The Holstein polaron: coupling to multiple phonon branches
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a recently developed approach, the Momentum Average approximation, to study po-
laron 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 phys-
ical 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.