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Sponsored by the Department of Physics and **M**olecular **M**agnets for **Q**uantum **M**aterials (M^2QM)

Title Quantum mechanics: How Einstein and Bohr led everybody astray

Abstract

For over 90 years, since quantum mechanics was formulated in 1926, physicists, mathematicians and philosophers have argued about the meaning of the mathematical entities in the quantum formalism. Bohr and Einstein argued that classical experimental concepts needed to be the basis, the young Heisenberg wanted to follow the formalism, explore it, and see where it would lead. Bohr and Einstein won the argument, leaving us with a mess of multiple inconsistent interpretations. But the basic rules are simple and precise and work exquisitely well.

The main problem with quantum mechanics is the probabilistic nature of quantum phenomena. In this talk we present a framework to discuss the deterministic foundation of quantum mechanics that is governed by the Schrödinger equation, introduce a probability measure to describe the statistics (different from von Neumann's statistical operator or density matrix, which Schrödinger showed in 1932 to be inadequate), derive dispersionless variables that satisfy classical Hamilton equations. This then allows a clear and detailed description of the measurement in quantum mechanics. It turns out that experiments have very limited access to the inner workings of quantum processes, most of which remain hidden. This is because physical systems are described at the quantum level by functions, not values as in classical theories.

Host Henk Monkhorst