nature of God and various questions like that. Such thought is very important because it is about God, who is supposed to be supreme. The thought about what is of supreme value must have the highest force. So if you disagree about that, the emotional impact can be very great, and you will then have no way to settle it. Two different beliefs about God will thus produce intense fragmentation â€” similarly with thoughts about the nature of society, which is also very important, or with ideologies such as communism and capitalism, or with different beliefs about your family or about your money. Whatever it is that is very important to you, fragmentation in your thought about it is going to be very powerful in its effects. Difference exist because

thought develops like a stream that happens to go one way here and another way there. We often find that we cannot easily give up the tendency to hold rigidly to patterns of thought built up over a long time. We are then caught up in what may be called absolute necessity. This kind of thought leaves no room at all intellectually for any other possibility, while emotionally and physically, it means we take a stance in our feelings, in our bodies, and indeed, in our whole culture, of holding back or resisting. This stance implies that under no circumstances whatsoever can we allow ourselves to give up certain things or change them. We may momentarily relieve the population problem, the ecological problem, and so on, but they will come back in another way. Of course, one of the main legitimate functions of thought has always been to help provide security, guaranteeing shelter and food for instance. However, this function went wrong when the principal source of insecurity came to be the operation of thought itself. Culture is shared meaning. Suppose we were able to share meanings freely without a compulsive urge to impose our view or conform to those of others and without distortion and self-deception. Would this not constitute a real revolution in culture. Therefore it would be wrong and misleading to break it up into my thought, your thought, my feelings, these feelings, those feelings. I would say that thought makes what is often called in modern language a system. A system means a set of connected things or parts. But the way people commonly use the word nowadays it means something all of whose parts are mutually interdependent â€" not only for their mutual action, but for their meaning and for their existence. A corporation is organized as a system â€" it has this department, that department, that department And also the body is a system. Society is a system in some sense. Similarly, thought is a system. That system not only includes thought and feelings, but it includes the state of the body; it includes the whole of society â€" as thought is passing back and forth between people in a process by which thought evolved from ancient times. But with the growth of civilization it has developed a great deal. It was probably very simple thought before civilization, and now it has become very complex and ramified and has much more incoherence than before. It is not a fault here, there or here, but it is a fault that is all throughout the system. Can you picture that? It is everywhere and nowhere. You may say "I see a problem here, so I will bring my thoughts to bear on this problem". But "my" thought is part of the system. Thought is constantly creating problems that way and then trying to solve them. Collaborations with others[edit] Dialogue, as we are choosing to use the word, is a way of exploring the roots of the many crises that face humanity today. It enables inquiry into, and understanding of, the sorts of processes that fragment and interfere with real communication between individuals , nations , and even different parts of the same organization. In our modern culture men and women are able to interact with one another in many ways: In our view this condition points to a deep and pervasive defect in the process of human thought. David Peat It is proposed that a form of free dialogue may well be one of the most effective ways of investigating the crisis which faces society , and indeed the whole of human nature and consciousness today.

3: Interview with David Bohm - F. David Peat

*David Bohm's World: New Physics and New Religion [Kevin Sharpe] on www.enganchecubano.com *FREE* shipping on qualifying offers. David Bohm is a physicist with a broad range of other interests including religion, philosophy, education, art.*

His theories are close to his metaphysical and religious thinking. Both Bohm and Capra appear to use their religious ideas in their physics. Religion is the source for physical hypotheses and provides the motivation to develop and uphold them. David Bohm, holomovement, religion and science, Fritjof Capra, nonlocality, physics. David Bohm started his career in physics as a brilliant exponent of the accepted point of view. In the early s he changed. Since then, his theories have been controversial. Most physicists do not accept them. Yet Bohm wrestles with basic questions raised by contemporary quantum physics. He does not escape physics into a world of his own. He asks questions of the accepted physics and, using its techniques, tries to solve them. One of his principle drives is to clarify an idea he finds at the heart of quantum physics. Every thing connects with everything else. Bohm has a strong philosophical and religious sense. Physics also immerses him. His religion appears to influence his physics, as well as the other way around. In this paper I will explore a little of his physics and his religion. I will look at some of their connections. The nonlocality illustrated by the EPR experiment will be my focus. Nonlocality For Bohm, one of the significant and novel features of quantum theory appears in the EPR paradox. Its name comes from the first letters of its authors, Albert Einstein, Boris Podolsky and Nathan Rosen, who published an article on it in Einstein, Podolsky and Rosen Bohm helped to develop it further in Bohm , In this thought experiment certain events appear connected, but they do not physically interact with each other and are some distance apart. A simplified version of the EPR experiment is as follows. A particle enters the experimental device. It has the properties that it is not spinning and can be split in half. It is split with each half heading off in opposite directions. One half is spinning in one direction and the other half is spinning in the opposite direction. The total spin must be zero by the conservation of spin at the point at which the parent split. The parent particle had zero spin and equal but opposite spins cancel each other out. When the two halves are some distance apart one half has its spin changed. The question concerns what happens to the spin of the other half. It would instantaneously change so the conservation of spin holds. How could it do this? It is a blatant contradiction of physics as Einstein understood it. One way to approach this question is to ask about the connection between the two half particles. What tells the second half that its sibling has changed its spin? Normal connections do not travel faster than light. The EPR experiment, however, requires a connection which travels faster than light. The instantaneous connection between particles suggested by quantum physics is a base for the EPR experiment. However, the experiment contradicts the idea that connections cannot travel faster than the speed of light. Thus it disproves, to Einstein at least, the validity of quantum physics. Unlike Einstein, however, Bohm and his colleagues do not interpret the result of the EPR experiment as illustrating a problem in quantum physics. They see it as representing an essential new feature in quantum phenomena. Moreover, they do not think it contradicts relativity. They have another way of explaining it Bohm and Hiley The experiment is an example of a nonlocal effect. This means that something affects something else which is not within its immediate area. Neither is there a normal causal connection between the two; for instance, there are no physical forces connecting them. Nonlocality contrasts with the common-sense "principle of local causes", or locality. This says the following. Take two places some distance apart. Take them at the same moment of time. What happens in one has nothing to do with what happens at the other Stapp , The opposite idea, nonlocality, is sensational. Physics violates common sense once again. The public interest arouses from its slumber. Einstein writes that physics should be "free from spooky actions from a distance [that is, nonlocality]". Locality was necessary in his relativity theory and he took it as being an "absolutely inevitable requirement for any reasonable physical theory" Bohm and Hiley , For many years the EPR experiment existed only in the imaginations of physicists. John Bell was a primary force in changing that. In a paper published in he distinguished precisely and mathematically the experimental results of the two types of theories Bell One is classical and assumes locality. It takes the properties of a system to be independent of

