Electronics – Free electron gas

1. Perspectives & Tasks

2. Free electron gas

   Electron dispersion

   Fermi energy E_F

   Electronic DOS

   Fermi-Dirac distribution

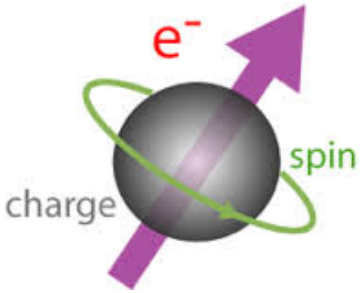
3. Electronic specific heat

   Temperature dependence

   Quantitative expression

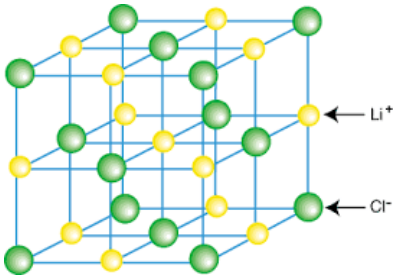
   Comparison to experiments

Electronics –



mass

SPIN	ORBITAL
CHARGE	LATTICE



Historical periods

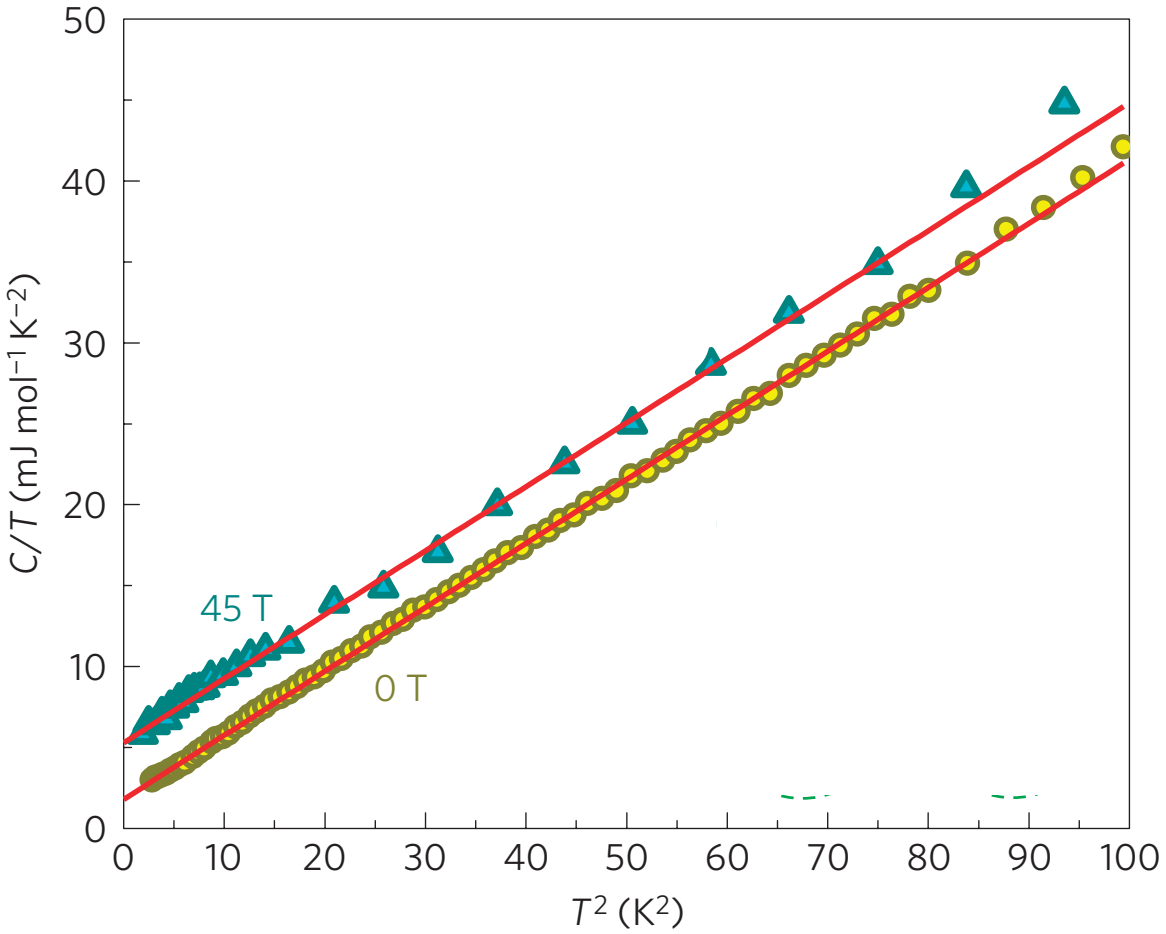
Bronze age

Iron age

Silicon age

Electronic specific heat

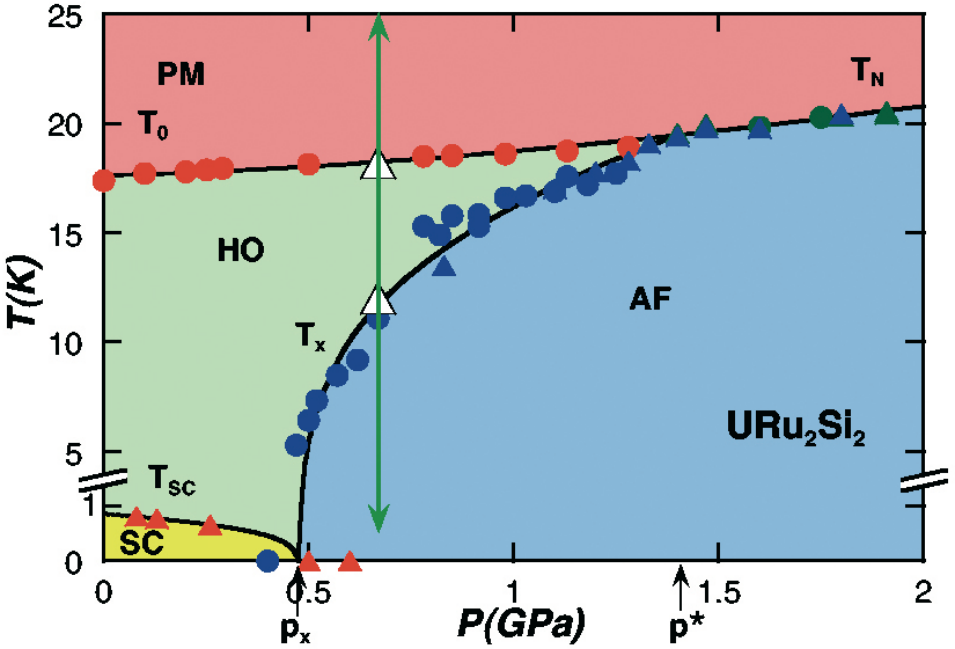
High-temperature superconductor
$YBa_2Cu_3O_{7-x}$

