



BP - Nonlocal causation

**From the book *Science, Order and Creativity* by physicists David Bohm and David Peat: “The causal interpretation of quantum physics was developed by David Bohm over a period of several decades beginning in the 1950’s...it provides an account of how actual quantum processes may take place. Moreover it does not require a conceptual or formal separation between the quantum system and its surrounding “classical” apparatus...there is no fundamental “incommensurability” between classical and quantum concepts. In developing the discussion it is necessary to introduce some new ideas, such as the notion of active information, which becomes important in explaining the ideas of [generative order](#).**

**“Causal” should not be taken as a form of complete determinism. Indeed this interpretation opens the door for the creative operation of underlying, and yet subtler, levels of reality. Within Newton’s physics, a classical particle moves according to Newton’s laws of motion, and the forces that act on the particle are derived from a classical potential  $V$ . The basic proposal of the causal interpretation is that there also acts a quantum potential  $Q$ .”**

That means that there is a level of reality that has to do with quantum waves of possibilities and probabilities and potential, and that dimension (or those dimensions) - beyond the 3 (+time) that we are readily familiar with – has a lot to do with why and how things happen. Quantum potential has a prime spot in the “chain” of cause and effect. And that means a new universe of possibility.

We are expanding out of the paradigm of probability into one of possibility. We need to teach a new set of operating assumptions that fits with “spooky action at a distance”. That’s what Einstein called it. Later in his life, sometime after the 1927 5th Solvay conference in Brussels (with Heisenberg, Bohr, etc) Einstein said: "Anyone who becomes seriously involved in the pursuit of science becomes convinced that there is a spirit manifest in the laws of the universe, a spirit vastly superior to that of man."

*“In the causal interpretation, the electron moves under its own energy, but the information in the form of the quantum wave directs the energy of the electron. Clearly the term causal is now being used in a very new way from its more familiar sense.*

*Information within quantum potential will determine the outcome of a quantum process...it is useful to extend this idea to what could be called active information...The quantum wave carries “information” [the wavefunction contains all information about the system that is potentially available, not just the*



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information actually in hand] *and is therefore potentially active everywhere, but is actually active only when and where this energy enters into the energy of the particle...*

**Another name for this theory is non-local causation.** Or what Einstein called “spooky action at a distance.”

**Peat/Bohm:** *“There is great reluctance on the part of physicists to consider such non-locality seriously, even though it does lie at the heart of the formal implications of quantum theory. Because theories in terms of local interactions have been so successful over the past few centuries, the concept is now seen as both necessary and inevitable. But in fact, there does not appear to be in any intrinsic reason to rule out non-local forces. However, a general attitude has arisen out of the tacit infrastructure of ideas over the last few centuries which prejudice scientists against any serious consideration of non-locality.”*

**Anton Zeilinger:** *“...we have done experiments on entangled states where we can show that causes cannot exist insofar as they are local. That’s an important point... We have now seen [8]0 years of quantum physics and many people trying to understand what’s happening on the basis of old notions, and none of them have solved the problems. **I like to take the radical view that the next plateau must be even more strange and weird than what we have now. When we talk about non-local action, we are saying, when this particle is measured, some information instantly travels over there and tells the other one.**”*

That means instantaneous interconnectedness. It goes beyond a linear, materialist chain of cause and effect to something that defies materialist, mechanistic, Newtonian laws.

**The Non-Local Universe: New Physics and Matters of the Mind Robert Nadeau and Menas Kafatos:**

Intro *“...background for understanding a new relationship between parts and wholes in quantum physics, as well as a similar view of that relationship that has emerged in the so-called new biology and in recent studies of evolution of modern humans.*

*But at the end of the sometimes arduous journey lie 2 conclusions that should make the trip very worthwhile. First, there is no basis in contemporary physics or biology for believing on the stark division between mind and world that some have described as “the disease of the Western Mind.” Second, there’s a new basis for dialogue between the humanists-social scientists and the scientists-engineers.*

*Like Einstein before him, Bell was discomforted by the threats that quantum physics posed to a fundamental assumption of classical physics...Quantum physics allows for what Einstein disparagingly*



termed “spooky action at a distance.” Also, that even though no signal can travel faster than light, the correlations occur instantaneously or in “no time.”

Bell published his theorem in 1964. Results of Alain Aspect in '82 makes the answer to Bell's questions “quite clear – quantum physics is a self-consistent theory, and character of physical reality is non-local.” Further confirmation came in 1997 with Nicholas Gisin twin photon experiment (U of Geneva).”

**Fred Hoyle**, “Success may come one day, but only from a nonlocal form of physics, the kind of physics that is not at all popular right now.”

### [John Gribbin](#) – Schrodinger's Kittens and the Search for Reality:

*“The same year Schrodinger published his cat-in-the-box paradox, Eistein, Podolsky and Rosen's EPR puzzle appeared in print – 1935. The puzzle was refined by David Bohm in 1951; but it remained a thought experiment. **The most comprehensive and conclusive of these [actual later] experiments were carried out by Alain Aspect and his colleagues in the early '80's. They demonstrated beyond reasonable doubt that common sense is wrong and non-locality really does rule in the quantum world.***

*Although couched in mathematical language, the ...**results of the Aspect experiment are equivalent, in logical terms, to discovering there are, actually more teenagers in the world than there are teenage girls and all men (teenagers and adults) put together.** Bell's inequality is violated, which means non-locality is at work... though we still don't know what that means.”*

At the end of his book, Gribbin wrote:

*“...it seems miraculous, unless we invoke some form of communication and feedback, that the polarization states of two photons flying out on opposite sides of an atom can be correlated in the way that the Aspect experiment reveals. The one big difference, **the hurdle that we have to overcome, is the instantaneous nature of the feedback in the quantum world. But that is explained by the nature of [light](#) itself.**”*