Nonseparability and Quantum Chaos

Kronz, Fred (1997) Nonseparability and Quantum Chaos.

Abstract

Conventional wisdom has it that chaotic behavior is either strongly suppressed or absent in quantum models. Indeed, some researchers have concluded that these considerations serve to undermine the correspondence principle, thereby raising serious doubts about the adequacy of quantum mechanics. Thus, the quantum chaos question is a prime subject for philosophical analysis. The most significant reasons given for the absence or suppression of chaotic behavior in quantum models are the linearity of Schrödinger's equation and the unitarity of the time-evolution described by that equation. Both are shown in this essay to be irrelevant by demonstrating that the crucial feature for chaos is the nonseparability of the Hamiltonian. That demonstration indicates that quantum chaos is likely to be exhibited in models of open quantum systems. A measure for probing such models for chaotic behavior is developed, and then used to show that quantum mechanics has chaotic models for systems having a continuous energy spectrum. The prospects of this result for vindicating the correspondence principle (or the motivation behind it, at least) are then briefly examined.

Keywords:	quantum, nonseparability, chaos, entropy, open systems, Hamiltonian
Subjects:	Specific Sciences: Complex Systems General Issues: Determinism/Indeterminism Specific Sciences: Probability/Statistics Specific Sciences: Physics: Quantum Mechanics
ID Code:	259
Deposited By:	Kronz, Fred
Deposited On:	04 May 2001