Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Energy transfer in mesoscopic vibrational systems enabled by eigenfrequency fluctuations JUAN ATALAYA[1], Michigan State University — Energy transfer between low-frequency vibrational modes can be achieved by means of nonlinear coupling if their eigenfrequencies fulfill certain nonlinear resonance conditions. Because of the discreteness of the vibrational spectrum at low frequencies, such conditions may be difficult to satisfy for most low-frequency modes in typical mesoscopic vibrational systems. Fluctuations of the vibrational eigenfrequencies can also be relatively strong in such systems. We show that energy transfer between modes can occur in the absence of nonlinear resonance if frequency fluctuations are allowed. The case of three modes with cubic nonlinear coupling and no damping is particularly interesting. It is found that the system has a non-thermal equilibrium state which depends only on the initial conditions. The rate at which the system approaches to such state is determined by the parameters such as the noise strength and correlation time, the nonlinearity strength and the detuning from exact non-linear resonance. We also discuss the case of many weakly coupled modes. Our results shed light on the problem of energy relaxation of low-frequency vibrational modes into the continuum of high-frequency vibrational modes. The results have been obtained with Mark Dykman.

[1]Alternative email: jatalaya2012@gmail.com

Juan Atalaya
Michigan State University

Date submitted: 06 Nov 2015 Electronic form version 1.4