Quantum motion in complex space

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Abstract

This paper is dedicated to the development of a general theory unifying classical and quantum mechanics in complex space, and to the conveyance of the philosophy that what have been considered as probabilistic quantum events have a common origin from the particle's deterministic motion in complex space. We postulate that the actual scenario of dynamic motion happens in complex space and what we customarily consider as physical reality is merely the projection of the actual scenario into the real space. The proposed theory employs complex-extended classical mechanics to describe and model quantum systems in such a way that all the particle-like properties can be reserved due to its classical nature and in the meanwhile, all the wave-like properties are manifested naturally via the multi-path behavior of complex trajectories. The proposed framework of complex mechanics makes use of classical concepts and tools to deal with particle's quantum behavior by the introduction of a complex Hamiltonian from which complex Hamilton equations describing particle's quantum motion are derived in a form of Newton's second law defined in complex space. Complex mechanics is then connected with quantum mechanics by showing the equivalence between the complex Hamilton–Jacobi equation and Schrödinger equation. The solutions

of the complex Hamilton equations give us the complex trajectories traced by a particle, which are found to be non-unique. It is this non-uniqueness of the complex trajectories projected into real space that produces the multi-path phenomenon and the observed wave behavior of a material particle in the real space. This conclusion seems to be consistent with that of Elnaschie $\varepsilon^{(\infty)}$ space–time [Elnaschie MS. The Feynman path intergal and *E*-infinity from the two-slit Geclanken experiment. Int J Nonlinear Sci Numer Simul 2005;6(4):335–42; Elnaschie MS. A review of the *E*-infinity theory and the mass spectrum of high energy particle physics. Chaos, Solitons & Fractals 2004;19:209–36; Elnaschie MS. Elementry number theory in superstrings, loop quantum mechanics, twisters and *E*-infinity high energy physics. Chaos, Solitons & Fractals 2006;27:297–330].