WAVE PACKETS, QUANTUM CHAOS AND THE CLASSICAL LIMIT OF BOHMIAN MECHANICS

Abstract

Gary Edward Bowman

Quantum-mechanical wave packets are studied from the perspective of Bohmian mechanics in the simple harmonic oscillator and in the kicked rotator. For the oscillator, the behavior of Gaussians of arbitrary width is studied. Conditions under which these states behave essentially classically are determined. An extensive study of wave packets in the kicked rotator, a paradigm of both classical and quantum chaos, is then carried out, utilizing a novel numerical approach along with the mathematical and conceptual tools of Bohmian mechanics. A clear physical picture of the behavior of these packets emerges, as does a new understanding of the spreading of rotator wave packets. Criteria and methods for obtaining the classical limit of Bohmian mechanics are then assessed. I argue that the Bohmian classical limit will only be obtained by combining mixed states and narrow wave packets with interaction with the environment.