those which are some distance from it. The other supports the nonlocal connection, at least at the quantum level, of systems which are quite separate. Suppose quantum theory has the locality of classical physics. Then there is a limit on the number of pairs of particles with a certain property. Experiments can detect this number. Einstein would then be wrong. Experimental evidence for nonlocality did exist to some extent in Bohm and Aharonov However, the unambigous carrying out of an EPR experiment had to wait until the s. A team headed by Alain Aspect performed the decisive experiment, which most physicists now accept Aspect, Dalibard and Roger In so doing it confirms quantum connections over distances up to twenty-six meters and perhaps up to thirty meters. It disproves theories which assume locality. Researchers also plan more experimental work on this question. Bohm and Basil Hiley leave us with a warning. We may want to accept nonlocality. We may even want to see it in all situations. Thus we may think of everything as connected to everything else regardless of their separations in time and space. The evidence, however, does not support doing this. The connection between objects at the quantum level may only apply in certain circumstances. An example is "over relatively short distances for simple systems". It can also appear in complex systems and over somewhat longer distances with the temperature near absolute zero. Thus breaking systems into independent subsystems as required by classical physics is often quite acceptable. Bohm and Hiley believe "nonlocality will only reveal itself in very subtle ways". They want to explore "the precise conditions under which such effects appear" Bohm and Hiley , However, they challenge our usual understandings of, for example, space, time and matter. Frescura and Hiley Frescura and Hiley , 8. John Clauser and Abner Shimony think similarly. There are many conflicting approaches and interpretations. Must we have nonlocality or can we rewrite physics to keep locality? If we do have to have nonlocality, how are we to understand why it is there? Approaches which accept nonlocality differ from common sense. Nonlocality itself is not common sense. Some approaches go so far as to conflict with acceptable physics. Konkowski ask about influences travelling faster than the speed of light Helliwell and Konkowski , Could there be a relativity-disobedient faster-than-light "elaborate signalling mechanism" between the two particles in the experiment? Or do the particles somehow know what is going on with each other? An "unattractive proposition" to Hiley Hiley ,

4: BM RELATING THE PHYSICS AND RELIGION OF DAVID BOHM

David Bohm, whose work inspired many people all over the world, died in London. David Bohm's contributions to science and philosophy are profound, and they have yet to be fully recognized and integrated on the grand scale.

Bohm introduced concepts of Implicate Order and Explicate Order. Bohm defined explicate order as the order of the physical world. He defined implicate order as the source of explicate order, and as an underlying whole that physical form constantly unfolds out from and enfolds back into. Bohm meant his concepts to replace order and disorder although he was not able to convince other scientists of this necessity, and Bohm struggled with depression at not being able to convince the scientific community of the scientific value of his discoveries. In describing Implicate Order Bohm writes: This order is not to be understood solely in terms of a regular arrangement of objects e. Rather, a total order is contained in some implicit sense, in each region of space and time. The two directions of order are probably the most important features of nature that we will ever understand. There are endless applications of two orders in every field, in physics, biology, geology, politics, and psychology, just naming the more obvious fields. The theory of two orders generally describes all change, all patterns, all definitive form, so what if anything could be excluded. As we learn to perceive the cosmos as one type of order transforming into another, doors of comprehension will open beyond our wildest dreams. In order to understand how the whole can exist in every part, Bohm became interested in the mechanics of holographic photography. Using lasers, a holographic image is recorded evenly across the photographic film. Consequently any region of the film contains information about the whole image, so any small region of the film can recreate the image, although in poorer resolution than the entire film produces. Bohm believed all matter is unfolded out of what he eventually described as a holomovement, which meant that matter could also enfold and so return into the holomovement. Bohm considered quantum mechanics to be a process of unfolding and enfolding. Every part of the universe is related to every other part but in different degrees. David Peat and John Briggs, Bohm explained his concept of enfoldment: You fold up a sheet of paper, turn it into a small packet, make cuts in it, and then unfold it into a pattern. The parts that were close in the cuts unfold to be far away. This is like what happens in a hologram. Enfoldment is really very common in our experience. All the light in this room comes in so that the entire room is in effect folded into each part. If your eye looks, the light will be then unfolded by your eye and brain. As you look through a telescope or a camera, the whole universe of space and time is enfolded into each part, and that is unfolded to the eye. The program featured a small scientific wonder, where an insoluble drop of dark ink in one process disappears uniformly into a glycerin, then in the opposite process the drop reappears. About the time I was looking into these questions, a BBC science program showed a device that illustrates these things very well. It consists of two concentric glass cylinders. Between them is a viscous fluid, such as glycerin. If a drop of insoluble ink is placed in the glycerin and the outer cylinder is turned slowly, the drop of dye will be drawn out into a thread. Eventually the thread gets so diffused it cannot be seen. At that moment there seems to be no order present at all. Yet if you slowly turn the cylinder backward, the glycerin draws back into its original form, and suddenly the ink drop is visible again. The ink had been enfolded into the glycerin, and it was unfolded again by the reverse turning. Of course we can accomplish this same transformation less dramatically with any container filled with water and oil, and simply shake the container until the two liquids mix together evenly. Then at rest electrostatic cohesion and gravity will rather quickly re-separate the liquids into two pure groups. What these analogies of mixing and separation attempt to convey is that material form can integrate and disappear into a whole. This suggests an equivalency between matter and that invisible background, a background which we know simply to be space. All the empty space in the universe, which we naturally assume to be less than the physical matter we are able to interact with, is actually more full of content than the surface of form we see due to light waves. What we imagine to be empty space contains the whole of everything. It is a considerably different way of looking at the world, but the message is that matter is constantly unfolding out of and refolding into a larger balanced whole. Classical physics says that reality is actually little particles that separate the world into its independent elements. We could picture the electron not

