

Anomalous magnetic, thermodynamic and transport properties of the ruthenium perovskites $\text{Ca}_{1-x}\text{Sr}_x\text{RuO}_3$ in the region of high calcium concentration

A. Zarzycki,¹ M. Rams,² E.A. Görlich,² and K. Tomala²

¹*H. Niewodniczański Institute of Nuclear Physics, PAS, Kraków*

²*M. Smoluchowski Institute of Physics, Jagiellonian University, Kraków*

SrRuO_3 is a metallic ferromagnet with $T_C \simeq 163$ K. In the $\text{Ca}_{1-x}\text{Sr}_x\text{RuO}_3$ system, dilution of the strontium sublattice by calcium atoms leads to decrease of the Curie temperature. The ferromagnetic order disappears at a critical concentration of strontium $x_{\text{cr}} \approx 0.27$, at the quantum phase transition between the itinerant ferromagnet and a metallic paramagnet. All materials with $x < x_{\text{cr}}$ are paramagnetic.

Investigations of the magnetic, thermodynamic and transport properties of the materials with the strontium concentration varying from $x = 0.4$ (ferromagnet with $T_C \simeq 20$ K) to $x = 0$ are reported. The ferromagnetic $\text{Ca}_{0.6}\text{Sr}_{0.4}\text{RuO}_3$ shows typical Landau Fermi-liquid behaviour with $C/T = \text{const}$ and $\rho \sim T^2$. For materials with $x < x_{\text{cr}}$ the magnetic susceptibility in the range of temperatures between about 10 K and 100 K behaves as $\chi \sim T^{1-\lambda}$. The heat capacity and the electrical resistivity demonstrate transitions from the Fermi-liquid at very low temperatures to the anomalous behaviour with $C/T \sim \log T$ and $\rho \sim T^{3/2}$ at higher temperatures. The Fermi-liquid behaviour is restored in the external magnetic field.