Superconducting and normal state properties of nearly ferromagnetic UTe_2 under hydrostatic pressure.

M. Vališka[1]*, D. Braithwaite[1], G. Lapertot[1], G. Knebel[1], J.-P. Brison[1] and J. Flouquet[1]

[1]*Université Grenoble Alpes and CEA, IRIG-PHELIQS, F-38000 Grenoble, France*

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*e-mail: michal.valiska@cea.fr

We report the effect of applied hydrostatic pressure on the recently discovered superconductor UTe_2. This heavy-fermion paramagnet exhibits superconductivity at T_{sc} = 1.6 K at ambient pressure [1] and crystalizes in the orthorhombic Immm space group. Although UTe_2 has a paramagnetic ground state its magnetic susceptibility for field parallel to *a* axis is strongly enhanced, suggesting its vicinity to ferromagnetic order, and indeed it shares some of the remarkable properties of the uranium based ferromagnetic superconductors (UGe_2 [2] URhGe [3] UCoGe [4] and UIr [5]). Both URhGe and UCoGe have remarkable phase diagrams under magnetic field $H \| b$ perpendicular to the orientation of the magnetic moments along *c* axis. This causes reinforcement of superconductivity for UCoGe [6] and reentrant superconductivity for URhGe [7] corresponding to the reorientation of the moments and increased magnetic fluctuations. The upper critical field H_{c2} of UTe_2 exceeds the Pauli limit, suggesting spin-triplet coupling, and is strongly anisotropic. H_{c2} for magnetic field applied along *b* axis shows dramatic upturn for the high quality samples [8] that resembles the case of UCoGe [6] and URhGe [7]. The magnetic susceptibility for $H \| b$ has a maximum at T_{χ}^{max} = 35 K. Thus, in further analogy with UCoGe and URhGe [9], a metamagnetic transition was predicted and finally confirmed by high-field experiments at $\mu_0 H_m$ = 35 T [10].

Pressure is a very effective tuning parameter for the magnetic and superconducting properties of these compounds, and has been crucial for the understanding of the phenomena. The Curie temperature of URhGe is enhanced by hydrostatic pressure whereas superconductivity is suppressed at around 4 GPa [11]. However applying uniaxial stress along the *b* axis connects the high-field reentrant superconducting phase with the low-field phase and enhances the temperature of superconducting transition [12]. On the other hand the clearly itinerant ferromagnetism of UCoGe is pushed by hydrostatic pressure towards the ferromagnetic instability. Such enhancement of magnetic fluctuations leads to the increase of the temperature of superconducting transition that reaches maximum close to the critical pressure of the ferromagnetic order at around 1 GPa [13-15].

We performed transport and calorimetry measurements under hydrostatic pressure and magnetic field in order to construct the complete *p-T-H* phase diagram of UTe_2 that shows the evolution of both the normal and superconducting state of the system.

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