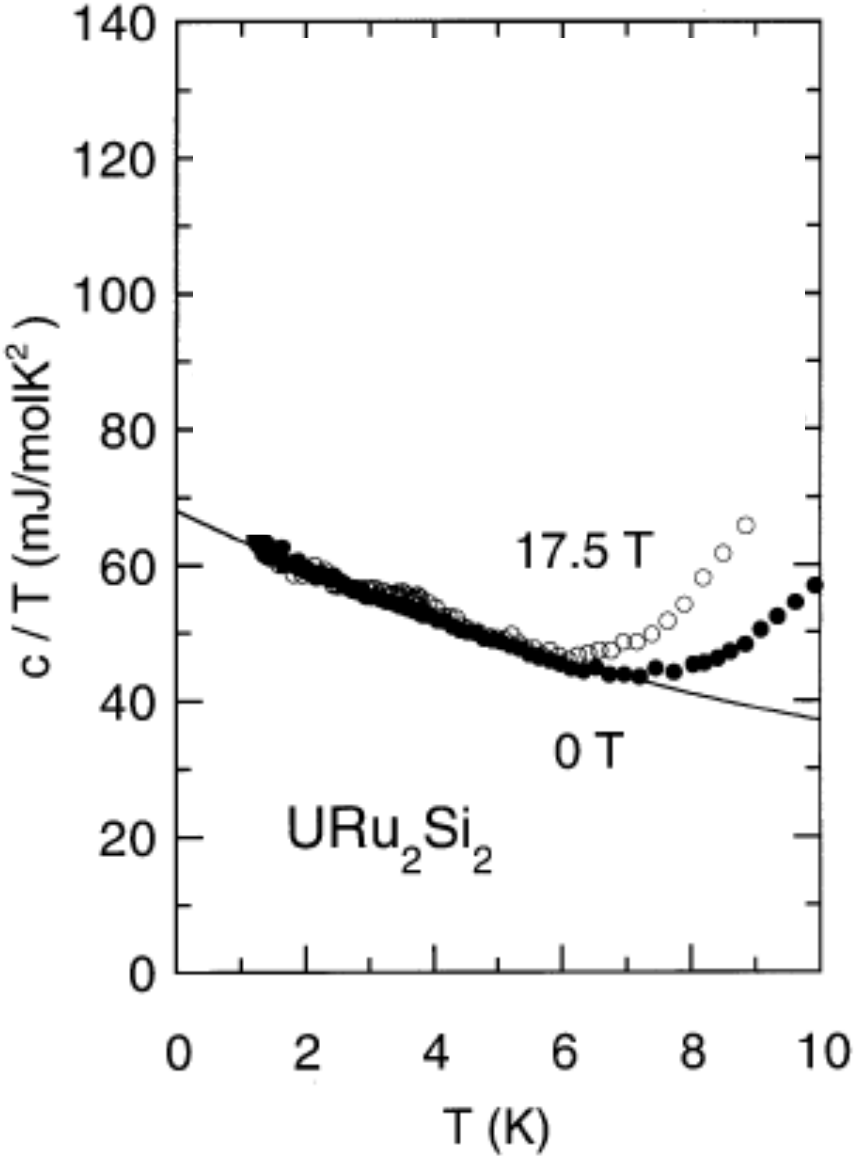


http://www.nature.com/nphys/journal/v7/n4/pdf/nphys1921.pdf (2011)

