Nonlocality and Maritain's Dream of A Philosophy of Nature

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In 1952 Jacques Maritain was living in Princeton at 26 Linden Lane with its walls covered with murals of Parisian street scenes. That spring he had given the A.W. Mellon Lectures on the Fine Arts at the National Gallery in Washington, which were to become his *Creative Intuition in Art and Poetry*.

Not far away a young physicist named David Bohm was teaching at Princeton and had written a textbook on quantum physics which he had sent to Neils Bohr, who did not answer, to Wolfgang Pauli, who was enthusiastic about it, and to Einstein who called him and invited him to visit.

These two events, so close in physical proximity and yet apparently completely unconnected, are a fitting symbol of the dialogue, or better, the failure of dialogue between Thomism and modern physics.

Maritain had long had a deep interest in reviving a Thomist philosophy of nature. He had not only laid down the epistemological principles that would govern and guide such a dialogue in his *The Degrees of Knowledge*, but he had gone to listen to Einstein speak at the Sorbonne some thirty years before and had written an intriguing study of relativity. Later, when these Princeton years were a bitter-sweet memory, he would write in *The Peasant of the Garonne* that this program for a renewed philosophy of nature was "a vanished dream of my youth."[1]

Bohm, for his part, was at the beginning of what looked like a promising career in physics. It must have been deeply gratifying that Einstein wanted to talk to him. Einstein had always resisted the prevailing orthodoxy of the Copenhagen interpretation of quantum physics that had coalesced around Bohr, an approach that Bohm had largely followed in his textbook, and now he urged Bohm to see if he could go beyond it. And Bohm did in two papers that appeared in 1952. But no one, including Einstein and Bohm, himself,

[1] Jacques Maritain, *The Peasant of the Garonne*, trans. Michael Cuddihy and Elizabeth Hughes (New York: Holt, Rinehart and Winston, 1968), p.140.

really grasped the full import of what those papers presaged. Soon Bohm was banished from the Princeton scene, another victim of the House Committee on unAmerican Activities, and went off to exile in Brazil.

But let us try to see what could have been, and still can be, in terms of a dialogue between quantum physics and a Thomist philosophy of nature. "Few spectacles," Maritain wrote in *The Degrees of Knowledge,* "are as beautiful and moving for the mind as that of physics...advancing towards its destiny like a huge, throbbing ship."[2] But physics is a very human enterprise, as well. Bohm's 1952 papers were like explosives with a slow burning fuse. They were going to cause distant detonations that would change the landscape of modern physics, or to pursue Maritain's metaphor, the great ship of physics was going to find itself sailing the strange and simmering sea of nonlocality.

In order to understand what is at stake in a dialogue between Thomism and quantum physics we need to take a short tour of quantum theory. The still prevailing Copenhagen interpretation can be best explained in terms of the two-slit experiment. A beam of particles is shot at a screen, and a barrier with two narrow slits is placed between the source of the particles and their target. If one slit is closed, the particles go through the other and form a line on the target, which is just how particles should act, but if both slits are open, instead of there being two lines formed on the target, we see a whole pattern of light and dark lines, an interference pattern that indicates to the physicist that these particles in some way also have the qualities that they attribute to waves.

Now in the Copenhagen interpretation the wave-like distribution of the particles is attributed to a probability wave—that is, the mathematical probability that tells us what the odds are a certain particle will end up in a certain place. There is no way, they tell us, to discover which slit an individual particle goes through, and this indeterminism of the particle is given a philosophical meaning. The physicist, John Gribbin, explains the matter like this: "The electrons not only know whether or not both holes are open, they know whether or not we are watching them, and they adjust their behavior accordingly. There is no clearer example of the interaction of the observer with the experiment. When we try to look at the spread-out electron wave, it collapses into a definite particle, but when we are not looking it keeps its options open. In terms of Born's probabilities, the electron is being forced by our measurement to choose one course of action out of an array of possibilities. There is a certain probability that it could go through one hole, and an equivalent probability that it may go through the other; probability interfer-

[2] Jacques Maritain, *The Degrees of Knowledge*, trans. Gerald B. Phelan (Notre Dame, Indiana: University of Notre Dame Press, 1995), p. 165.

ence produces the diffraction pattern at our detector. When we detect the electron, though, it can only be in one place, and that changes the probability pattern for its future behavior—for that electron, it is now certain which hole it went through. But unless someone looks, nature herself does not know which hole the electron is going through."[3]

