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Influences of Quantum and Disorder Effects on Solitons Excited in Protein Molecules in Improved Model

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Abstract: Utilizing the improved model with quasi-coherent two-quantum state and new Hamiltonian containing an additional interaction term [Phys. Rev. E62 (2000) 6989 and Euro. Phys. J. B19 (2001) 297] we study numerically the influences of the quantum and disorder effects including distortion of the sequences of masses of amino acid molecules and fluctuations of force constant of molecular chains, and of exciton-phonon coupled constants and of the dipole-dipole interaction constant and of the ground state energy on the properties of the solitons transported the bio-energy in the protein molecules by Runge-Kutta method. The results obtained show that the new soliton is robust against these structure disorders, especially for stronger disorders in the sequence of masses spring constants and coupling constants, except for quite larger fluctuations of the ground state energy and dipole-dipole interaction constant. This means that the new soliton in the improved model is very stable in normal cases and is possibly a carrier of bio-energy transport in the protein molecules.

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Key words: bio-energy transport, protein, soliton, quantum effect, disorder effect, numerical simulation

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