

PHONONS IN A NANOPARTICLE MECHANICALLY COUPLED TO THE ENVIRONMENT

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The discrete nature of the vibrational modes of an isolated nanometer-scale solid dramatically modifies its low-energy electron and phonon dynamics from that of a bulk crystal. However, nanocrystals are usually coupled—even if only weakly so—to an environment consisting of other nanocrystals, a support matrix, or a solid substrate, and this environmental interaction can dominate the vibrational properties at low frequencies. We will discuss our recent investigation the modification of the vibrational modes of an isolated spherical nanoparticle caused by a weak mechanical coupling to a semi-infinite solid substrate.¹ As a probe of the modified nanoparticle phonon spectrum, we consider an electron in a localized impurity state in the nanoparticle, and calculate the rate of low-energy nonradiative energy relaxation provided by the substrate interaction.

¹K. R. Patton and M. R. Geller (to be published).