Thermal decay of breathers in Klein-Gordon and Josephson-junction lattices

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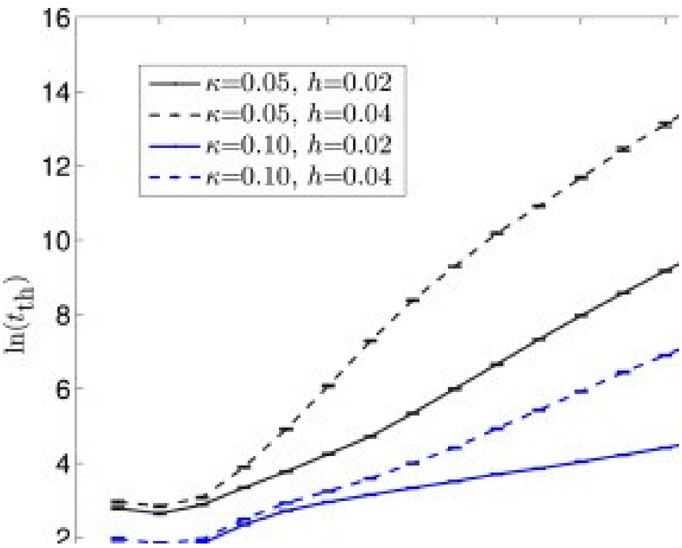

Abstract: We consider three Klein-Gordon systems with different on-site potential and coupling, and an FPU system, composed of Josephson junctions, and study its route to thermalization after creating a single breather. We propose a parameter, the participation number *P*, to measure the degree of thermalization of a system. We deduce approximately that the value of *P*=*N*/2 is a good measure of the thermalization [1].
Breathers are created by delivering kinetic energy to a single site within a thermalized system. The system evolves until *P* achieves the value *N*/2, determining the thermalization time $t_{\rm th}$. While $t_{\rm th}$ varies several orders of magnitude, the mean for a sample of ten thousand simulations has a tiny standard deviation of the mean. The mean thermalization time increases in quasi-exponential form for the four different systems. For some potentialz and sufficient energy, $< t_{\rm th} >$ can be extremely long posing problems for simulations. In real systems, where many breathers are created by the impact of swift particles, they may produce a measurable impact. One such a a system could be tokamak fusion reactors, where the huge amount of alpha particles may produce energetic breathers which can seriously hinder heat evacuation. Moreover, breathers can bind to an electric charge, compromising [2] the isolation needed to keep the intense magnetic field confining the ions within the plasma chamber.

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References:

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