

Review of: "An alternative foundation of quantum theory"

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Potential competing interests: No potential competing interests to declare.

This paper has several aims. Firstly to derive the Hilbert space of states, at least in the finite dimensional case, from minimal assumptions of what the author calls accessible and inaccessible variables. The second thing is, having derived the idea of the states — though in fact it would only be pure states, not the full set of states — to then give an epistemic interpretation to them, so that what appears to be their changes and correlations are merely changes and correlations in the epistemic states of some set of observers. A third purpose is to somehow incorporate God's existence and Omniscience into the picture of what can and cannot be known in QM (Quantum Mechanics).

There are problems. Obviously if the reconstruction of Hilbert space is to have value then the basis of the reconstruction needs to be carefully defined. In this case the definition has been given up under previous criticism.

The theoretical variables may be accessible or inaccessible to A (or to the group). Very roughly we can say: If q is accessible, A will, in principle in some future be able to find an accurate value of q as he likes. But as a referee remarks, this rough definition raises many questions: What is meant by the future? Is the accuracy limited by the Planck length? — and so on.

So I will just take 'accessible' as a primitive notion.

This is a decision which undercuts the purpose of the paper and moreover is, as far as I can see, unnecessary. Unnecessary, perhaps, because the author only has the purpose of accounting for finite dimensional Hilbert spaces and so position and momentum operators and square integrable complex functions are not within the scope of the project. At any rate I found this early part of essay very unclear and, I'm sorry to have to say, poorly written. (I'm not sure why the author wants to pursue this line anyway: von Neumann already did this and others (including Irving Segal in the C-star context; Hardy more recently) have pursued this line in a sophisticated way. the author's contribution fares very unfavourably here.)

A separable project is the idea of giving an epistemic account of state behaviour. In this context we already have the idea of Rovelli's Relational Quantum mechanics (RQM) and there is nothing in this paper which adds any further light on it. What light would one like to be shed? The main problem as I see it is that Rovelli has replaced one mystery with another. Measurement of a system, or the interaction of a system with an observer, is meant to cause 'state values' to appear, or to appear to appear. (Such quantum states look to be modifiable monadic properties or attributes). But there are, on RQM, no such states in the systems, they are merely cases of beliefs being updated in a Bayesian fashion. There is no "collapse of the wave packet" on measurement, there is merely a new private valuation in the measuring observer. But

how *does* a system *relate* to an observer? In a normal causal encounter there is something in the thing affected that is modified (A bird hits a window: the bird and the window are modified; Jenny fails to loan John some money and John becomes homeless; a firing squad shoots Pierre and Pierre is killed, etc.) If there is no state intrinsically present in the system, as Rovelli maintains, then there is nothing for causation to act upon to produce effects: there is nothing modifiable. So what is this relation that Rovelli is leaning everything on? It seems he cannot give an account of it. But just as this is a problem for Rovelli so it is also a problem for the present author — and nothing is said that throws any light on it. So effectively the reader is taken no further than Rovelli or the subsequent discussions of QBism (which are similarly defective on this point). We have had Rovelli's view and the subsequent QBism for more than twenty years — thus the present author must go beyond what we already have, they cannot say that they are giving 'A new approach to quantum theory' (first line of abstract) where either what is given is not new or it fails to be convincing, or both.

Then there is the introduction of God.

As a background for my theory, I assume that God has existed forever, and so have basic physical laws. A rather common assumption in various religions is that we humans are created in God's image. Thus, in very metaphysical terms, one can simplify a theory of God's mind by a theory of an observer's mind, which is partly done in this article. For more on my views on religion and quantum foundation, see [77,80].

If someone wants to introduce a new hypothesis then one shouldn't rule it out by fiat. But the claim here (man was created in God's image therefore one can 'simplify a theory of God's mind by a theory of an observer's mind') is just a flat-out fallacy. Nothing that rests on such a claim lasts a second under rational scrutiny.

The material on group representations is interesting but is reproduced verbatim from the author's published works (some find this objectionable as a form of self-plagiarism; I don't share that view). At this point the quality of the writing goes up very noticeably. But again these ideas go back to the work in the 1920's by Weyl, Wigner and von Neumann. One cannot present these things as anything new — unless of course one wants to make new use of them. But I don't see where that is done. (Could it be done? Yes of course, but that is now also a crowded field.) But this section brings up another anomaly in the author's work: Weyl is entirely unmentioned except in the context of the Heisenberg-Weyl group; Wigner is barely mentioned, and von Neumann is only mentioned in terms of a derivation of the Born law from 1927. On the other hand the author liberally references unpublished papers — sometimes unpublished even on ArXiv — in support of views that are bound to be controversial and in need of support.

My ultimate view then is one of disappointment. I believe that the author could do better work if they slowed down and put more thought into this project.