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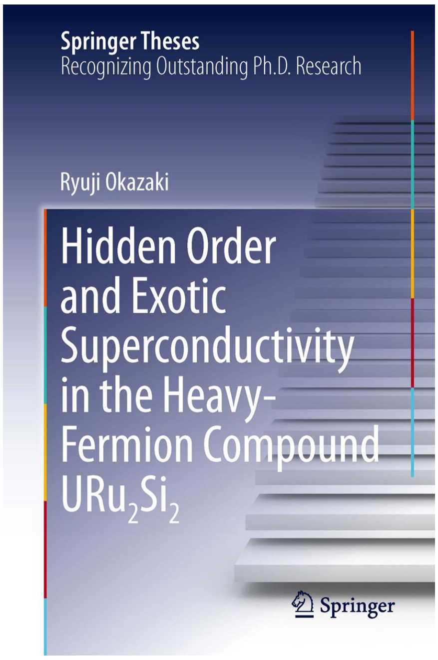

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Physics : Strongly Correlated Systems, Superconductivity

Okazaki, Ryuji, Nagoya University, Nagoya, Japan

Hidden Order and Exotic Superconductivity in the Heavy-Fermion Compound URu2Si2

- Describes precise magnetic torque measurement using micro cantilever and local magnetization measurement using micro-Hall array
- Investigates the symmetry breaking in the hidden-order phase of URu_2Si_2 and vortex state in the superconducting phase
- Covers observation of the vortex lattice melting transition in ultraclean URu_2Si_2 single crystals at sub-Kelvin temperatures
- Nominated as an outstanding contribution by Kyoto University's Physics Department in 2013

In this thesis, the author investigates hidden-order phase transition at T0 = 17.5 K in the heavy-fermion URu2Si2. The four-fold rotational symmetry breaking in the hidden order phase, which imposes a strong constraint on the theoretical model, is observed through the magnetic torque measurement. The translationally invariant phase with broken rotational symmetry is interpreted as meaning that the hidden-order phase is an electronic "nematic" phase. The observation of such nematicity in URu2Si2 indicates a ubiquitous nature among the strongly correlated electron systems. The author also studies the superconducting state of URu2Si2 below Tc = 1.4 K, which coexists with the hidden-order phase. A peculiar vortex penetration in the superconducting state is found, which may be related to the rotational symmetry breaking in the hidden-order phase. The author also identifies a vortex lattice melting transition.

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