The Copenhagen interpretation was only reinforced in 1932 when the famous mathematician, John von Neumann, created a proof that showed that there was no way to go beyond the Copenhagen interpretation and arrive at what was going on deeper down and discover some sort of hidden variables. None of this ever sat well with Einstein, as I said, which is why he wanted Bohm to try to go beyond it. Bohm's 1952 papers showed that there was another way to interpret the mathematical formalism of quantum theory and, indeed, in this other way the much-proclaimed quantum weirdness of the Copenhagen interpretation disappears. Bohm proposed that a quantum potential, or quantum wave, was guiding each particle. In the two-slit experiment, then, when one slit is open the particle and its pilot wave go through it and form a line on the screen. But when the two slits are open, each particle goes through one slit or the other, but its attendant pilot wave goes through both and causes the characteristic interference pattern.

While Bohm's 1952 papers made scarcely a ripple in the world of physics, they did interest a young Irish physicist, John Stewart Bell, and by 1964 Bell was ready to seriously think about their implications. At least two things struck him. One was that von Neumann's proof must be wrong because otherwise Bohm could not have written his papers at all because they propose a hidden variable theory. And secondly, Bohm's quantum wave was nonlocal, that is, it had to be instantaneously propagated to distant objects in order to cause the effects that it did. And so Bell took an important step and asked himself whether all quantum theories had be nonlocal. What was at stake was this: let us imagine that two particles interact and go off in different directions. If we measure one, according to the normal law of physics, we assume that this measurement does not affect the other particle unless the first particle can somehow communicate with the second particle at a speed under the speed of light, which physicists set down at the speed limit of the universe. But here is Bell asking himself whether these two particles can somehow communicate faster than the speed of light, although this is not quite how to put it, or better, if one particle somehow instantaneously knows what is happening to its partner. Bell later used the analogy of two identical twins, reared apart, who later, it is discovered, share many characteristics

[3] John Gribbin, *In Search of Schrödinger's Cat*, (New York: Bantam, 1984), p. 171.

with no known means of communication between them, for example, each of them names his dog George.

It was a few years before physicists figured out a way to test Bell's theory, and ever since they have been staging ever more refined experiments to see if nonlocality is actually a feature of the universe, and so far the experiments have demonstrated that it is. Recently, for example, experimenters split a photon and sent the pair through a fiber optic network until they were ten kilometers apart. When they measured the energy of one photon, it instantaneously determined the measurement of the other.

Now that you are up to speed on quantum physics, let us turn to the question of a dialogue between it and Maritain's philosophy of nature. There are two principle issues. First is the problem of quantum weirdness and its implicit or explicit philosophical meaning. The second question is what to do with nonlocality itself.

As far as the first issue is concerned, if physics confronted us with the Copenhagen interpretation with all its philosophical baggage, and said that the experimental evidence demands that we accept it, we would, as Thomist philosophers, face great difficulties. We would have to try to deal with the world in which causality is no longer operative, and this is really a metaphysical impossibility.

Instead, we need to make a fundamental distinction between the mathematical formalism of quantum theory and its philosophical interpretation. There are several ways we can begin to do this. We might say, with Maritain, that the mathematical formalism is one thing, while the underlying physical world that it measures is quite another. Physics measures this world and submits those measurements to the rule of mathematics, and this web of physico-mathematical constructs, while it does, indeed, grasp the real physical world, grasps it blindly as far as its ontological nature is concerned, and we cannot expect that these constructs have a point by point correspondence to the physical world. What seems to be happening in the Copenhagen interpretation is that not only are the physico-mathematical constructs presented as the only thing we can know, and the underlying physical world as unknowable in principle, but the different constructs, for example, the wave aspects of the electron and the particle aspects of the electron, which represent contrasting theories, are paradoxically presumed to be characteristics of the unknowable physical world, itself, and therefore we are told about the quantum weirdness of that world.

This point is brought out well in the mathematician Wolfgang Smith's book *The Quantum Enigma* where he tells us that a distinction must be made between the electron and its observables, or the electron in the corporeal world and how it is grasped by the methods of physics: "...one spuriously projects," he writes, "the results of distinct and interferring measurements upon the electron itself, which consequently seems to combine logically incompatible attributes."[4] Wolfgang Smith has continued this line of thought in his articles, "From Schrödinger's Cat to Thomistic Ontology," and "Bell's Theorem and the Perennial Ontology."[5]

What is at issue here is a series of challenging epistemological questions, but questions for which we can look for the resources to answer them in Maritain's well developed ideas on the epistemological type of modern physics, or in Wolfgang Smith's use of perennial themes of classical Western philosophy, or in an updated Thomistic view of the philosophy of nature that can be found in William Wallace's *The Modeling of Nature,* and his article, "Thomistic Reflections on *The Modeling of Nature*." Quantum weirdness in the Copenhagen sense vanishes when we take the proper philosophical perspective.

