# MAGNETORESISTANCE MEASUREMENTS ON $URU_{2-X}RE_XSI_2$ : X = 0.01 AND 0.08

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In the present series of measurements (see report ), we studied the field dependence of the magnetoresistivity ρ in single-crystal samples of nominal compositions $URu_{1.99}Re_{0.01}Si_2$ and $URu_{1.92}Re_{0.08}Si_2$ of bar-*like* shape. The pulse field measurements were carried out in Cell 1 (50 T, mid pulse) up to 42 T for several different temperatures between 0.5 K and 20 K. The sample connected with four platinum leads was mounted on the sample holder such as the easy magnetic orientation axis *c* is aligned with the magnetic field and the applied electrical current orthogonal to it. At 11 K, the measured sample resistance was 29.5 mΩ in $URu_{1.99}Re_{0.01}Si_2$ and 10.7 mΩ in $URu_{1.92}Re_{0.08}Si_2$. In both samples, the resistance was followed in temperature during the cool down from 180 to 4.1 K so as to detect any anomaly indicating phase boundaries at zero field. During the pulse, the resistivity is measured using a lock-in amplifier operating at 87.55 kHz.

At 1.5 K, the HO phase is shown to be suppressed at 32.8 T in $URu_{1.99}Re_{0.01}Si_2$ and 30.3 T in $URu_{1.92}Re_{0.08}Si_2$ *vs* 35 T in pure $URu_2Si_2$. Its domain in temperature shrinks considerably from 19.7 K to 11.7 K *vs.* 17.5 K, respectively. For a 4% Ru → Re substitution, a new ordered phase domain is found at fields below 5 T and temperatures below 5 K. Quantum criticality is usually associated with the presence of a broad maximum in the field dependence of the magnetoresistivity the position of which maximum when followed in temperature allows to extrapolate the position of the QCP. In $URu_2Si_2$, this disordered region is centered at $B_{QCP}$ ~ 37.5 T and it overlaps with the metamagnetic crossover region centered around 38 T. In the present studied samples, such a broad maximum is evidenced but its position is surprisingly shifted to 35 T for both samples. This maximum can be followed down to 4.1 K at x = 0.01 (see Fig.1) and 1.5 K at x = 0.08 whereas ordering occurs from 6 K in $URu_2Si_2$. In $URu_{1.92}Re_{0.08}Si_2$, at the lowest measured temperature of 1.5 K, there is no clear indication of the presence of field-induced ordering around the QCP whereas in $URu_{1.99}Re_{0.01}Si_2$, from 3 K, there is. Those preliminary results are somehow surprising for the low Re- doped sample as we do not expect the field dependence of the resistivity to be so much different from the one in pure $URu_2Si_2$.

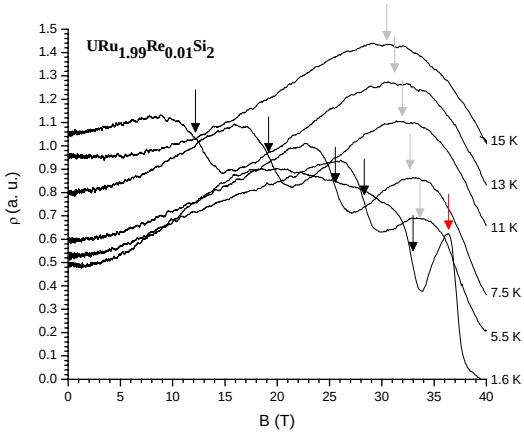


Fig. 1. Magnetic field dependence of the resistivity ρ at different temperatures in 1% doped $URu_2Si_2$. Black and grey arrows indicate positions of the HO phase region boundary and of the centered quantum critical region, respectively. At 1.6 K, a sharp maximum in ρ indicates ordering (red arrow)

Magnetoresistance in $URu_{2-x}Re_xSi_2$ samples with intermediate x content of 0.02 and 0.04 must be measured so as to confirm the present results. Moreover, complementary magnetization measurements must be carried out in order to obtain a comprehensive (B, T) phase diagram.