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**Failure of the Holstein model to describe strong electron-phonon coupling**[1] CLEMENS P.J. ADOLPHS, MONA BERCIU, Department of Physics and Astronomy, University of British Columbia — We point out an inconsistency in the most widely used theoretical models that describe systems with strong electron-phonon coupling. Both the Holstein and the Fröhlich models assume that lattice distortions are sufficiently small to justify treating them to linear order. At strong coupling, however, it is well established that these models predict the formation of a small polaron, with potentially considerable local lattice distortions, invalidating the original assumption. Here we use the momentum average approximation to study the effect of higher-order coupling terms in the Holstein model. We show that they have drastic consequences on the properties of the polaron when compared to the linear model, and that these effects cannot be captured by a linear model with renormalized parameters.

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