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Stabilization of the Soliton Transported Bio-energy in Protein Molecules in the Improved Model

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Abstract: We study the stabilization of the soliton transported bio-energy by the dynamic equations in the improved Davydov theory from four aspects containing the feature of free motion and states of the soliton at the long-time motion and at biological temperature 300 K and behaviors of collision of the solitons by Runge-Kutta method and physical parameter values appropriate to the α-helix protein molecules. We prove that the new solitons can move without dispersion at a constant speed retaining its shape and energy in free and long-time motions and can go through each other without scattering. If considering further influence of the temperature effect of heat bath on the soliton, it is still thermally stable at biological temperature 300 K and in a time as long as 300 ps and amino acid spacings as large as 400, which shows that the lifetime of the new soliton is at least 300 ps, which is consistent with analytic result obtained by quantum perturbation theory. These results exhibit that the new soliton is a possible carrier of bio-energy transport and the improved model is possibly a candidate for the mechanism of this transport.

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