Title: Locality estimates for classical oscillator systems.

Robert Sims

Abstract:

A notion of locality is crucial in rigorously analyzing most physical systems. Typically, sets of local observables are associated with bounded regions of space, and one is interested in how these observables evolve dynamically with respect to the interactions governing the system. In relativistic theories, the evolution of a local observable remains local, i.e. the associated dynamics is restricted to a light cone. For non-relativistic models, such as those we will be considering in the present work, the dynamics does not preserve locality in the sense that, generically, an observable initially chosen localized to a particular site is immediately evolved into an observable dependent on all sites of the system.

We prove locality estimates, in the form of Lieb-Robinson bounds, for classical oscillator systems defined on a lattice. Our results hold for the harmonic system and a variety of anharmonic perturbations with long range interactions. The anharmonic estimates are applicable to a special class of observables, the Weyl functions, and the bounds which follow are not only independent of the volume but also the initial condition.