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Department of Mathematics Seminar Sept 30, 2019

Title On using a functional measure to capture the probabilistic character of measurement in quantum mechanics

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 experiments. In this talk we present a framework that has the deterministic foundation provided by the Schrödinger equation and introduce a functional probability measure on the infinite dimensional Hilbert space of wave functions to describe the statistics (different from von Neumann's statistical operator or density matrix, which Schrödinger showed in 1932 to be inadequate). Dispersionless variables that satisfy classical Hamilton equations are derived to obtain classical systems from quantum systems. This then allows a clear and detailed description of the measurement process in quantum mechanics, including its probabilistic character.

Host Kevin Knudson