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Shepherding intrinsic localized modes in micro-mechanical arrays

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The energy profiles of intrinsic localized modes (ILMs) in periodic physical lattices with nonlinear forces resemble those of localized vibrational modes at defects in a harmonic lattice but, like solitons, they can propagate; however, in contrast with solitons they loose energy as they move through the lattice - the more localized the excitation the faster the energy loss. One of our experimental studies with micro-mechanical arrays involves steady state locking of ILMs, and their interactions with impurities. By measuring the linear response spectra of a driven array containing an ILM both the dynamics of bifurcation transitions and the hopping of vibrational energy have been connected to the transition properties of soft modes. Recently the search for a completely mobile ILM has focused attention on minimizing the resonance interaction that occurs between the localized excitation and small amplitude plane wave modes. Via simulations we demonstrate that when more than one type of nonlinear force is present their Fourier components can often be designed to cancel against each other in the k-space region of the plane wave dispersion curve, removing the resonance. The end result is super-transmission for an ILM in a discrete physical lattice. Such an engineered, intrinsic, low loss channel may prove to be a useful property for other physical systems treated within a tight binding approximation. In collaboration with M. Sato.