

699th ASRC Seminar

Date: November 29 (Wed.), 13:30 ~

Location: Room 302, ASRC bldg.

Speaker: Prof. Naoto Metoki (JAEA·Ibaraki University)

Title: Neutron Scattering study of the successive magnetic ordering and the relevant *f*-electron state in NdB₄

Abstract: NdB₄ is an orthogonal dimer system with geometrical frustration. Because of the cancellation of exchange interactions, competing weak interactions can play dominant role. Actually NdB₄ exhibits successive magnetic order with in-plane component m_{ab} and *c*-moment m_c at different temperatures, suggesting anisotropic interaction ($J_{ab} \gg J_c$). A very small m_c ($\sim 0.2 \mu_B$) was detected using polarization analysis with $m_c = (m_{ab})^n$ ($n:3\sim 6$) obtained from Landau expansion. The multipole would be important but the high order n remains difficulty. We determined the quasi-quartet *f*-electron state of NdB₄ based on the wave functions $|\pm 5/2\rangle$ and $|\pm 7/2\rangle$ from the CEF excitation. The *f*-electron state in the ordered states is described by those linear combinations. We found that the rotation of the wave function can develop J_z and O_{zx} from zero (like singlet) up to finite values. This provides microscopic mechanism for the successive transition and can systematically explain the unusual properties in NdB₄ such as steep increase of m_c with very high order n , low temperature sinusoidal modulation of m_c , softening of the elastic constant C_{44} , etc. The rotation angle ψ of the wave function can be determined by the spectral weight of CEF exceptions, which will be proposed for J-PARC/MLF.

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