Complex dynamics in diatomic molecules. Part II:
Quantum trajectories

Ciann-Dong Yang and Hung-Jen Weng

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Abstract

The second part of this paper deals with quantum trajectories in diatomic molecules, which has not been considered before in the literature. Morse potential serves as a more accurate function than a simple harmonic oscillator for illustrating a realistic picture about the vibration of diatomic molecules. However, if we determine molecular dynamics by integrating the classical force equations derived from a Morse potential, we will find that the resulting trajectories do not consist with the probabilistic prediction of quantum mechanics. On the other hand, the quantum trajectory determined by Bohmian mechanics [Bohm D. A suggested interpretation of the quantum theory in terms of hidden variable. Phys. Rev. 1952;85:166–179] leads to the conclusion that a diatomic molecule is motionless in all its vibrational eigen-states, which also contradicts probabilistic prediction of quantum mechanics. In this paper, we point out that the quantum trajectory of a diatomic molecule completely consistent with quantum mechanics does exist and can be solved from the quantum Hamilton equations of motion derived in Part I, which is based on a complex-space formulation of fractal spacetime [El Naschie MS. A review of