Title: Magnetism in the non-centrosymmetric uranium compound: $UIrSi_3$

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Abstract: The study presented in this thesis is focused on $UIrSi_3$ which is one of two known uranium compounds that crystallize in a non-centrosymmetric structure. This first study of $UIrSi_3$ in single-crystalline form confirms antiferromagnetic order below $T_N = 41.7$ K and reveals strong uniaxial anisotropy. The antiferromagnetic order is suppressed by application of a magnetic field along the *c* axis ($\mu_0 H_C = 7.3$ T at 2 K). In contrast, application of a magnetic field up to 14 T along the *a* axis gives paramagnetic response. The high T_N, contrasting with the low $\mu_0 H_C$, together with the opposite signs of the paramagnetic Curie temperatures of the *a*-axis and *c*-axis paramagnetic susceptibility indicate a competition between antiferromagnetic and ferromagnetic interactions. The first-order metamagnetic transition at H_C shows asymmetric hysteresis which reflects a complex antiferromagnetic ground state. With increasing temperature, the hysteresis becomes gradually smaller and vanishes at 28 K where the first-order transition changes to second-order transition which remains up to T_N. The point where the order of the transition changes is considered to be the tricritical point ($T_{tcp} = 28$ K, $\mu_0 H_{tcp} = 5.8$ T). As possible scenario to explain this change, it has been suggested that the first-order transition is a manifestation of antiferromagnetic ↔ paramagnetic state with polarized magnetic moments probably accompanied by a magnetic-field-induced Lifshitz transition. The second-order transition is a transition between the antiferromagnetic and the paramagnetic state. A pressure study reveals an opposite pressure evolution of T_N and H_C. The increasing of T_N and the decrease of H_C with increasing pressure suggests possible pressure-induced ferromagnetic order at high pressures. The compressibility along the *a* axis is found to be more than three times larger than along the *c* axis which, together with the opposite pressure evolution of T_N and H_C indicates that the magnetic properties are driven by magnetoelastic coupling. Neutron-diffraction experiments reveal a propagation vector (0.1, 0.1, 0) which changes upon application of a magnetic field and, above $\mu_0 H_C$, disappearance of the antiferromagnetic order is observed.

Keywords: non-centrosymmetric structure, anisotropy, tricritical point, pressure, antiferromagnetism