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Peer Review

Review of: "Aristotle, Heisenberg, and the Non-Locality and Non-Temporality of a Single Photon"

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This paper, by its title, purports to discuss the issues of non-locality and non-temporality of photons from the perspective of Aristotelian physics. I must admit to feeling somewhat disappointed at the very brief discussion of Aristotle and his ideas in relation to photon behaviour. The most interesting idea from Aristotelian physics is that of potentia, which actually appears in a quotation from Heisenberg. An exploration of this concept from the viewpoint of event-based interpretations of quantum mechanics might shed more light on the more significant question as to whether or not the enhanced correlations seen in experiments with photons represent superluminal causal influences or not. That photons exhibit correlations that have been attributed to non-local or non-temporal influences is well known. These correlations have been demonstrated experimentally time and again. I am not sure that much new has been added to this part of the discussion. Relevant would be a discussion of delayed choice experiments, but they receive short shrift here.

Most of the arguments are qualitative - some more quantitative or formal arguments would help, as would more appeal to actual literature - again, I do not know that gedanken experiments are all that useful when there are abundant actual experimental results. Of course, that may be just the author's preference, but again, I would be most interested in deeper results.

I would have liked to have seen more detailed appeals to Aristotle in the analysis of these results. I am not so convinced by appeals to the HUP - using an argument based on that presumes that the wave function is interpreted ontologically and not merely epistemologically - a question that appears to have no resolution.

I have the impression that the author wishes to interpret photons as classical objects with unusual properties such as non-locality and non-temporality - formally, though, I am not aware of a wave

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function for the photon but rather wave functions for the EM field, of which photons represent discrete modes, related to creation and annihilation operators. It might help for the author to be more precise in exactly what they mean by a photon, and concepts like photon trajectories (since these are dubious concepts in QM unless one takes a diffusion approach such as Nagasawa, or a Bohmian approach - but there the non-locality is intrinsic to the theory, so the argument would become circular).

I do not find any significant errors here - I would have been with a bit more of a substantive argument.

Declarations

Potential competing interests: No potential competing interests to declare.