Review of: "An alternative foundation of quantum theory"

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Potential competing interests: No potential competing interests to declare.

This paper addresses a impressive range of formal topics. This reviewer does not claim proficiency in all of these topics.

The identification of two terms: epistemic and ontological, underlying quantum mechanics (really all physics) is a useful contribution.

These two terms require two different measurement processes as the author notes (although not with the words below):

1. Epistemic measurement process: observable/measurement/observer

2. Ontological measurement process: measurand/measurement/reference

Where measurand (that which is measured) is a defined metrology term. 2. is closer to a metrology view. Across physics literature there is some confusion about which process is applied and in a number of disciplines both may be applied. E.g., in statistics a measurement may be to a mean (1.) or to a reference (2.). There is a fundamental difference in the significance of these two statistical measurement forms.

In 1. a perfect measurement is possible. In 2. a perfect measurement is not possible. The uncertainty principle indicates 2 is valid. Einstein identified that space and time, where a measurement occurs, are both relative to a reference (the velocity of light). Given these facts, this reviewer is biased towards 2.

In current physics measurement theory (which supports 1.) 1. is also termed a representational measurement system, which Rovelli in QM has termed a relational measurement system. Bayesian analysis is also based upon 1. These all represent arguments (based on others' considered opinion, not facts) in favor of 1., which the author notes. This paper is developed based on 1, which the author has well explained (a step ahead of most such papers this reviewer has seen).

Once an observer is treated as part of a system in Hilbert space, any derivation is possible. This makes the author's development plausible, but not proven, as the author recognizes. Many papers have been written about the measurement problem based upon formal derivations with substantial assumptions, perhaps not as well developed as in this paper. Until a paper offers a proof, not of the assumptions made, but of the complete theory with an accompanying formal explanation of perplexing experiments, it is not very useful to make comment in more detail on such papers. In this review of this paper, the assumptions or the math are not at issue, but the measurement process applied is.