659th ASRC Seminar

Date: Tuesday, December 13, 14:00 ～15:00

Location: Room 103, ASRC bldg.

Speaker: Dr. Hiroshi Yasuoka
(Max Planck Institute)

Title: Emergent Weyl fermion excitations in TaP and NbP explored by ^{93}Nb NMR and ^{181}Ta NQR

•Abstract: The past decade has seen an explosion of interest in the role of topology in condensed matter physics. Arguably the most topical of the new classes of material are Dirac- and Weyl-semi metals (WSMs) which are predicted to host topologically protected states in the bulk. A combination of non-centrosymmetric crystal structure and sizable spin-orbit coupling (SOC) causes the nodes to split into pairs of opposite chirality (Weyl points). For WSMs such as the d-electron monophosphides NbP and TaP, E_F does not exactly coincide with the Weyl nodes. However, if the nodes sit close enough to E_F, in a region of linear dispersion (E ∝ K), the Weyl physics can still be observed in the properties of very light fermions. A key issue in the study of the monophosphides is therefore to establish how close to the Fermi level the Weyl points sit, and to estimate the range of energy over which the linear dispersion exists. The ^{93}Nb NMR and ^{181}Ta NQR techniques have been utilized to investigate Weyl fermion excitations in TaP and NbP. As a typical example, we show the temperature dependence of $1/T_1T$ in TaP. The band structure calculation of TaP tells us that besides the normal bands, two types of Weyl points appear. The first set of Weyl points, termed W1 and located at much lower energy (~40 meV) than the E_F. The second set of Weyl points, W2, are slightly higher in energy (~13 meV) than E_F. From this band structure one can easily imagine that the conventional Korringa process is valid in well below temperature corresponding to the W2 energy, while increasing temperature excitations at the W2 Weyl nodes become progressively dominant. A construction of the total relaxation processes, including an anomalous orbital hyperfine coupling, is in good agreement with the experimental result.

＜Contact＞
Hiroyuki Chudo (81-3831)
Advanced Science Research Center