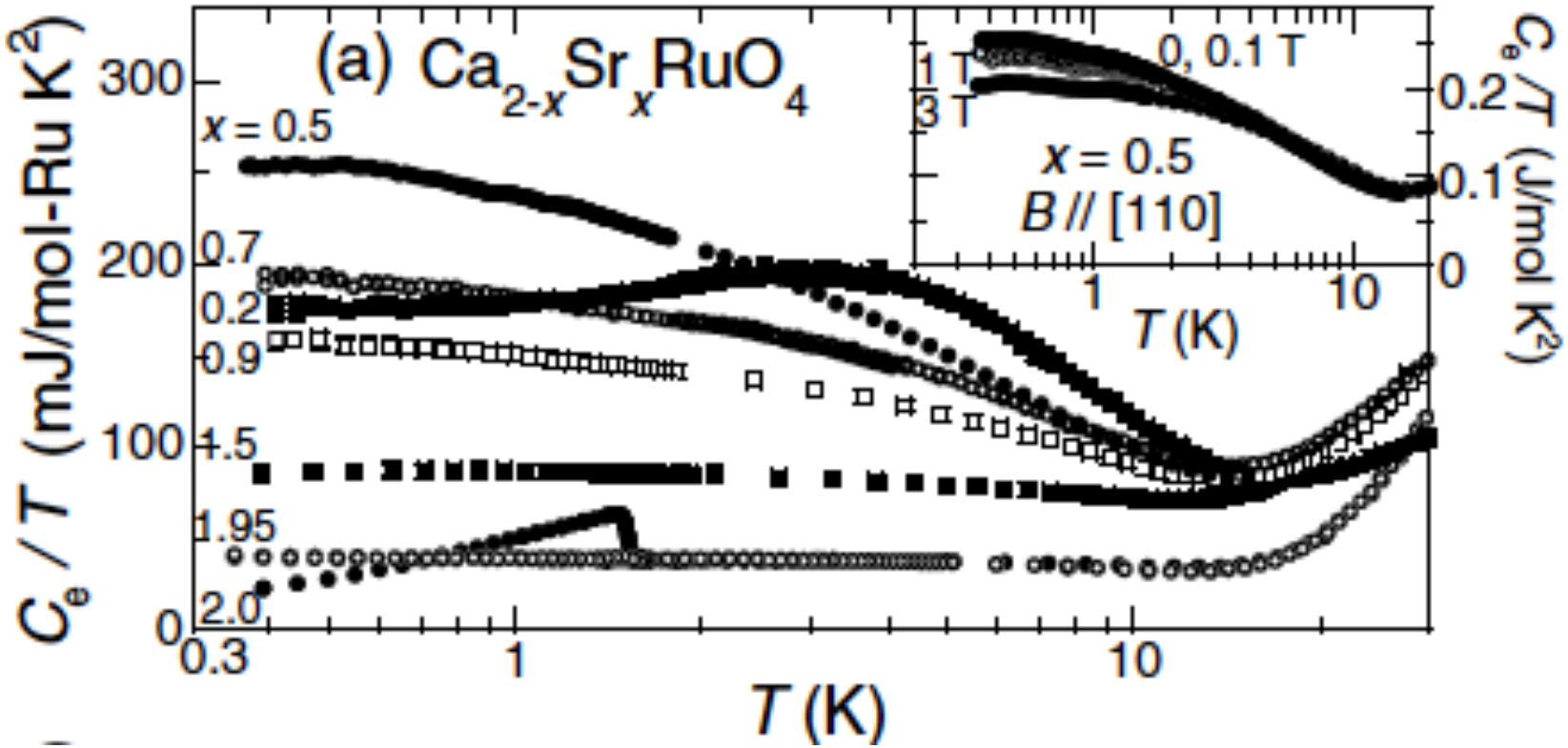
Heavi Fermions

Hidden order in URu_2Si_2





Heavi Fermions



PRL **90**, 137202 (2003)

