Colloquium

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Neutron Scattering in Intermediate Valence Compounds

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Abstract

Intermediate Valence (IV) materials are rare earth (e.g. Ce or Yb) intermetallic compounds where the nearly-local 4f states hybridize with the conduction electrons. On-site Coulomb repulsion that prevents multiple 4f occupancy causes the hopping (hybridization) to be correlated. These correlations "renormalize" the band structure, leading to smaller energy scales and heavier masses than predicted by standard density functional (DFT) band theory. Inelastic neutron scattering in these compounds measures the dynamic susceptibility $\chi''(Q,\Delta E)$ arising from particle-hole excitations in the renormalized bands. Our experimental results for the inelastic scattering in the IV compound $CePd_3$ can be very well fit by calculations of $\chi''(Q,\Delta E)$ where the correlations are treated by dynamic mean field theory (DMFT) and where "vertex corrections" that account for the interactions between the particle and the hole are included. We find that the scattering becomes increasingly incoherent (Q-independent, or impurity-like) as the temperature is raised. Preliminary results for the IV compound $YbAl_3$ are similar, with the additional feature that the 4f electrons appear to resonate with optic phonons.

Monday, April 8, 2019, at 3:00 pm
SERC, Room 116
Refreshments served at 2:45 pm