as a particle that exists continuously but as something coming in and going out and then coming in again. If these various condensations are close together, they approximate a track. The electron itself can never be separated from the whole of space, which is its ground. Talbot also suggests the whole universe is a hologram. Just as every portion of the hologram contains the image of the whole, every portion of the universe enfolds the whole. This means that if we knew how to access it we could find the Andromeda galaxy in the thumbnail of your left hand. We could also find Cleopatra meeting Caesar for the first time, for in principle the whole past and implications for the whole future are also enfolded in each small region of space and time. Every cell in our body enfolds the entire cosmos. Also I think he tried to convince the wrong audience. Judging from my own experiences I am sure it would have taken years for even a fully convincing challenge to sink in to the sometimes dull collective mind of science, which grounded in the present dry paradigm tends to shy away from profound concepts altogether. One of the most important lessons I convey perhaps uniquely from Bohm, is that symmetry order is an entirely separate component of the patterns we find in nature, so that we can see the unfolding and enfolding process as a governing system, visible not only within the general evolution of time, but also present within each individual, and within humanity as a whole. I expect anyone who reads this book will eventually be able to observe any pattern in their world and recognize the two components of order not only contributing to the appearance of order, but also the appearance of what we think of as disorder. The Absence of One Order Creates the Other Both the Irish poet William Yeats, who received the Nobel Prize for literature in , and the French philosopher Henri Bergson who received a Nobel in literature in , wrote of two fundamental orders at work in the evolutionary process of the universe. Although the nature of the orders was not described as clearly as Bohm managed with his implicate and explicate concepts, both men recognized the exclusive quality of the two orders more clearly than Bohm. In his book entitled Creative Evolution Bergson writes: Obviously Bergson somehow recognized how any decrease in the measure of one type of order, increases the order of the other type. This can be recognized if we consider a breakdown in the purity of each order. Suppose we switch two oppositely colored squares on a checkerboard. The inconsistency in the symmetrical arrangement stands out like a beacon. The rhythmic order of symmetrical pattern has been broken. The symmetry order is clearly diminished. And yet the fusing of three colored squares into one larger block is an increase in a type of order. Grouping order has increased. Alternatively, at the other end of order, if we group together the game pieces by colors on each side of the board, and mistakenly displace one colored piece with another, the diminished purity of the grouping order stands out vividly here also. The purity of each of the two groups is contaminated, yet note here how this is a first move toward increased symmetry order. Each of these first steps away from an unbroken high order is both an increase of an order and a decrease of an order. Hence the order of one type is the disorder of the other. Anywhere that a substance gravitates together, grouping order has increased while symmetry order has decreased. Anyplace where things spread more evenly throughout any frame of reference, symmetry order has increased while grouping order has decreased. Generally, one type of order cannot increase without decreasing the other. Each order has its own direction. Each order is unique. And all there is throughout the universe is order. We observe order in the universe and are amiss at why it exists over disorder. We typically imagine that our corner of the universe must be a tiny island of order within a greater chaos. The term order within chaos is common. However, once we learn to appreciate the two kinds of order, existentially speaking, it seems more apt to say that chaos exists within order. If the disorder of symmetry is inversely the order of grouping, and if every pattern consists of a combination of two orders, then all there can be is order. These images relate to the double wedge shape of pattern space, but they more accurately portray the measure or intensity of one order compared to the other throughout the entire span of what is possible. They represent how the two orders combine and so become two parts of the same description. Different Gyres described by Yeats. The two cones effectively represent the integration and inseparability of grouping and symmetry orders. It is said that Yeats discovered the images through the mystical experience of his wife Georgie Hyde-Lee, who demonstrated a gift for automatic writing. In various ways Yeats diagrammed two cones or wedges embedded together. Yeats notes that the information his wife acquires mystically seems to come from a common dream they and a few others shared. It attempts to describe the fundamental way that the physical universe changes as time passes, stating that the overall

entropy of a system; entropy being the measure of spent energy, always increases with time, which is true, there is no way to get around that law of nature, but the second law also makes a statement which erroneously assumes a connection between a loss of usable energy and an increase in disorder. And we find now that this part of the second law cannot be true, primarily because there is no such thing as general disorder. Symmetry order is the disorder of grouping order, and grouping order is the disorder of symmetry order. If the order of one is the disorder of the other, then there is no room for a general disorder. All there is in nature is ordered patterns of one type or the other, and combinations thereof. We envision order and chaos as being opposed, and chaos theorists speak of an order at the edge of chaos, but neither accurately represents order as it exists in nature. The order that is so visible throughout our universe springs from combinations of imbalance and balance. Whether we speak of the even distribution of galaxies, or gaseous particles that disperse evenly throughout available space, we find what is happening is that time is evolving away from the most extreme state of imbalance to the most extreme state of balance. When one learns to see this transition, it suddenly is visible in everything from red hot flowing materials that solidify into rock or steel, to water vapor which crystallize into a snowflake. My own early diagram, meaning to show the opposition and exclusivity of two orders was simply of a square split in half by opposite corners, and likewise was meant to show that the extreme of one order type is the disorder of the other. Order gradients indicating the absence of a general disorder. The order of one type is the disorder of the other.

5: Wholeness and the Implicate Order - David Bohm - Google Books

David Bohm was an American theoretical physicist who would later become a citizen of the United Kingdom. After finishing his undergraduate degree at the Pennsylvania State University in , Bohm arrived at the University of California, Berkeley on a seemingly meteoric rise.

To count as synchronicity, the events should be unlikely to occur together by chance. My first experience with synchronicity was on March 21st at 3: It was my alignment with the universal forces, the planet, space and time. My awakening was also through no effort of my own and came by way of a supernatural encounter with an entity of light. My experiences are not entirely unique, but the way in which this window of understanding opened for me is. There was no journey, no explanation as to why â€" the knowledge was just revealed. Things that to many are never more than concepts and metaphors, I actually see as having real form. So unlike many others who seek the path, I feel that for some reason the source found me. Being human however leaves me questioning: But what is our connection? Without an observer YOU there is no mind, no synchronicity, no meaning. Thoughts connected to events, mind connected to movements of matter, absent of a cause acausal. Thinking something before it happens, remote viewing, telekinesis, where do these abilities come from? How then do we prove any of this? I say that we are using a flawed science because it is incomplete. Bohm says there is a hidden variable implying that neither relativity nor quantum mechanics should be accepted as a conclusive nor exclusive solution. My research began with Carl Jung but for millennia prior to Jung man has experienced synchronicity. Theoretically it begins outside of our space-time in the flow where all knowledge exits and our material reality takes shape. It then unfolds into our dimension only to return back to the flow. In the fourth century B. Everything is in sympathy. This is a classic idea whereby separateness is an illusion. Now what you should know is that Jung had a lifelong interest in and many experiences with the paranormal. Working with him was the Nobel Prize winning physicist Wolfgang Pauli who also had experiences with telekinesis. Catastrophic breakdowns of experimental equipment would inexplicably occur when he was around. It was often joked about, but other scientists feared his presence during experiments because it was commonly believed he was the cause. Others studying non-material or fringe science also advanced the field sometimes unknowingly by the very nature of their work. Consciousness itself cannot be scientifically quantified â€" there is no explaining it. Many believe it exists outside the brain, perhaps the Akashic field. Psi-fields, source fields, the flow, these are all conceptual dimensions bound together by abstract relationships. Where consciousness and matter are two aspects of the same thing. These are the domains of the trickster gods where Hermes and Loki conspire to fool us using mind, matter and meaning. What is the intelligence behind the curtain? Since before recorded history humankind has recognized the existence of a greater intelligence. We must assume behind this force is the existence of a conscious and intelligent mind. This mind is the matrix of all matter. There are others who believe that all existence is an emanation of God. This is not my belief! What many of these theories and beliefs have in common, is that your own thoughts can alter the outside world in relation to you. Though, you alone are not the creator within the flow of the source field. You are simply part of the process. Ultimately there is a separate coordinating intelligence in control. This is what causes events to coincide without your thoughts, like for instance, the moment of my birth: How many times do events align that seem so strange and statistically unlikely to have occurred by chance? They must originate externally.

