Conditional expectations in Quantum Mechanics and Kirkwood-Dirac quasiprobability distributions

Raymond Brummelhuis

Contrary to the notion of joint probability, that of a conditional expectation has a natural extension to pairs of non-commuting observables in Quantum mechanics, either as a best predictor or, equivalently, an orthogonal projection. We review its definition and give a simple characterization.

Alternatively, one can associate a conditional expectation to any quasiprobability distribution, which we show to coincide with the quantum mechanical conditional expectation above iff the quasiprobability distribution is the Kirkwood-Dirac one. This then provides a characterization of the latter.

This talk is based on joint work with Stephan de Bièvre, Christopher Langrenez and Matéo Spriet.