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Doping dependent isotope effects of the quasi-1D electron-phonon system: comparison with the high-temperature superconductors IAN BINDLOSS, University of California, Los Angeles — The weak-coupling quantum phase diagrams of the one-dimensional (1D) Holstein-Hubbard and Peierls-Hubbard models are computed near half-filling, using a multi-step renormalization group technique. If strong enough, the electron-phonon interaction induces a spin gap. The spin gap, which determines the superconducting pairing energy, depends strongly on the band filling and decreases monotonically as the system is doped away from half-filling. However, the superconducting susceptibility exhibits a different doping dependence; it can vary non- monotonically with doping and exhibit a maximum at an "optimal" value of the doping. For a quasi-1D array of weakly coupled, fluctuating 1D chains, the superconducting transition temperature T_c exhibits a similar non-monotonic doping dependence. The effect of changing the ion mass (isotope effect) on T_c is found to be largest near half-filling and to decrease rapidly upon doping away from half-filling. The isotope effect on the spin gap is the opposite sign as the isotope effect on T_c. We discuss qualitative similarities between these results and properties of the high-temperature superconductors.

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