Anisotropy of the electronic g-factor in the hidden order state of URu_2Si_2 revealed by quantum oscillations

Gaël Bastien[a,b], Dai Aoki[a,c], Jean-Pascal Brison[a],
Gerard Lapertot[a], Jacques Flouquet[a], Georg Knebel[a,*]

a. Univ. Grenoble Alpes, CEA, INAC-Pheliqs, F-38000 Grenoble, France
b. Present address : IFW Dresden, Institute for Solid State Research, Helmholtzstraße 20, 01069 Dresden, Germany
c. IMR, Tohoku University, Oarai, Ibaraki 311-1313, Japan

* georg.knebel@cea.fr

The "hidden order" state in the heavy-fermion compound URu_2Si_2 that develops below T_0 = 17.5 K is still under debate despite several decades of research after its discovery. An important characteristic of the hidden order state is the strong Ising-type anisotropy of the magnetic properties of the quasiparticles. We re-investigated the g-factor anisotropy of the quasiparticles in URu2Si2 macroscopically by detailed measurements of the superconducting upper critical field H_{c2} and microscopically by Shubnikov-de Haas experiments. From the angular dependence of the amplitude of the Shubnikov de Haas oscillations we determine the anisotropy of the g-factor for the α, β and γ Fermi surface pockets. Both techniques show a strong g factor anisotropy between the c axis and the basal plane. The Shubnikov-de Haas oscillations shows an additional anisotropy in the basal plane for the α Fermi surface pocket. The β branch shows a non-linear Zeeman splitting leading to a reduction of the observed g-factor anisotropy under magnetic field.

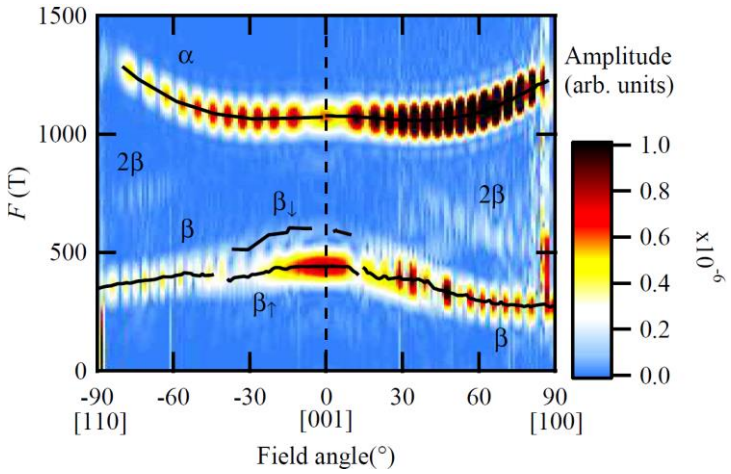

Figure 1: FFT spectra of quantum oscillations at $T=22~$mK in the field range from 12~T to 15~T as a function of angle for S2. The color code corresponds to the amplitude of the FFT spectra.