

Contextual unification of classical and quantum physics

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Following an article by John von Neumann on infinite tensor products, we develop the idea that the usual formalism of quantum mechanics, associated with unitary equivalence of representations, stops working when countable infinities of particles (or degrees of freedom) are encountered [1]. This is because the dimension of the corresponding Hilbert space becomes uncountably infinite, leading to the loss of unitary equivalence, and to sectorization. By interpreting physically this mathematical fact, we show that it provides a natural way to describe the “Heisenberg cut”, as well as a unified mathematical model including both quantum and classical physics [2], appearing as required incommensurable facets in the description of nature [3].

- [1] M. Van Den Bossche and P. Grangier, “Contextual unification of classical and quantum physics”, *Foundations of Physics* 53:45 (2023), <https://arxiv.org/abs/2209.01463>
- [2] M. Van Den Bossche and P. Grangier, “Postulating the Unicity of the Macroscopic Physical World”, *Entropy* 25(12), 1600 (2023); <https://www.mdpi.com/1099-4300/25/12/1600>
- [3] P. Grangier, “Revisiting the Interpretations of Quantum Mechanics: From FAPP Solutions to Contextual Ontologies”, <https://arxiv.org/abs/2601.20488>