One-electron excitations vs collective excitations

in the 1D Falicov-Kimball model with Hund coupling at half filling

Jakub Wrzodak and Romuald Lemański

Institut of Low Temperature and Structure Research, Polish Academy of Sciences, Okólna 2, 50-422 Wrocław

The Falicov-Kimball model enriched with Ising-type Hund coupling between itinerant electrons and localized spins is studied exactly on finite 1D rings. At half filling (one electron per site) and for the density of magnetic ions equal to 1/2 it is shown that many-electron collective excitations coupled to spin reorientations of the magnetic ions have much lower energy than one-electron excitations. This property is caused by energy gaps formed at Fermi levels in one-electron energy spectra of all relevant magnetic configurations of the ions. Consequently, low temperature properties of the system are not driven by one-particle, elementary excitations but many-particle collective excitations where both electrons and spins are involved.