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Electronic Squeezing of Pumped Phonons: Negative U and Transient Superconductivity DANTE KENNES, ELI WILNER, DAVID REICHMAN, ANDREW MILLIS, Columbia University — Advances in light sources and time resolved spectroscopy have made it possible to excite specific atomic vibrations in solids and to observe the resulting changes in electronic properties but the mechanism by which phonon excitation causes qualitative changes in electronic properties has remained unclear. Here we show that the dominant symmetry-allowed coupling between electron density and dipole active modes implies an electron density-dependent squeezing of the phonon state which provides an attractive contribution to the electron-electron interaction, independent of the sign of the bare electron-phonon coupling and with a magnitude proportional to the degree of laser-induced phonon excitation. Reasonable excitation amplitudes lead to non-negligible attractive interactions that may cause significant transient changes in electronic properties including superconductivity. The mechanism is generically applicable to a wide range of systems, offering a promising route to manipulating and controlling electronic phase behavior in novel materials.

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