6: Exploring David Bohmâ€™s Panendeistic God â€“ The Panendeism Organization

David Bohm is a physicist with a broad range of other interests including religion, philosophy, education, art, and linguistics. This book surveys Bohm's physical theories including the quantum.

Albert Einstein, , Leiden When forced to summarize the general theory of relativity in one sentence: Time and space and gravitation have no separate existence from matter. The supreme task of the physicist is to arrive at those universal elementary laws from which the cosmos can be built by pure deduction. Bohmian Mechanics Bohmian mechanics, which is also called the de Broglie-Bohm theory, the pilot-wave model, and the causal interpretation of quantum mechanics, is a version of quantum theory discovered by Louis de Broglie in and rediscovered by David Bohm in It is the simplest example of what is often called a hidden variables interpretation of quantum mechanics. However, the wave function provides only a partial description of the system. This description is completed by the specification of the actual positions of the particles. The latter evolve according to the "guiding equation," which expresses the velocities of the particles in terms of the wave function. Thus, in Bohmian mechanics the configuration of a system of particles evolves via a deterministic motion choreographed by the wave function. In particular, when a particle is sent into a two-slit apparatus, the slit through which it passes and where it arrives on the photographic plate are completely determined by its initial position and wave function. Bohmian mechanics inherits and makes explicit the nonlocality implicit in the notion, common to just about all formulations and interpretations of quantum theory, of a wave function on the configuration space of a many-particle system. It accounts for all of the phenomena governed by nonrelativistic quantum mechanics, from spectral lines and scattering theory to superconductivity, the quantum Hall effect and quantum computing. David Bohm, Wholeness and the Implicate Order I would say that my scientific and philosophical work, my main concern has been with understanding the nature of reality in general and consciousness in particular as a coherent whole, which is never static or complete, but which is in an unending process of movement and unfoldment. Thus, when I look back, I see that even as a child I was fascinated by the puzzle, indeed the mystery, of what is the nature of movement. Whenever one thinks of anything, it seems to be apprehended either as static or as a series of static images. Then there is the further question of what is the relationship of thinking to reality. As careful attention shows, thought itself is in an actual process of movement. May not thought itself thus be part of reality as a whole? But then, what could it mean for one part of reality to know another, and to what extent would this be possible? David Bohm, Wholeness and the Implicate Order, So what we have to do with regard to the great wisdom from the whole of the past, both in the East and in the West, is to assimilate it and to go on to new and original perception relevant to our present condition of life. If he thinks of the totality as constituted as independent fragments, then that is how his mind will tend to operate, but if he can include everything coherently and harmoniously in an overall whole that is undivided, unbroken and without border for every border is a division or break then his mind will tend to move in a similar way, and from this will flow an orderly action within the whole. David Bohm, Wholeness and the Implicate Order, Indeed, man has always been seeking wholeness - mental, physical, social and individual All of this indicates that man has sensed always that wholeness or integrity is an absolute necessity to make life worth living. Yet, over the ages, he has generally lived in fragmentation. Such an absurd conclusion does not arise, however, if we say that all theories are insights, which are neither true nor false. Man is continually developing new forms of insight, which are clear up to a point and then tend to become unclear. In this activity, there is evidently no reason to suppose that there is or will be a final form of insight corresponding to absolute truth or even a steady series of approximations to this. Rather, one may expect the unending development of new forms of insight which will, however assimilate certain key features of the older forms as simplifications, in the way that relativity theory does with Newtonian theory. David Bohm, Wholeness and the Implicate Order, What prevents theoretical insights from going beyond existing limitations and changing to meet new facts is just the belief that theories give true knowledge of reality which implies, of course, that they never change. Although our modern way of thinking has changed a great deal relative to the ancient one, the two have had one key feature in common: Thus, both are led to confuse the

forms and shapes induced in our perceptions by theoretical insight with a reality independent of our thought and way of looking. This confusion is of crucial significance, since it leads us to approach nature, society and the individual in terms of more or less fixed and limited forms of thought, and thus, apparently, to keep on confirming the limitations of these forms of thought in experience. David Bohm, Wholeness and the Implicate Order, If man thinks of the totality as constituted of independent fragments, then that is how his mind will tend to operate, but if he can include everything coherently and harmoniously in an overall whole that is undivided, unbroken, and without a border then his mind will tend to move in a similar way, and from this will flow an orderly action within the whole. David Bohm, Wholeness and the Implicate Order, The notion that all these fragments is separately existent is evidently an illusion, and this illusion cannot do other than lead to endless conflict and confusion. Indeed, the attempt to live according to the notion that the fragments are really separate is, in essence, what has led to the growing series of extremely urgent crises that is confronting us today. Thus, as is now well known, this way of life has brought about pollution, destruction of the balance of nature, over-population, world-wide economic and political disorder and the creation of an overall environment that is neither physically nor mentally healthy for most of the people who live in it. Individually there has developed a widespread feeling of helplessness and despair, in the face of what seems to be an overwhelming mass of disparate social forces, going beyond the control and even the comprehension of the human beings who are caught up in it. David Bohm, Wholeness and the Implicate Order, David Bohm Quotes on Quantum Theory The quantum theory, as it is now constituted, presents us with a very great challenge, if we are at all interested in such a venture, for in quantum physics there is no consistent notion at all of what the reality may be that underlies the universal constitution and structure of matter. If on the other hand we apply the world view in which the world is regarded as a continuous field, we find that this field must also be discontinuous, as well as particle-like, and that it is as undermined in its actual behavior as is required in the particle view of relation as a whole. David Bohm, On Quantum Theory, Wholeness and the Implicate Order, In relativity, movement is continuous, causally determinate and well defined, while in quantum mechanics it is discontinuous, not causally determinate and not well defined. Each theory is committed to its own notions of essentially static and fragmentary modes of existence relativity to that of separate events, connectable by signals, and quantum mechanics to a well-defined quantum state. One thus sees that a new kind of theory is needed which drops these basic commitments and at most recovers some essential features of the older theories as abstract forms derived from a deeper reality in which what prevails in unbroken wholeness. David Bohm, On Quantum Mechanics, Wholeness and the Implicate Order, At present quantum physicists tend to avoid the issue by adopting the attitude that our overall views concerning the nature of reality are of little or no importance. All that counts in physical theory is supposed to be the development of mathematical equations that permit us to predict and control the behaviour of large statistical aggregates of particles. Such a goal is not regarded as merely for its pragmatic and technical utility: Rather, we say that inseparable quantum interconnectedness of the whole universe is the fundamental reality, and that relatively independent behaving parts are merely particular and contingent forms within this whole. David Bohm, On the Intuitive Understanding of Nonlocality as Implied by Quantum Theory, Foundations of Physics, vol 5, The main problem with modern physics is that quantum mechanics gives only the probability of an experimental result. Neither the decay of an atomic nucleus nor the fact that it decays at one moment and not another can be properly pictured within the theory. It can only enable you to predict statistically the results of various experiments. Physics has changed from its earlier form, when it tried to explain things and give some physical picture. Now the essence is regarded as mathematical. Now they may find an algorithm by which they hope to explain a wider range of experimental results, but it will still have inconsistencies. They hope that they can eventually explain all the results that could be gotten, but that is only a hope. When we met he said the book had done about as well as you could do with quantum mechanics. But he was still not convinced it was a satisfactory theory. He felt it was a kind of abstraction; quantum mechanics got correct results but left out much that would have made it intelligible. I came up with the causal interpretation that the electron is a particle, but it also has a field around it. The particle is never separated from that field, and the field affects the movement of the particle in certain ways. Things that are far away from each other profoundly affect each other. He believed only in local action.

