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Guest Commentary

Post-Classical Physical Ontology

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In a series of written works, three of which have so far been published[1], I have been investigating a question which I will formulate here as follows: Suppose for the sake of argument that the concept of physical reality employed in the classical era of physics has met its complete and irretrievable demise. Does this necessarily mean that “natural philosophy”—in the sense practiced, for example, by Michael Faraday and James Clerk Maxwell—is also permanently at an end? By "natural philosophy” I mean primarily the endeavor toward genuine physical/causal explanations in verbal language for fundamental physical phenomena such as force fields and light, an endeavor that was passionately advocated and defended by these two scientists. The answer to this question at which I have consistently arrived, is that “natural philosophy” in this allegedly antiquated sense does not in fact live or die with the classical conception of nature as being absolutely mechanistic and deterministic. This clear and consistent finding of mine is quite at odds, at least in effect, with long-standard views.

The notion of a radically post-classical continuation of natural philosophy is not original with me, though the precedents are few and rather obscure. One of them is Faraday’s theoretical work, the basics of which have unfortunately been buried in misunderstanding for over a century. The problem here is a failure to understand that Faraday’s lifelong quest to explain the forces in terms of underlying causal structure ultimately led him to abandon the “ether” that had been supposed to exist as a material medium for light and forces. The reason this fails to be understood is that generations of scholars relying on secondary sources have passed along a regrettable conflation of the theories of Faraday and Maxwell, which are fundamentally different. In any case, Faraday’s natural philosophy was as I see it quite ahead of its time in that by abandoning the ether it took what might be regarded as the first decisive step in moving beyond the traditional or classical conception of nature, and did so decades before Einstein. Another quite obscure precedent for post-classical natural philosophy is Alfred North Whitehead’s early-twentieth-century efforts to interpret modern physics, in which he sought to work out a conceptual foundation for physics to supersede the classical one, in part by building upon these basic ideas of Faraday. But Whitehead had no lasting influence on the science of physics, which for the past century has regarded natural philosophy as an entirely antiquated pursuit. Nevertheless, my work has been endeavoring to show that a breakdown of the classical conception of nature, however complete, does not at all imply a wholesale and permanent collapse of this once-living dimension of questioning in physical science (which, if it still existed, would be an entirely different sort of animal from the formalistic and mathematical treatments that currently make up the heading of “theory”). One other thinker who has commented with lucidity, though only in the most general terms, on the possibility of a post-classical conception of nature is the philosopher Maurice Merleau-Ponty.[2] There is no doubt in my mind, however, that if a contemporary project toward fundamental physical explanation (which I call “physical ontology") were to have any hope of success it would have to find a way to radically depart from the classical concept of physical reality (without going outside the sphere of naturalism into metaphysics, say).[3] And the precedents mentioned above, such as they were, were indeed radical in approach. Faraday not only went beyond the ether; he also speculated that the occupation of space by matter is not fundamental (to physical reality) and that the atom is in fact constituted of and by the indefinitely extended field or fields of force.[4] Whitehead strove to supplant Cartesian material substance as a foundational concept for physics, proposing in its place an ontology of “events” and/or “process.” This would invert the traditional picture in which any physical process or event has to be some change/motion in/of matter. Both thinkers were heading, in my view, in a direction away from the fundamental status of locality and localized matter and toward something called “relational holism,” or what Whitehead termed the inherent or internal relatedness of each entity or event to a whole of nature. This “relatedness” for Whitehead is as much an active and effective physical fact as the constitutive “force” (extending throughout a contextual whole) was for Faraday.

Full evaluation of the prospects for a radically post-classical approach to ontology of physics requires that a philosopher at some point attempt to determine the potential explanatory power of these alternative foundational notions—"process" as fundamental, relational holism—in application to a range of specific unsolved problems of physical explanation. Efforts along this line can be found in certain of my writings in this area[5], and are briefly summarized below. One may justifiably have some general philosophical qualms about the whole idea of constructively supplanting the classical concept of physical reality, which was based on the fundamental status of matter and locality, with an ontology based on irreducible “process” and relational holism. Rather than addressing these

