Complex dynamics in diatomic molecules. Part I: Fine structure of internuclear potential

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Abstract

The current understanding of internuclear potential of diatomic molecules is limited to electronic states. In this paper, we point out that every electronic-state internuclear potential is actually accompanied by a fine structure, which characterizes the detailed internuclear potential for each vibrational substate belonging to the same electronic state. This fine structure, which governs the bond length, the force constant, the vibration frequency, and the quantum motion for each vibrational state, is obtained by extending Bohm's quantum potential [Bohm D. A suggested interpretation of the quantum theory in terms of hidden variable. Phys Rev 1952;85:166–79] to complex domain. It is shown that the fine structure of the internuclear potential can be determined exactly by the vibrational wavefunctions so that its predictions about the internuclear forces (Part I) and the vibrational nuclear quantum motion (Part II) are fully consistent with the Max Born's probability interpretation of the vibrational wavefunctions, and are in line with El Naschie's *E*-infinity [El Naschie MS. A review of *E*-infinity theory and the mass spectrum of high energy particle physics. Chaos, Solitons & Fractals 2004;19:209–36; El Naschie MS. *E*-infinity theory – some recent results and new interpretations.

Chaos, Solitons & Fractals 2006;29:845–53; El Naschie MS. The concepts of *E*-infinity. An elementary introduction to the Cantorian-fractal theory of quantum physics. Chaos, Solitons & Fractals 2004;22:495–511], Nottale's scale relativity [Nottale L. Fractal space-time and microphysics: Towards a theory of scale relativity. Singapore: World Scientific; 1993], and Ord's random walk [Ord G. Fractal space time and the statistical mechanics of random works. Chaos, Soiltons & Fractals 1996;7:821–43] approaches to quantum mechanics.