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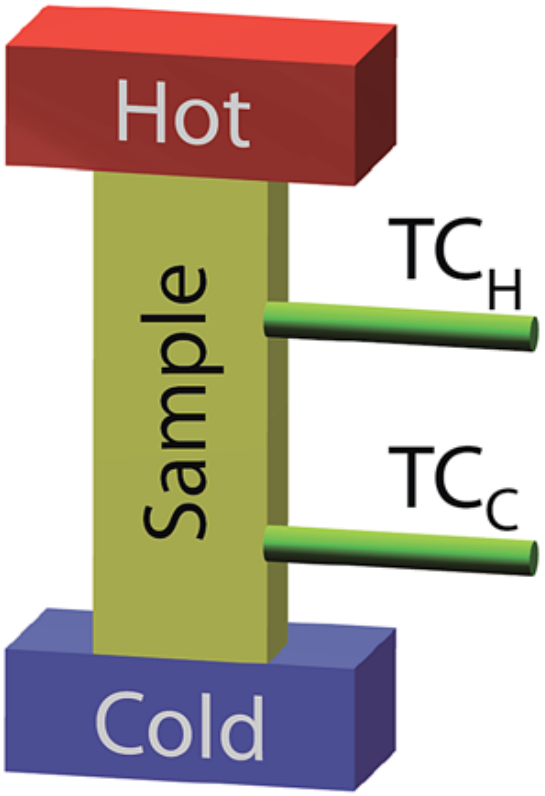
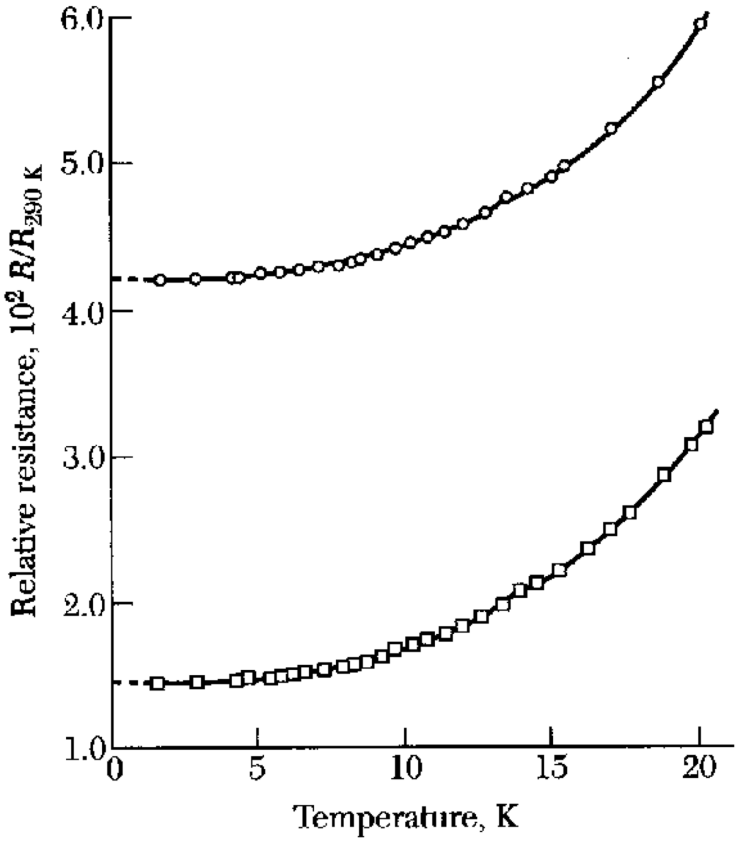


