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Title

Resonant generation of coherent phonons in a superconductor by ultrafast optical pump pulses

Source

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Abstract

We study the generation of coherent phonons in a superconductor by ultrafast optical pump pulses. The nonequilibrium dynamics of the coupled Bogoliubov quasiparticle-phonon system after excitation with the pump pulse is analyzed by means of the density-matrix formalism with the phonons treated at a full quantum kinetic level. For ultrashort excitation pulses, the superconductor exhibits a nonadiabatic behavior in which the superconducting order parameter oscillates. We find that in this nonadiabatic regime the generation of coherent phonons is resonantly enhanced when the frequency of the order-parameter oscillation is tuned to the phonon energy, a condition that can be achieved in experiments by varying the integrated pump pulse intensity.