662nd ASRC Seminar

Date: Tuesday, January 24, 16:00 ~17:00

Location: Room 103, ASRC bldg.

Speaker: Dr. Masaaki Matsuda
(Oak Ridge National Laboratory)

Title: Helical magnetism in the vicinity of the superconducting state in CrAs and MnP

•Abstract: CrAs and MnP exhibit superconductivity under pressure with a maximum transition temperature of ~2 K at 2 GPa and ~1 K at 8 GPa, respectively. Since Cr and Mn have the spin degree of freedom, elucidating the magnetic contribution to the superconductivity is crucial to understand the pairing mechanism. A helical structure is the magnetic ground state at ambient pressure in both materials. We performed neutron scattering studies in both materials under pressure.

CrAs shows a helical spin structure with antiferromagnetic interactions dominant accompanied by an abrupt lattice expansion at T_N~260 K at ambient pressure. We performed inelastic neutron scattering experiments in undoped and P-doped CrAs using powder samples. The results in the P-doped CrAs clearly indicate that the antiferromagnetic fluctuations still remain above the critical P content, suggesting a coupling between the magnetism and the superconductivity.

MnP exhibits a ferromagnetic order below T_c~290 K followed by a helical order with the spins lying in the ab plane and the helical rotation propagating along the *c* axis below T_s~50 K at ambient pressure. Both T_c and T_s are gradually suppressed with increasing pressure and the helical order disappears at ~1.2 GPa. Above 2 GPa, a magnetic transition from paramagnetic to a helical magnetic order appears, which hosts the spins in the *ac* plane and the propagation along the *b* axis. With increasing pressure, the helical transition temperature and the ordered moment decrease and the period of this *b* axis modulation becomes shorter. The mechanism of the helical magnetic order in the both materials and its pressure dependence will be discussed.

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