Resonant X-ray Scattering Studies of Hidden Order in URu_2Si_2

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Nature of the phase transition, called hidden order (HO), that develops below 17.5 K ($\equiv T_o$) in URu_2Si_2 has been a long-standing issue in the heavy-fermion physics [1-3]. Despite the presence of large bulk anomalies at T_o, which indicate the occurrence of a second-order phase transition, no identification of the order parameter has been achieved by various microscopic measurements performed over the past 25 years. More than twenty different theoretical proposals have been submitted, including exotic spin and charge density waves, structural changes, higher-order-multipole orderings and so on. Most of them explicitly or implicitly assume that the most probable wave vector $\boldsymbol{Q}$ is (0, 0, 1) for the bct structure. Among the proposed models, we focus our attention on the antiferro-quadrupole [4-6] and the antiferro-hexadecapole ordering scenarios [7,8], and here will report our efforts to date in testing the possibility of these order parameters by using the resonant X-ray scattering (RXS) measurements at the U M_4 absorption edge, performed at BL-22XU in SPring-8 [9]. We will also overview our research plan and initial experimental results of the RXS measurements at Ru and Si absorption edges, developed at BL-11B in the Photon Factory KEK.

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