

A New Variational Study for Two-Site Holstein Model

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Abstract: A variational approach is developed to study the groundstate (GS) of the two-site Holstein model. By the extended coherent state, where the more phonon correlations are easily incorporated, we can get the very accurate ground state energy for all electron-phonon coupling range in typical values of hopping integral $t=0.5, 1.1$, and 2.1 (in units of phonon frequency ω_0), which covers the crossover region from antiadiabatic limit to the adiabatic limit. Within a very wide t range $[0, 2.7]$, the exact results for the GS energy are obtained with the twelfth (fourteenth) order corrections to the zeroth order wave function. Moreover, the present approach is more concise than any other analytical ones in this field, and hopefully can be easily generalized to many other Holstein models.

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