I realized then the problem is that coordinates are still the basic order in physics, whereas everything else has changed. When you apply quantum theory to general relativity, at very short distances like ten to the minus thirty-three centimeters, the notion of the order of space and time breaks down. I think physicists have a tremendous reluctance to admit this. There is a long history of belief in quantum mechanics, and people have faith in it. David Bohm, On Quantum Physics, Classical physics says that reality is actually little particles that separate the world into its independent elements. We could picture the electron not as a particle that exists continuously but as something coming in and going out and then coming in again. If these various condensations are close together, they approximate a track. The electron itself can never be separated from the whole of space, which is its ground. Formulas are means of talking utter nonsense until you understand what they mean. Every page of formulas usually contains six or seven arbitrary assumptions that take weeks of hard study to penetrate. Younger physicists usually appreciate the implicate order because it makes quantum mechanics easier to grasp. Of course, nobody has really refuted them. At this point, I think that the major issue is mathematics. In super-symmetry theory an interesting piece of mathematics will attract attention, even without any experimental confirmation. My understanding of these words, that is, this notion of wholeness - not necessarily directed toward God but as a way of living - had a tremendous impact on me. I also felt a sense of nature being whole very early. When I first studied quantum mechanics I felt again that sense of internal relationship - that it was describing something that I was experiencing directly rather than just thinking about. The notion of spin particularly fascinated me: I felt that somehow that described experience with the processes of the mind. In thinking about spin I felt I was in a direct relationship to nature. In quantum mechanics I came closer to my intuitive sense of nature. David Bohm, Interview conducted by F.

7: David Bohm and The Holographic Universe

Einstein once spoke of the physicist David Bohm as his successor. Bohm introduced concepts of Implicate Order and Explicate Order. Bohm defined explicate order as the order of the physical world.

The Completeness of the Quantum Mechanical Description Conceptual difficulties have plagued quantum mechanics since its inception, despite its extraordinary predictive successes. The basic problem, plainly put, is this: It is not at all clear what quantum mechanics is about. What, in fact, does quantum mechanics describe? It might seem, since it is widely agreed that any quantum mechanical system is completely described by its wave function, that quantum mechanics is fundamentally about the behavior of wave functions. His difficulty had little to do with the novelty of the wave function: That it is an abstract, unintuitive mathematical construct is a scruple that almost always surfaces against new aids to thought and that carries no great message. The screen however does not show a more or less constant uniform surface glow, but rather lights up at one instant at one spot â€¦. But then what does? We are told that no distinction is to be made between the state of a natural object and what I know about it, or perhaps better, what I can know about it if I go to some trouble. Actuallyâ€”so they sayâ€”there is intrinsically only awareness, observation, measurement. But it is becoming increasingly difficult to find any who, when pressed, will defend this interpretation. It seems clear that quantum mechanics is fundamentally about atoms and electrons, quarks and strings, not those particular macroscopic regularities associated with what we call measurements of the properties of these things. But if these entities are not somehow identified with the wave function itselfâ€”and if talk of them is not merely shorthand for elaborate statements about measurementsâ€”then where are they to be found in the quantum description? There is, perhaps, a very simple reason why it is so difficult to discern in the quantum description the objects we believe quantum mechanics ought to describe. Perhaps the quantum mechanical description is not the whole story, a possibility most prominently associated with Albert Einstein. They concluded with this observation: While we have thus shown that the wave function does not provide a complete description of the physical reality, we left open the question of whether or not such a description exists. We believe, however, that such a theory is possible. See the entries on the Einstein-Podolsky-Rosen argument in quantum theory and on quantum entanglement and information. In relation to a theory incorporating a more complete description, Einstein remarked that the statistical quantum theory would â€¦ take an approximately analogous position to the statistical mechanics within the framework of classical mechanics. He concluded that It is therefore not, as is often assumed, a question of a re-interpretation of quantum mechanicsâ€”the present system of quantum mechanics would have to be objectively false, in order that another description of the elementary processes than the statistical one be possible. For example, Max Born, who formulated the statistical interpretation of the wave function, assured us that No concealed parameters can be introduced with the help of which the indeterministic description could be transformed into a deterministic one. Hence if a future theory should be deterministic, it cannot be a modification of the present one but must be essentially different. We still find, a quarter of a century after the rediscovery of Bohmian mechanics in , statements such as these: The proof he [von Neumann] published â€¦, though it was made much more convincing later on by Kochen and Specker , still uses assumptions which, in my opinion, can quite reasonably be questioned. This quotation is significant because Wigner was one of the leading physicists of his generation. Unlike most of his contemporaries, moreover, he was also profoundly concerned about the conceptual foundations of quantum mechanics and wrote on the subject with great clarity and insight. There was, however, one physicist who wrote on this subject with even greater clarity and insight than Wigner himself: Bell whom Wigner praises for demonstrating the impossibility of a deterministic completion of quantum theory such as Bohmian mechanics. But in I saw the impossible done. It was in papers by David Bohm. Bohm showed explicitly how parameters could indeed be introduced, into nonrelativistic wave mechanics, with the help of which the indeterministic description could be transformed into a deterministic one. If only to point out what was wrong with it? Why did von Neumann not consider it? Should it not be taught, not as the only way, but as an antidote to the prevailing complacency? To show us that vagueness, subjectivity, and indeterminism, are not forced on us by

