Review of: "Quaternion Quantum Mechanics: Unraveling the Mysteries of Gravity and Quantum Mechanics within the Planck-Kleinert Crystal"

Jens Köplinger

Potential competing interests: No potential competing interests to declare.

(I'm forced to give a “rating”, even though I would much rather just give a review from the side line, abstain from giving a rating in its current form, and advertise and encourage future work by the authors; so I'm giving it “4 stars” in order not to prevent the authors from getting exposure to gather feedback for future work; the article itself should not be formally published like this)

Hello - thank you for inviting me to review this article. If it's ok, I'd like to give a first-look account on the general framing of the article, without going too deep into the actual formulas. The rationale is that I'm personally interested in various approaches to reconstructing QM, but not necessarily in the approach outlined in the paper. That said, given a possibly different framing and context, I may recognize aspects that do indeed overlap. Also, it may help the authors finding stronger context related to their article.

The introduction starts with a statement of the specific topic area of the article:

> *Quaternion quantum mechanics answers two central ontological questions of its interpretation:*
>
> - *The being: the Cauchy elastic continuum and*
> - *The categories of being and their relations: the Planck oscillator, the quaternion algebra and gravity.*

This is a bit of an unfortunate start, since readers are most likely not familiar with QQM, and will be confused right-away (I was). Instead, I strongly suggest beginning with a broad statement of context, followed by a description of the specific (isolated, self-contained) investigation and finding in this paper, and leave personal (tangential, philosophical, future-work, speculative) interpretations to the outlook (if you want to hint at something in the introduction, then my recommendation would be two sentences at most, at the very end of the introduction). All of this is of course not related to the content of the paper, topic, or context; but merely making it more palatable.

I was surprised not to find a reference to Stephen Adler's work in the references, but see it in Marek Danielewski's prior work (which is referenced). This is something I would recommend bringing right at the beginning of the introduction, in the “context” area. I found a YouTube video narrated by Chantal Roth from three weeks ago (

), and the authors are well-aware of some of the context. The current paper may be much strengthened by bringing more

references from the past 20 years. One key paper was possibly Lucien Hardy's “Quantum Theory From Five Reasonable Axioms”, at least it was a key contribution to contemporary interest in reconstructing quantum mechanics (see e.g. https://www.iqoqi-vienna.at/research/mueller-group/reconstructions-of-quantum-theory for a nice overview, and other articles and conferences from a “quantum reconstruction program” internet search prompt).

I observe in the presentation by Roth that you're using a dated interpretation of de Broglie-Bohm theory, taking the term “pilot wave theory” too literal. Instead, you may want to consider giving the field another look, since its modern interpretation is a realistic, linear model of QM, with emergent (apparent, inteherent) nonlocality. You might want to look at A. Shadi Tahvildar-Zadeh's work for a more modern interpretation of Bohmian mechanics (e.g. a recent talk

).

I understand that your chosen framing my means of an aether may be a bit intentionally provocative, though from a principles-driven 10,000-foot view, it would be plausible to me that your approaches could be related: Both de Broigle-Bohm theory and yours are inherently linear interactions on a given configuration space (and are realistic, emergent nonlocal).

Ok, let me stop here. I'd like to add that in the current framing, the authors approach to gravity is not accessible to me. There are many (too many) ways to reconstruct gravity, it would help me delineate if the overall context and principles, as I suggest above, were clarified.

Best wishes, Jens