But this does not mean that nonlocality has vanished. Nonlocality has been called one of the greatest scientific discoveries of the past century. Somehow things communicate in the universe in a way that defies the normal models of the physicist and the normal speeds of interaction. We could say that they do not seem to communicate through the normal ways of efficient causality as physics understands them. Bohm has developed some intriguing examples to illuminate what we are up against. Imagine, he tells us, that we have two cameras mounted at 90° to each other facing an aquarium. When we look at the two monitors attached to the cameras, we can elaborate various theories whose purpose is to try to correlate the two different images that we are seeing. But these two dimensional images are aspects of a higher, in this case, three-dimensional reality. If we could somehow take that higher perspective, we would have no problem understanding the two different perspectives that we see on the monitors. This is what Bohm means by an implicate order about which he wrote a great deal.

But just how are we, as philosophers of nature, to begin to deal with the apparent fact of nonlocality? Let me sketch one approach that can find support in Bohm's writings. Modern physics can be said to be focused on efficient causality. But is it not possible that there is an implicate dimension of things, a dimension that is akin to formal causality, and it is this dimension that physics is encountering in nonlocality?

[4] Wolfgang Smith, *The Quantum Enigma*, (LaSalle, Illinois: Sherwood Sugden Co., 1995).

[5] Wolfgang Smith, "From Schrödinger's Cat to Thomistic Ontology," *The Thomist*, 61 (1997), pp. 455-67; Wolfgang Smith, "Bell's Theorem and the Perennial Ontology," *Sophia* 3 (1997), pp. 19-38.

Let us take the two particles that have interacted and gone off far apart, and yet know what is happening to each other. Why not say, with Bohm, that the two particles are manifestations of one higher order implicate reality? However strange this might sound from the point of view of physics, it is not really strange to philosophers of nature if we look beyond the surface terminology. Maritain, for example, in a footnote in *The Degrees of Knowledge* wrote: "The problem arises whether the substantial unity of a corporeal individual (for example, like a molecule of a gas, or a living organism) necessarily requires continuity in extension, as the ancients believed. In other words, cannot a substantial form inform a whole of discontinuous parts, whether contiguous (as blood plasma is contiguous to the walls of the blood vessels) or, on the atomic scale, separated by inter-atomic or intermolecular interstices (in the case that, contrary to the hypothesis of Gredt, these interstices would not themselves be informed by the substantial form of the individual whole). In my opinion, such a structural discontinuity is compatible with the substantial unity of the individual whole, and I think that, in that case, the Thomistic theory of individuation by *materia signata quantitate* is verified without special difficulty. The transcendental relation of matter to quantity would then mean, a transcendental relation to a constellation of positions."[6]

Now to turn this remark into a full-fledged philosophical theory of nonlocality would demand, among other things, that we do a fundamental analysis of the notion of formal causality and the way things interact, and along with it, take an equally searching look at the notion of matter in the Aristotelian-Thomistic tradition, and then take these hopefully renewed ideas and apply them to the question of nonlocality. I tried to begin to do this in my book, *The Mystery of Matter,*[7] which touches not only on nonlocality, but Jung's ideas on synchronicity and Rupert Sheldrake's on morphic resonance. The question of the nature of matter is particularly intriguing because it leads us to the very heart of Thomist metaphysics because matter must be brought into intimate relationship not only with form, but also with *esse*. The pioneering work of William Carlo is particularly important in this regard.[8]

A final remark. If a Thomistic philosophy of nature has been and still is mostly moribund even in the aftermath of the great Thomistic metaphysical

[6] *The Degrees of Knowledge*, p. 191n72.

[7] James Arraj, *The Mystery of Matter* (Chiloquin, Oregon: Inner Growth Books, 1996).

[8] William Carlo, *The Ultimate Reducibility of Essence to Existence in Existential Metaphysics*, (The Hague: Martinus Nijhoff, 1966).

revival around World War II, it is not because it lacked the philosophical resources to enter into dialogue with the natural sciences, but because it is still asleep, and the most promising way for it to awake and mobilize those resources is to attempt to look at central issues in the sciences, like nonlocality, and try to understand them from its own particular philosophical point of view.