NEUTRON SCATTERING AND THERMOPOWER OF CERIUM HEAVY FERMION SYSTEMS

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The main difficulty in understanding a Heavy Fermion system is the different behaviours exibited at differant temperatures. At high temperature it behaves like a collection of independent Kondo ions while at low temperature it behaves like a Fermi liquid. At intermediate temperatures it probably represents some sort of partially coherant Fermi liquid. Theoretical calculations based on the Anderson lattice model do not quite reproduce the diversity of behaviour. The current trend is to employ the spin fluctuation model in a semi-phenomenological manner. The input is the experimentally detrmined neutron scattering spectra from which the dynamical susceptibility, the self energy function and hence all the physical properties are calculated. In Heavy Fermion systems the quasielastic and inelastic spectra correspond to single site and intersite spin fluctuations. A signature of this observation is clearly seen in the thermopower measurements. Recently Fischer /1/ has given a theory of the thermopower in which these spin fluctuation effects are explicitly taken into account.

In the present work we test Fischer's theory using the experimental data on the Heavy Fermion systems $CeCu_6$ and $CeRu_2Si_2$. Conduction electron scattering by f - spin leads to two contributions to the thermopower : S_1 due to the Kondo scattering and S_2 due to resonance scattering. These are due to single site and intersite spin fluctuations respectively. At low temperature $T < T_K$ (T_K = Kondo temperature) S_2 dominates while at high temperature $T > T_K$ S_2 becomes negligible and S_1 dominates. S_2 has opposite sign to S_1. The total thermopower thus exibits a positive maximum at higher temperature and a negative minimum at low temperature. We calculate S_1 S_2 and S using quasielastic and inelastic linewidths from the neutron scattering data of Rossat-Mignod et al. /2/ and compare with the thermopower results of Amato et al. /3/.

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/2/ J.Rossat-Mignod et al. J.Magn.Magn.Mat., 76-77, (1988), 376.
/3/ A.Amato et al. J.Magn.Magn.Mat., 76-77, (1988) 263.