Residual Resistivity - $\rho(T = 0)$



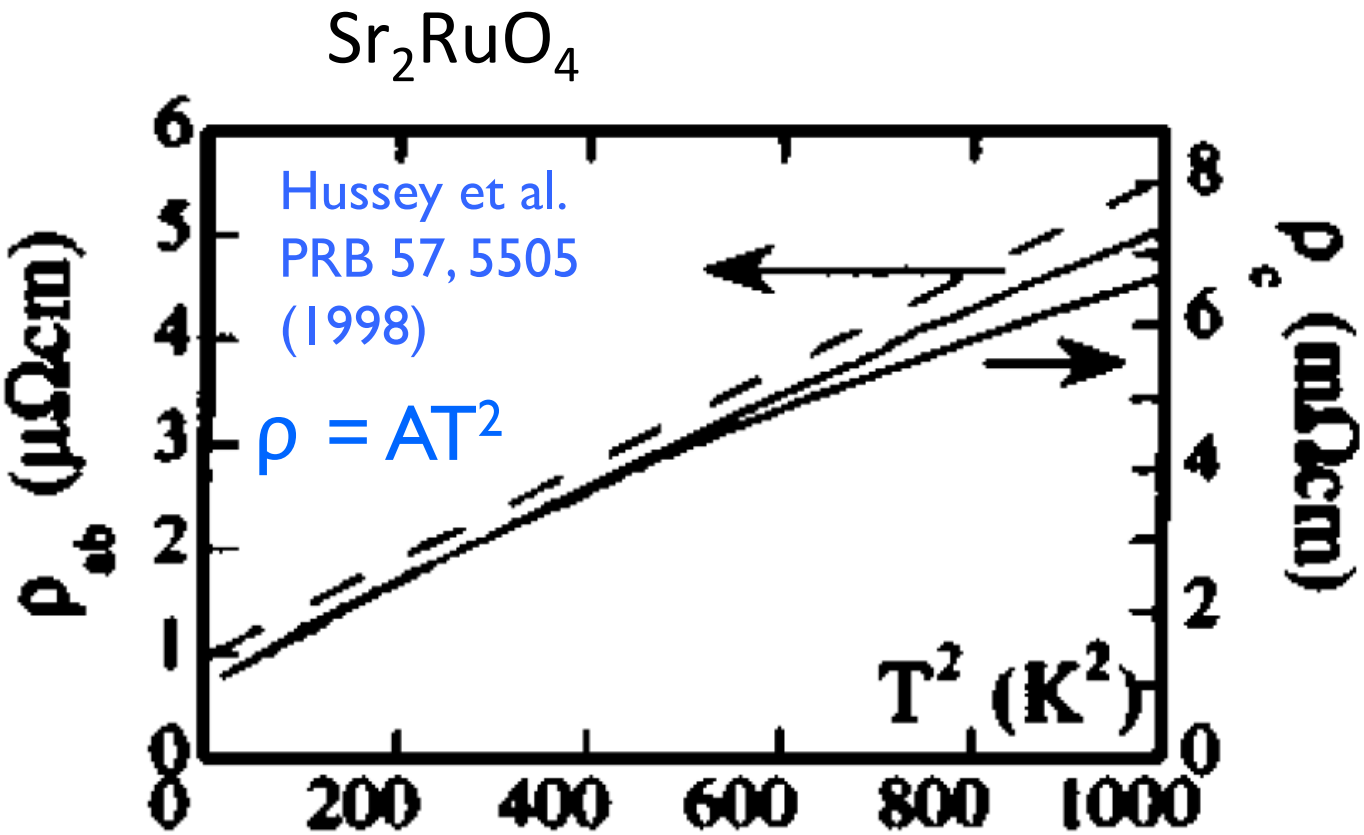
Definition: Residual Resistivity Ratio

RRR = $\frac{\rho(300\ K)}{\rho(0\ K)}$

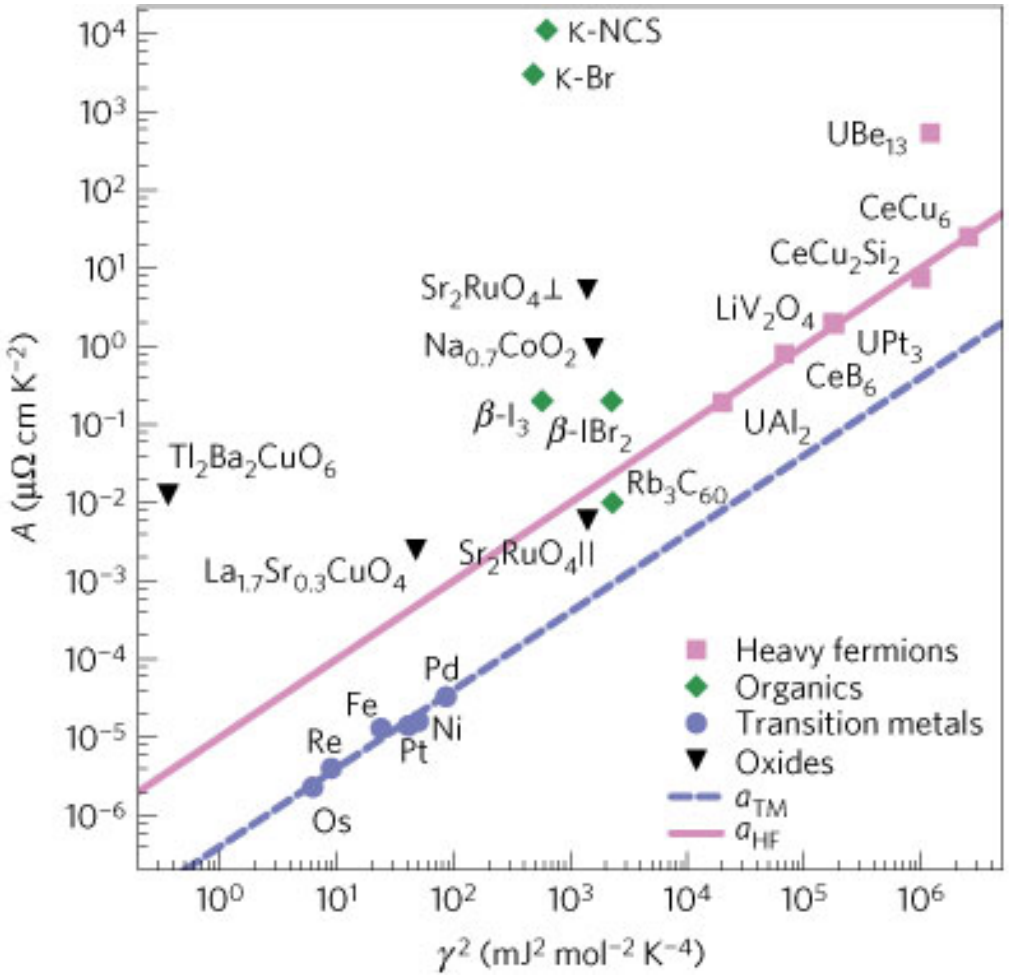
RRR is a measure of purity

Figure 12 Resistance of potassium below 20 K, as measured on two specimens by D. MacDonald and K. Mendelssohn. The different intercepts at 0 K are attributed to different concentrations of impurities and static imperfections in the two specimens.

Resistivity: T - dependence



Heavi Fermions



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