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Quasiparticle properties of the nonlinear Holstein model at finite doping and temperature. SHAOZHI LI, Univ of Tennessee, Knoxville, BETH NOWADNICK, Cornell University, STEVEN JOHNSTON, Univ of Tennessee, Knoxville — Models with linear electron-phonon (e-ph) interactions often predict the formation of small polarons with large lattice displacements. This directly violates the approximations made in deriving the linear model, which implies that one should consider higher order terms in the interaction. Previously we have shown that even small positive nonlinear e-ph interactions dramatically suppress charge-density-wave formation and s-wave superconductivity relative to the linear model [EPL. 109, 27007 (2015)]. In this talk, we present a determinant quantum Monte Carlo study of thesingle-particle properties of quasiparticles and phonons in a two-dimensional Holstein model that includes an additional nonlinear e-ph interaction. We show that a small positive nonlinear e-ph interaction reduces the effective coupling between electrons and phonons and hardens the effective phonon frequency. Conversely, a small negative nonlinear interaction can enhance e-ph coupling resulting in heavier quasiparticles. In addition, we find that an effective linear model fails to simultaneously capture the quantitative effects of the nonlinearity of both the electronic and phononic degrees of freedom, even though it can qualitatively reproduce properties.

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