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A Kadanoff-Wilson renormalization group analysis of half-filled one-dimensional quantum electron-phonon models HASSAN BAKRIM, CLAUDE BOURBONNAIS, Departement de physique, Universite de Sherbrooke, Sherbrooke, Quebec, Canada J1K-2R1 — We study the zero temperature phase diagrams of the half-filled one-dimensional Su- Schrieffer-Heeger (SSH) and molecular crystal (CM) models using the Kadanoff-Wilson renormalization group approach. At the one-loop level, the full frequency dependence of the phonon induced electron-electron coupling constants is taken into account in the vertex corrections and the quantum interference between the Cooper and Peierls diffusion channels. This enters as a key ingredient for the description of the quantum to classical transition for the Peierls instability. Our results confirm that finite phonon frequency introduces quantum fluctuations that depress the Peierls gap Δ compared to the classical - mean field - limit Δ_0. It is found that in the spinless fermion case, the Peierls gap vanishes at the threshold $\omega_D \sim \pi\Delta_0$, whereas for fermions with spins, the gap remains in the quantum spin- charge separated regime. We extend our study to the XY spin-Peierls chain and confirm the DMRG result about the existence of a power law relation between the critical spin-phonon coupling α_c and frequency at the quantum-classical boundary, namely $\alpha_c \sim \omega_D^{0.7}$.

Claude Bourbonnais
Departement de physique, Universite de Sherbrooke
Sherbrooke, Quebec, Canada J1K-2R1

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