

Thermodynamic investigations of the Quantum Critical Point in $\text{CeRh}_{1-x}\text{Ir}_x\text{In}_5$

Master 2

Summary

In the series of $\text{CeRh}_{1-x}\text{Ir}_x\text{In}_5$, at zero magnetic field, the antiferromagnetic order is suppressed at the Quantum Critical Point corresponding to $x_c = 0.6$, while superconductivity emerges above $x \sim 0.3$. The objective is to investigate the interplay of different types of magnetic orders and superconductivity under magnetic field by means of specific heat measurements down to the lowest temperature (~ 300 mK) for various values of x .

Detailed subject

The doping dependent phase diagram of $\text{CeRh}_{1-x}\text{Ir}_x\text{In}_5$ was previously established by neutron diffraction, specific heat and electrical resistivity measurements. However, the effect of magnetic field on superconductivity and different types of magnetic orders is at present unknown. In order to understand the interplay between magnetism and superconductivity, it is important to study how both of them are affected by magnetic field. This can be done by specific heat measurements only since electrical transport measurements tend to over-estimate the superconducting critical temperature.

Specific heat measurements on high quality single crystals of $\text{CeRh}_{1-x}\text{Ir}_x\text{In}_5$ with different Ir concentrations will be performed at temperatures down to 300 mK and magnetic fields up to 16 T. These measurements will additionally allow us to select the best Ir concentration for future neutron diffraction measurements under magnetic field. This could lead to a PhD project.

Publications linked to the theme

P. G. Pagliuso *et al.*, *Coexistence of magnetism and superconductivity in $\text{CeRh}_{1-x}\text{Ir}_x\text{In}_5$* ,
[Phys. Rev. B 64 100503\(R\) \(2001\)](#), [arxiv 0101316](#)

A.D. Christianson *et al.*, *Novel Coexistence of Superconductivity with Two Distinct Magnetic Orders*,
[Phys. Rev. Lett. 95 217002 \(2005\)](#), [arxiv 0509780](#)

Background and skills expected:

Taste for experimental studies, basic knowledge of the solid-state physic.

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