

Jani Lukkarinen (University of Helsinki) - Thermalization and prethermalization in anharmonic oscillator chains

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In a joint work with Christian Mendl and Jianfeng Lu [Phys. Rev. E 94 (2016) 062104], we consider a particle chain with an onsite anharmonicity, known to exhibit normal heat conduction. We make a direct comparison between the relevant spatially homogeneous, but time-dependent, Boltzmann-Peierls equation and the average Wigner function computed from numerical simulations of the chain, and we demonstrate quantitative agreement after an initial transient time interval. In particular, besides energy conservation, we observe additional quasi-conservation of the phonon density, as predicted by the kinetic equation. On super-kinetic time scales, density quasi-conservation is lost while energy remains conserved, and we find evidence for eventual relaxation of the density to its canonical ensemble value. However, the final relaxation can be extremely slow, similar to “prethermalization” observed in certain quantum systems, and it begs for an explanation going beyond the framework of standard kinetic theory.