experimental facts, but by deliberate theoretical choice? Bell , reprinted in c: On the contrary, until his untimely death in , Bell was the prime proponent, and for much of this period almost the sole proponent, of the very theory, Bohmian mechanics, that he supposedly demolished. Bohmian mechanics is of course as much a counterexample to the Kochen-Specker argument for the impossibility of hidden variables as it is to the one of von Neumann. It is obviously a counterexample to any such argument. However reasonable the assumptions of such an argument, some of them must fail for Bohmian mechanics. Wigner was quite right to suggest that the assumptions of Kochen and Specker are more convincing than those of von Neumann. They appear, in fact, to be quite reasonable indeed. However, they are not. The impression that they are arises from a pervasive error, an uncritical realism about operators, that we discuss below in the sections on quantum observables , spin , and contextuality. It would be hard to argue against the reasonableness of such an assumption, even if one were so bold as to doubt its inevitability. Bell showed that any hidden-variables formulation of quantum mechanics must be nonlocal, as, indeed, Bohmian mechanics is. But he showed much much more. In a celebrated paper he published in , Bell showed that quantum theory itself is irreducibly nonlocal. That this did not happen is no doubt due in part to the obscurity of orthodox quantum theory and to the ambiguity of its commitments. It almost did happen: For details see Hemmick and Shakur , chapter 4. It was, in fact, his examination of Bohmian mechanics that led Bell to his nonlocality analysis. In the course of investigating Bohmian mechanics, he observed that: For a discussion of how nonlocality emerges in Bohmian mechanics, see Section Bell showed that the predictions of standard quantum theory itself imply nonlocality. Thus if these predictions govern nature, then nature is nonlocal. More conclusive still is the experiment of Weihs et al. It is important to note that to the limited degree to which determinism plays a role in the EPR argument, it is not assumed but inferred. Bell a, reprinted c: Note well then that the following argument makes no mention whatever of determinism. The difficulty is not created by any such picture or any such terminology. It is created by the predictions about the correlations in the visible outputs of certain conceivable experimental set-ups. Let me summarize once again the logic that leads to the impasse. The EPRB correlations are such that the result of the experiment on one side immediately foretells that on the other, whenever the analyzers happen to be parallel. If we do not accept the intervention on one side as a causal influence on the other, we seem obliged to admit that the results on both sides are determined in advance anyway, independently of the intervention on the other side, by signals from the source and by the local magnet setting. But this has implications for non-parallel settings which conflict with those of quantum mechanics. So we cannot dismiss intervention on one side as a causal influence on the other. For further insight into the various controversies see Maudlin and Goldstein et al. Nonetheless, the opinion of Bell himself about what he showed is perfectly clear. History The pilot-wave approach to quantum theory was initiated by Einstein, even before the discovery of quantum mechanics itself. While the notion of the electromagnetic field as guiding field turned out to be rather problematical, Max Born explored the possibility that the wave function could play this role, of guiding field or pilot wave, for a system of electrons in his early paper founding quantum scattering theory Born Heisenberg was profoundly unsympathetic. In , de Broglie found an equation of particle motion equivalent to the guiding equation for a scalar wave function de Broglie However, despite what is suggested by Bacciagaluppi and Valentini , de Broglie responded very poorly to an objection of Wolfgang Pauli Pauli concerning inelastic scattering, no doubt making a rather bad impression on the illustrious audience at the congress. Born and de Broglie very quickly abandoned the pilot-wave approach and became enthusiastic supporters of the rapidly developing consensus in favor of the Copenhagen interpretation. He was the first person to genuinely understand its significance and implications. John Bell became its principal proponent during the sixties, seventies and eighties. For a very good discussion of the history of quantum mechanics, the debates about its foundations, and about the reception of Bohmian mechanics in particular, see Bricmont See also Beller Rather, it governs the motion of the fundamental variables, the positions of the particles: In the Bohmian mechanical version of nonrelativistic quantum theory, quantum mechanics is fundamentally about the behavior of particles; the particles are described by their positions, and Bohmian mechanics prescribes how these change with time. In this sense, for Bohmian mechanics the particles are primary, or primitive, while the wave function is secondary, or derivative. For no sharp definition of such a scale could be made. But

to admit things not visible to the gross creatures that we are is, in my opinion, to show a decent humility, and not just a lamentable addiction to metaphysics. In any case, the most hidden of all variables, in the pilot wave picture, is the wavefunction, which manifests itself to us only by its influence on the complementary variables. The theory is then defined by two evolution equations: When external magnetic fields are present, the gradient should be understood as the covariant derivative, involving the vector potential. This deterministic theory of particles in motion accounts for all the phenomena of nonrelativistic quantum mechanics, from interference effects to spectral lines Bohm It does so in an entirely ordinary manner, as we explain in the following sections. For a scalar wave function, describing particles without spin, the form of the guiding equation above is a little more complicated than necessary, since the complex conjugate of the wave function, which appears in the numerator and the denominator, cancels out. However, the form above has two advantages: First, it makes sense for particles with spinâ€”and, in fact, Bohmian mechanics without further ado accounts for all the apparently paradoxical quantum phenomena associated with spin. This demonstrates that it is wrong to claim that the predictions of quantum theory are incompatible with the existence of hidden variables, with an underlying deterministic model in which quantum randomness arises from averaging over ignorance. Bohmian mechanics provides us with just such a model: For any quantum experiment we merely take as the relevant Bohmian system the combined system, including the system upon which the experiment is performed as well as all the measuring instruments and other devices used to perform the experiment together with all other systems with which these have significant interaction over the course of the experiment. The guiding equation for the big system then transforms the initial configuration into the final configuration at the conclusion of the experiment. It then follows that this final configuration of the big system, including in particular the orientation of instrument pointers, will also be distributed in the quantum mechanical way.

8: Bohm's Gnosis: The Implicate Order

This article discusses the vision David Bohm intuited from his insight (gnosis) into the quantum world. This vision discerns the characteristics of an evolving cosmos in process; and, also, it ponders upon the implications for humanity.

