Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

The Holstein polaron: coupling to multiple phonon branches
MONA BERCIU, LUCIAN COVACI, University of British Columbia — We extend a recently developed approach, the Momentum Average approximation, to study polaron properties when the electron couples to two or more phonon branches through Holstein-like terms. The efficient numerical procedure we propose for obtaining the Green's function within this approximation allows the accurate calculation of physical properties for a wide range of parameters and in any dimension. Our results are exact in limiting cases of very weak and very strong couplings, and accurate in the intermediate regime. This is demonstrated by studying the sum rules of the spectral function, the first 6 of which are satisfied exactly. We present results for the polaron ground state energy, quasiparticle weight, average number of phonons in the ground state and effective mass, as well as spectral functions. These are all readily calculated for a wide range of momenta and a wide range of couplings. An ansatz allowing efficient generalizations to more phonon branches will also be presented.

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Date submitted: 17 Nov 2006 Electronic form version 1.4