STABILIZING ROLE OF LATTICE ANHARMONICITY IN THE BISOLITON DYNAMICS

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S u m m a r y

We show that, in anharmonic one-dimensional lattices, the pairing of electrons or holes in a localized bisoliton (called also bisolectron) state is possible due to a coupling between the charges and the lattice deformation that can overcome the Coulomb repulsion. We show that bisolitons are dynamically stable up to the sound velocities in lattices with cubic or quartic anharmonicities, and have finite values of energy and momentum in the whole interval of bisoliton velocities up to the sound velocity in the chain. We calculate the bisoliton binding energy and the critical value of Coulomb repulsion at which the bisoliton becomes unstable and decays into two independent electrosolitons. We estimate these energies for chain parameters that are typical of biological macromolecules and some quasi-one-dimensional conducting systems and show that the Coulomb repulsion in such systems is relatively weak as compared with the binding energy. Our analytical results are in a good agreement with the results of numerical simulations in a broad interval of the parameter values.