David Bohm and the Implicate Order By David Pratt The death of David Bohm on 27 October is a great loss not only for the physics community but for all those interested in the philosophical implications of modern science. David Bohm was one of the most distinguished theoretical physicists of his generation, and a fearless challenger of scientific orthodoxy. His interests and influence extended far beyond physics and embraced biology, psychology, philosophy, religion, art, and the future of society. Underlying his innovative approach to many different issues was the fundamental idea that beyond the visible, tangible world there lies a deeper, implicate order of undivided wholeness. David Bohm was born in Wilkes-Barre, Pennsylvania, in He became interested in science at an early age, and as a young boy invented a dripless teapot, and his father, a successful businessman, urged him to try to make a profit on the idea. But after learning that the first step was to conduct a door-to-door survey to test market demand, his interest in business waned and he decided to become a theoretical physicist instead. In the s he attended Pennsylvania State College where he became deeply interested in quantum physics, the physics of the subatomic realm. After graduating, he attended the University of California, Berkeley. While there he worked at the Lawrence Radiation Laboratory where, after receiving his doctorate in , he began what was to become his landmark work on plasmas a plasma is a gas containing a high density of electrons and positive ions. Bohm was surprised to find that once electrons were in a plasma, they stopped behaving like individuals and started behaving as if they were part of a larger and interconnected whole. He later remarked that he frequently had the impression that the sea of electrons was in some sense alive. In Bohm took up the post of assistant professor at Princeton University, where he extended his research to the study of electrons in metals. Once again the seemingly haphazard movements of individual electrons managed to produce highly organized overall effects. In Bohm wrote a classic textbook entitled Quantum Theory , in which he presented a clear account of the orthodox, Copenhagen interpretation of quantum physics. The Copenhagen interpretation was formulated mainly by Niels Bohr and Werner Heisenberg in the s and is still highly influential today. But even before the book was published, Bohm began to have doubts about the assumptions underlying the conventional approach. He had difficulty accepting that subatomic particles had no objective existence and took on definite properties only when physicists tried to observe and measure them. He also had difficulty believing that the quantum world was characterized by absolute indeterminism and chance, and that things just happened for no reason whatsoever. He began to suspect that there might be deeper causes behind the apparently random and crazy nature of the subatomic world. Bohm sent copies of his textbook to Bohr and Einstein. Bohr did not respond, but Einstein phoned him to say that he wanted to discuss it with him. In the first of what was to turn into a six-month series of spirited conversations, Einstein enthusiastically told Bohm that he had never seen quantum theory presented so clearly, and admitted that he was just as dissatisfied with the orthodox approach as Bohm was. He was called upon to appear before the Un-American Activities Committee in order to testify against colleagues and associates. Ever a man of principle, he refused. The result was that when his contract at Princeton expired, he was unable to obtain a job in the USA. He moved first to Brazil, then to Israel, and finally to Britain in , where he worked first at Bristol University and later as Professor of Theoretical Physics at Birkbeck College, University of London, until his retirement in Bohm will be remembered above all for two radical scientific theories: In , the year after his discussions with Einstein, Bohm published two papers sketching what later came to be called the causal interpretation of quantum theory which, he said, "opens the door for the creative operation of underlying, and yet subtler, levels of reality. He continued to elaborate and refine his ideas until the end of his life. In his view, subatomic particles such as electrons are not simple, structureless particles, but highly complex, dynamic entities. He rejects the view that their motion is fundamentally uncertain or ambiguous; they follow a precise path, but one which is determined not only by conventional physical forces but also by a more subtle force which he calls the quantum potential. The quantum potential guides the motion of particles

by providing "active information" about the whole environment. Bohm gives the analogy of a ship being guided by radar signals: The quantum potential pervades all space and provides direct connections between quantum systems. In Bohm and a young research student Yakir Aharonov discovered an important example of quantum interconnectedness. They found that in certain circumstances electrons are able to "feel" the presence of a nearby magnetic field even though they are traveling in regions of space where the field strength is zero. This phenomenon is now known as the Aharonov-Bohm AB effect, and when the discovery was first announced many physicists reacted with disbelief. Even today, despite confirmation of the effect in numerous experiments, papers still occasionally appear arguing that it does not exist. In a remarkable experiment to test quantum interconnectedness was performed by a research team led by physicist Alain Aspect in Paris. The original idea was contained in a thought experiment also known as the "EPR paradox" proposed in by Albert Einstein, Boris Podolsky, and Nathan Rosen, but much of the later theoretical groundwork was laid by David Bohm and one of his enthusiastic supporters, John Bell of CERN, the physics research center near Geneva. The results of the experiment clearly showed that subatomic particles that are far apart are able to communicate in ways that cannot be explained by the transfer of physical signals traveling at or slower than the speed of light. Many physicists, including Bohm, regard these "nonlocal" connections as absolutely instantaneous. An alternative view is that they involve subtler, nonphysical energies traveling faster than light, but this view has few adherents since most physicists still believe that nothing-can exceed the speed of light. In recent years, however, the theory has been gaining increasing "respectability. In the s Bohm began to take a closer look at the notion of order. One day he saw a device on a television program that immediately fired his imagination. It consisted of two concentric glass cylinders, the space between them being filled with glycerin, a highly viscous fluid. If a droplet of ink is placed in the fluid and the outer cylinder is turned, the droplet is drawn out into a thread that eventually becomes so thin that it disappears from view; the ink particles are enfolded into the glycerin. But if the cylinder is then turned in the opposite direction, the thread-form reappears and rebecomes a droplet; the droplet is unfolded again. Bohm realized that when the ink was diffused through the glycerin it was not a state of "disorder" but possessed a hidden, or nonmanifest, order. Bohm gives the analogy of a flowing stream: On this stream, one may see an ever-changing pattern of vortices, ripples, waves, splashes, etc. Rather, they are abstracted from the flowing movement, arising and vanishing in the total process of the flow. Such transitory subsistence as may be possessed by these abstracted forms implies only a relative independence or autonomy of behaviour, rather than absolutely independent existence as ultimate substances. We must learn to view everything as part of " Undivided Wholeness in Flowing Movement. Another metaphor Bohm uses to illustrate the implicate order is that of the hologram. To make a hologram a laser light is split into two beams, one of which is reflected off an object onto a photographic plate where it interferes with the second beam. The complex swirls of the interference pattern recorded on the photographic plate appear meaningless and disordered to the naked eye. But like the ink drop dispersed in the glycerin, the pattern possesses a hidden or enfolded order, for when illuminated with laser light it produces a three-dimensional image of the original object, which can be viewed from any angle. A remarkable feature of a hologram is that if a holographic film is cut into pieces, each piece produces an image of the whole object, though the smaller the piece the hazier the image. Clearly the form and structure of the entire object are encoded within each region of the photographic record. Bohm suggests that the whole universe can be thought of as a kind of giant, flowing hologram, or holomovement , in which a total order is contained, in some implicit sense, in each region of space and time. The explicate order is a projection from higher dimensional levels of reality, and the apparent stability and solidity of the objects and entities composing it are generated and sustained by a ceaseless process of enfoldment and unfoldment, for subatomic particles are constantly dissolving into the implicate order and then recrystallizing. The quantum potential postulated in the causal interpretation corresponds to the implicate order. But Bohm suggests that the quantum potential is itself organized and guided by a superquantum potential, representing a second implicate order, or superimplicate order. Indeed he proposes that there may be an infinite series, and perhaps hierarchies, of implicate or "generative" orders, some of which form relatively closed loops and some of which do not. Higher implicate orders organize the lower ones, which in turn influence the higher. Bohm believes that life

and consciousness are enfolded deep in the generative order and are therefore present in varying degrees of unfoldment in all matter, including supposedly "inanimate" matter such as electrons or plasmas. He suggests that there is a "protointelligence" in matter, so that new evolutionary developments do not emerge in a random fashion but creatively as relatively integrated wholes from implicate levels of reality. The separation of the two -- matter and spirit -- is an abstraction. The ground is always one. His students and colleagues describe him as totally unselfish and non-competitive, always ready to share his latest thoughts with others, always open to fresh ideas, and single-mindedly devoted to a calm but passionate search into the nature of reality. In the words of one of his former students, "He can only be characterized as a secular saint. Bohm believed that the general tendency for individuals, nations, races, social groups, etc. It was his hope that one day people would come to recognize the essential interrelatedness of all things and would join together to build a more holistic and harmonious world.

