On the Thermoelectric Properties of Layered Cobaltates

QIANG LI, Brookhaven National Laboratory — A study on the thermoelectric properties of layered cobaltates is presented, based on the dynamic mean field theory for strongly correlated electron systems. Electron correlation results in a crossover from coherent quasi-particle excitation at low temperature to incoherent excitation at high temperatures in cobaltates. With an extremely narrow quasi-particle bandwidth \((\hbar \omega_c \sim 50 \text{ meV})\), the thermal destruction of Fermi-liquid occurs at the moderate crossover temperature \(T_M (\sim 200 \text{ K})\), and suggests a new scaling for thermoelectric power \(S\) of cobaltates \((S \sim kT/\hbar \omega_c \sim T/T_M)\) at low temperatures. At high temperatures, the dominating incoherent excitation leads to a weak temperature dependent \(S\), and electric resistivity \(\rho\) approaches the Mott-limit \(\hbar a/e^2 \sim \text{a few m\Omega-cm}\) for cobaltates, where \(a\) is a lattice constant.

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