Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Intrinsically Localized Modes in the three-dimensional Quantal Fermi-Pasta-Ulam Lattice DERYA KANBUR, PETER S. RISEBOROUGH, Temple University — Intrinsically Localized Modes (ILMs) are spatially localized oscillatory modes in homogeneous lattices, that are stabilized by anharmonic interactions. ILMs are frequently found in classical low-dimensional systems, where the frequency of the oscillations is a continuous variable. By contrast, due to the internal frequencies quantized,the quantum systems support a hierarch of excitations. The hierarchy of quantal excitations can be described in terms of a hierarchy of bound states of a multiple numbers of phonons. In one-dimension, the existence of the ILMs is ensured for any strength of the repulsive interactions by the divergent van-Hove singularities in the multi-phonon density of states. Inelastic neutron scattering measurements on NaI have revealed unexpected excitations which have been interpreted in terms of ILMs. Since the energies of the observed excitations are discrete, the experiments indicate that the ILMs have quantum character. Therefore, we search for low-energy quantized ILMs in a three-dimensional generalization of the Fermi-Pasta-Ulam lattice. We find that quantized ILMs may exist for values of the interaction strengths which exceeds a critical value. We examine the polarization-dependence, dispersion and the spatial characteristics of the lowest-energy ILMs.

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Date submitted: 04 Oct 2012 Electronic form version 1.4