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David Bohm () was an American theoretical physicist who contributed innovative and unorthodox ideas to quantum theory, philosophy of mind, and neuropsychology.

Overview[edit] The notion of implicate and explicate orders emphasizes the primacy of structure and process over individual objects. The latter are seen as mere approximations of an underlying process. In this approach, quantum particles and other objects are understood to have only a limited degree of stability and autonomy. In the words of F. David Peat , Bohm considers that what we take for reality are "surface phenomena, explicate forms that have temporarily unfolded out of an underlying implicate order". That is, the implicate order is the ground from which reality emerges. They considered spacetime itself as part of an explicate order that is connected to an implicate order that they called pre-space. The spacetime manifold and the properties of locality and nonlocality all arise from an order in such pre-space. Frescura and Hiley suggested that an implicate order could be carried by an algebra, with the explicate order being contained in the various representations of this algebra. Work by Bohm and Hiley on implicate orders, pre-space and algebraic structures. The term projection is a particularly happy choice here, not only because its common meaning is suitable for what is needed, but also because its mathematical meaning as a projection operation, P, is just what is required for working out these notions in terms of the quantum theory. This is a kind of extension of what is done in general relativity, which deals primarily with geometry and only secondarily with the entities that are described within this geometry. Within quantum theory there is entanglement of such objects. This view of order necessarily departs from any notion which entails signalling, and therefore causality. A common grounding for consciousness and matter[edit] Karl H. For example, in the case of matter, entities such as atoms may represent continuous enfoldment and unfoldment which manifests as a relatively stable and autonomous entity that can be observed to follow a relatively well-defined path in space-time. In the case of consciousness, Bohm pointed toward evidence presented by Karl Pribram that memories may be enfolded within every region of the brain rather than being localized for example in particular regions of the brain, cells, or atoms. Bohm went on to say: As in our discussion of matter in general, it is now necessary to go into the question of how in consciousness the explicate order is what is manifest Of course, to make possible such constancy it is also necessary that this content be organized, not only through relatively fixed association but also with the aid of the rules of logic, and of our basic categories of space, time, causality, universality, etc. So the relationship of each moment in the whole to all the others is implied by its total content: Bohm characterises consciousness as a process in which at each moment, content that was previously implicate is presently explicate, and content which was previously explicate has become implicate. One may indeed say that our memory is a special case of the process described above, for all that is recorded is held enfolded within the brain cells and these are part of matter in general. The recurrence and stability of our own memory as a relatively independent sub-totality is thus brought about as part of the very same process that sustains the recurrence and stability in the manifest order of matter in general. It follows, then, that the explicate and manifest order of consciousness is not ultimately distinct from that of matter in general. Bohm likens unfoldment also to the decoding of a television signal to produce a sensible image on a screen. The signal, screen, and television electronics in this analogy represent the implicate order while the image produced represents the explicate order. He also uses an example in which an ink droplet can be introduced into a highly viscous substance such as glycerine , and the substance rotated very slowly such that there is negligible diffusion of the substance. In this example, the droplet becomes a thread which, in turn, eventually becomes invisible. However, by rotating the substance in the reverse direction, the droplet can essentially reform. When it is invisible, according to Bohm, the order of the ink droplet as a pattern can be said to be implicate within the substance. In another analogy, Bohm asks us to consider a pattern produced by making small cuts in a folded piece of paper and then, literally, unfolding it. Widely separated elements of the pattern are, in actuality, produced by the same original cut in the folded piece of paper. Here the cuts in the folded paper represent the implicate order and the unfolded pattern represents the explicate order. Holograms and implicate

order[edit] See also: Holographic principle and Holographic paradigm In a holographic reconstruction, each region of a photographic plate contains the whole image Bohm employed the hologram as a means of characterising implicate order, noting that each region of a photographic plate in which a hologram is observable contains within it the whole three-dimensional image, which can be viewed from a range of perspectives. That is, each region contains a whole and undivided image. There is the germ of a new notion of order here. This order is not to be understood solely in terms of a regular arrangement of objects e. Rather, a total order is contained, in some implicit sense, in each region of space and time. In this view of order, laws represent invariant relationships between explicate entities and structures, and thus Bohm maintained that in physics, the explicate order generally reveals itself within well-constructed experimental contexts as, for example, in the sensibly observable results of instruments. With respect to implicate order, however, Bohm asked us to consider the possibility instead "that physical law should refer primarily to an order of undivided wholeness of the content of description similar to that indicated by the hologram rather than to an order of analysis of such content into separate parts Bohm and Peat emphasize the role of orders of varying complexity, which influence the perception of a work of art as a whole. They note that implicate orders are accessible to human experience. They refer for instance to earlier notes which reverberate when listening to music, or various resonances of words and images which are perceived when reading or hearing poetry. A hydrogen atom and its constituent particles: His paradigm is generally opposed to reductionism , and some view it as a form of ontological holism. This whole encompasses all things, structures , abstractions, and processes, including processes that result in relatively stable structures as well as those that involve a metamorphosis of structures or things. In this view, parts may be entities normally regarded as physical , such as atoms or subatomic particles , but they may also be abstract entities, such as quantum states. Whatever their nature and character, according to Bohm, these parts are considered in terms of the whole, and in such terms, they constitute relatively separate and independent "sub-totalities. Bohm , p. Such vortices can be relatively stable patterns within a continuous flow, but such an analysis does not imply that the flow patterns have any sharp division, or that they are literally separate and independently existent entities; rather, they are most fundamentally undivided. Quantum theory and relativity theory[edit] A key motivation for Bohm in proposing a new notion of order was the well-known incompatibility of quantum theory with relativity theory. Each theory is committed to its own notions of essentially static and fragmentary modes of existence relativity to that of separate events connectible by signals , and quantum mechanics to a well-defined quantum state. One thus sees that a new kind of theory is needed which drops these basic commitments and at most recovers some essential features of the older theories as abstract forms derived from a deeper reality in which what prevails is unbroken wholeness. Bohm maintained that relativity and quantum theories are in basic contradiction in these essential respects, and that a new concept of order should begin with that toward which both theories point: This should not be taken to mean that he advocated such powerful theories be discarded. He argued that each was relevant in a certain contextâ€”i. Thus, Bohm , pp. According to Bohm, a key motivation for doing so had been purely to show the possibility of such theories. On this, Bohm , p. On the dominant approaches in quantum theory, he said:

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