Study of valence in heavy-fermion single crystals under pulsed magnetic fields up to 30 T

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Heavy-fermions metals are characterized by a Fermi liquid regime with effective masses reaching hundred to several thousands times that of the free electron mass [1]. Strong electronic interactions can be tuned by pressure, doping, or magnetic field, which leads to magnetic quantum phase transitions where the effective mass is enhanced and exotic phenomena, as non-Fermi liquid and unconventional superconductivity, emerge. Recently, it has been proposed that changes of valence and valence fluctuations might play a significant role in these systems [2]. Valence changes occurring from tuning with high pressure or temperature have been extensively studied on several systems. Heavy fermion systems are also very sensitive to high magnetic fields [3], but the effect of field on the valence state requires magnetic fields higher than those readily available in synchrotron facilities and is still largely unexplored.

Thanks to the combined use of a long-duration pulsed magnet developed by the LNCMI-Toulouse and a specially designed helium flow cryostat developed by the ESRF-Grenoble on the Energy-Dispersive-XAS beamline ID24 at the ESRF, we can now investigate the valence of metallic single-crystals by x-ray absorption spectroscopy at low temperatures under pulsed magnetic fields up to 30 T. In this contribution, we present our first results: the investigation of valence in Yb-based heavy fermions under fields up to 30 T, at temperatures from 4 K to 300 K. At low temperature, a small but measurable variation of valence is observed when the field is applied along the easy magnetic axis, while no variation of valence is found when the field is applied along the hard magnetic axis. This anisotropic effect is a signature of the interplay between the magnetic properties and the variation of valence, which is usually understood as a consequence of the Kondo delocalization of the *f*-electrons.

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