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Alexander Figotin* (afigotin@uci.edu), Mathematics Department, University of California at Irvine, Irvine, CA 92697. *Title: Some Mathematical Problems in a Neoclassical Theory of Electric Charges.*

We study a number of mathematical problems related to our recently introduced neoclassical theory for electromagnetic phenomena in which charges are represented by complex valued wave functions as in the Schrodinger wave mechanics. In the non-relativistic case the dynamics of elementary charges is governed by a system of nonlinear Schrodinger equations coupled with the electromagnetic fields, and we prove that if the wave functions of charges are well separated and localized, then their centers converge to trajectories of the classical point charges governed by Newton's equations with the Lorentz forces. We also found exact solutions in the form of localized accelerating solitons. Our studies of a class of time multiharmonic solutions of the same field equations show that they satisfy Planck-Einstein relation and that the energy levels of the nonlinear eigenvalue problem for the hydrogen atom converge to the well-known energy levels of the linear Schrodinger operator when the free charge size is much larger than the Bohr radius. (Received August 17, 2011)