Nonequilibrium Quantum Dynamics of Strongly Correlated Ultracold Atoms in Optical Lattices

***A. Maltsev*[1]*, E. Demler, A. Prokofiev**

[1]*L.D. Landau Institute of Theoretical Physics RAS, Chernogolovka, Russia*

**e-mail address: maltsev@itp.ac.ru*

Motivated by recent experiments with ultracold atoms in optical lattices we address questions of nonequilibrium dynamics of hard core lattice bosons and lattice spin Hamiltonians. We use semiclassical description to analyze the nature of solitonic solutions and show that depending on microscopic parameters they can be of either KdV, or mKdV, or NLSE type. We analyze the problem of dynamical evolution starting from an initial state with a one dimensional density (magnetization) inhomogeneity and predict a universal dynamical phase diagram that includes regimes of formation and stability of one dimensional solitons as well as regimes of formation of higher dimensional lump solutions.