AGPhil 10: Quantum Foundations Poster Session

Time: Thursday 16:15–16:45 Location: JAN/0027

AGPhil 10.1 Thu 16:15 JAN/0027

The Limits of the $\hbar$-Limit — •Renzo Kapust — Institute of Philosophy, KU Leuven

It is often thought that the limit of $\hbar \to 0$ is a classical limit, meaning that it retrieves classical mechanics from quantum mechanics. Against this common belief, we argue that the $\hbar$-limit does not fully instantiate the relation between classical and quantum mechanics on its own and mostly serves anecdotal purposes.

Importantly, the conceptual analysis shows that "$\hbar \to 0$" expresses two different limits, which also has practical consequences. Firstly, the "classical idealization" tries to map the set of quantum formulas to the set of classical formulas by changing the constant $\hbar$; pictorially imagining other possible worlds with different $\hbar$-values. Secondly, the "classical approximation" remains in this actual world and tries to map quantum explanations to classical phenomena by letting a variable grow relative to the actual value of $\hbar$.

The problems of the classical approximation include the failure to be a limit in any proper sense and to necessarily neglect important effects of quantum composition. Moreover, it does not fully include other parameters necessary to wholly retrieve classical mechanics. The problems of the classical idealization include implausible convergences, the danger of divergences, the failure to tackle $\hbar$-independent quantum phenomena as well as the failure to apply to all required equations. Consequently, although the investigation of the $\hbar$-limit bears great insight into the quantum-classical relation, neither of its senses fully instantiates it.

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Measuring up to the measurement problem: Decoherence and Bohr's ideas through the lens of the measurement problem and quantum erasers — •Emilia Kjaersdam Telléus — University of Copenhagen

In this thesis, interpretations of the formalism of quantum mechanics are investigated in terms of their address to the classic measurement problem as well as the more modern quantum erasers. The main focus is on the interpretational insight provided by Niels Bohr and the concept of decoherence, but with an overview of other important interpretations as well. The measurement problem is described and strategies for its solution is divided into two main categories: solutions and dissolutions, which are associated with collapse and no-collapse interpretations respectively. Decoherence is found to require an interpretational basis in order to properly address the measurement problem, while Bohr's interpretation has some unresolved points, mainly relating to the understanding of Bohr's notion of context, which is central to his idea of quantum mechanics. By comparing Bohr's ideas and decoherence, I argue that each can be of use to the other; decoherence can formalise some of Bohr's concepts, while Bohr's ideas provides a constructive interpretational basis for decoherence. Lastly, I argue that quantum erasers provides a ground for discussions on interpretational questions, as the insight into the nature of quantum mechanics challenges several aspects of the aforementioned different interpretations, the understanding of the Bohrian context among them.

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Is reality mystical and weird? — •Ed Dellian — Bogenst. 5, 14169 Berlin.

Current quantum mechanics is represented by the Schrödinger equation. This algorithm allows to calculate states of a particle system's kinetic energy. The concept stems from classical mechanics. It is the space integral of the concept of force. Accordingly the Schrödinger equation, as it considers energy states only (indifferently whether time dependent or not), does not consider the time required to generate an energy state, and also not the time that may separate different energy states at different places in space from each other. Therefore all possible energy states in space apparently seem to exist at the same time. As a consequence it may seem that a moving system, or particle, could even arrive at different places in space at the same time, or instantaneously, that is, without consuming time. It was realized already by Galileo and Newton that this result evidently contradicts natural experience, according to which nothing happens but in time. Therefore, the mystical and weird instantaneous effects appearing in quantum mechanics are not the features of a specific microphysical reality but only result from ignorance as to the genesis and mathematical content of the Schrödinger equation.