philosophical objections directly here, I am going to discuss something that is ultimately more interesting, namely, what happens if one simply pushes beyond these qualms and tries to make constructive use of these notions. One thing that happens is that it is soon discovered that there is only one way to reduce “presence” (occupied or unoccupied location) to “process” while retaining explanatory integrity, and that is by wholeheartedly adopting a formula which was first articulated by Whitehead (in his later metaphysical period and thus in a context alien to the present one)[6] and which may be simply stated as becoming constitutes being. This says that although the material thing, for instance, is, and is present, the underlying constitutive structure of any real thing in nature has the character of "process," specifically the physical emergence or genesis of the thing in question. This admittedly has quite a peculiar ring to it. Another way to describe this constitutive structure, and this might be more initially palatable, is to talk about a perpetually real and active trace of the reality of the physical thing reaching into a total context of nature (a whole of “passage” or becoming), hence “internal” or constitutive relatedness. My point is that once the decision is made to follow out a genuinely post-classical constructive physical ontology, a leap has been taken into just this quite radical and enigmatic strategy of explanation. There may at this point be a temptation to abandon the whole thing as absurd. I can only plead that we trudge onward in hope of some rewarding results.

What ultimately proves to be the case with process ontology—and this is what I find so interesting—is that if it is logically and conceptually viable, then it has the capability of explaining a wide range of phenomena across the whole of physics, in contrast to the air of inscrutability that normally attaches to matters of fundamental physics. For one thing, it takes account of the essentially dynamic or energetic (“processive”) character of what is termed the field. Secondly, the process-ontological account well accommodates the peculiar fact that a field-influence has an indefinite outward reach beyond the point at which it becomes quantitatively insignificant and immeasurable, or in other words, as I would put it, the fact that it pervades a contextual whole in each case. Thirdly, there is the directedness of a field toward or away from the thing (e.g., a magnet) of which it is the field. All of these properties flow from the very basics of the process-ontological account. Another thing that is explained (at least in basics) quite readily by this ontological procedure is the relation between the propagative phase of electromagnetic radiation and its phase of interaction with matter. In particular the drastic localization upon interaction which is much commented upon under the rubric of the “quantum measurement problem” is quite nicely accounted for as follows: propagation takes place in a “prelocal dimension,” so that it has a sort of a permanently tangential relation to local space and thus is not a local process, that is, it does not take place in or through space, and its action upon matter takes place through a shift of orientation in engagement with the already existing physical links (the “traces” or constitutive structures) terminating in specific atomic sites in matter. The response of this account of light to the talk of “wave-particle duality” is that the term “particle” is repudiated (for the purpose of ontological understanding) as indelibly classical and moreover unnecessary to any explanation, while the wave-like character of light is understood through a somewhat novel (as should be expected) notion of a cyclic process, namely a “gap-inclusive” regenerative causal series without localized continuity. All radiation and field processes, considered apart from their directly observable interactions with matter, are characterized as non-local or pre-local.

The peculiar properties of velocity *c* can also explained through this ontology in a very natural way in terms of the emergence, through mutual differentiation, of temporal and spatial extension (I will not attempt to summarize this explanation here). Obviously, such “co-emergence” is consistent with the deep connection between space and time that is indicated by special relativity theory. ("The emergence of space and time" plainly cannot be a process in space or in time, but involves transition of a different sort, which is fully explicable within the framework of the ontology.) Further, the ontology provides a successful alternative to both the Newtonian and the Machian theories of the “absolute reference” needed to make sense of inertial forces.[7] Finally, both quantum indeterminism and quantum non-locality are transformed, under these ontological assumptions, from being apparently intractable to causal explanation to being fairly expectable and potentially intelligible findings whose detailed explanations remain to be worked out.

In conclusion, my work in this area has endeavored to show that when the radical and enigmatic claims of “process” ontology are followed out in application to specific problems, it begins to appear that the popular rumors about physics having revealed the limits of rational understanding are entirely unfounded.

References:

1. Scientific Nihilism: On the Loss and Recovery of Physical Explanation (Albany, State University of New York Press, 1994); "Prospects for Physical Ontology: A Philosopher's Assessment," Physics Essays vol. 10, No. 4, December 1997; "Whitehead as Natural Philosopher: Anachronism or Visionary?" Process Studies 26/3-4, 1997.

2. Maurice Merleau-Ponty, "The Concept of Nature, I," In Praise of Philosophy and Other Essays, (Evanston: Northwestern University Press, 1963).

3. For the detailed argument see my article, "Prospects..." (see note 1).

4. Michael Faraday, "A Speculation Touching Electric Conduction and the Nature of Matter," Experimental Researches in Electricity,

vol. 2 (New York: Dover, 1965) 293.

5. Scientific Nihilism, Part Two, and "Whitehead as Natural Philosopher," 304-5.

6. Alfred north Whitehead, Process and Reality: An Essay in Cosmology, ed. Griffin and Sherburne (New York: The Free Press/Macmillan, 1978) 23.

7. Scientific Nihilism, Chapter 9.

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