568th ASRC Seminar

Date: 14:00 ～15:00, 1 October

Location: Meeting room 103, ASRC Building

Speaker: Dr. Yoshifumi Tokiwa
(Department of Physics, Kyoto University)

Title: Quantum critical phenomena induced by geometrical frustration

Quantum criticality is a central topic of modern physics in wide areas such as condensed matter, cold atoms, particle physics and quantum information. In recent years, it has been proposed that quantum fluctuations due to geometrical frustration can drive a system to a quantum critical point between magnetically ordered and spin liquid states. In this presentation, I show quantum critical phenomena of quantum spin liquid candidate, $Na_4Ir_3O_8$[1], quantum spin ice, $Pr_2Ir_2O_7$[2], frustrated Kondo lattices, YbAgGe[3] and CeRhSn[4]. The quantum criticality in the above materials has been evidenced by divergence of Gruneisen ratio. The obtained critical exponents cannot be explained by the conventional theory of quantum criticality and require further theoretical investigations.

We also show unique critical behavior of thermal expansion of a material at QCP driven by geometrical frustration. In the quasi-Kagome Kondo lattice, CeRhSn, singular behavior of thermal expansion along Kagome plane is observed, while it shows Fermi liquid behavior, when it is measured perpendicular to the plane. Such a disparate behavior for two measurement directions is caused by the QCP of geometrical origin.

[1] Y. Singh, Y. Tokiwa, J. Dong, P. Gegenwart, Phys. Rev. B 88, 220413 (2013)

[2] Y. Tokiwa, J. J. Ishikawa, S. Nakatsuji, P. Gegenwart, Nature Materials 13, 356 (2014)

[3] Y. Tokiwa, M. Garst, P. Gegenwart, et. al., Phys. Rev. Lett. 111, 116401 (2013)

[4] Y. Tokiwa, C. Stingl, T. Takabatake, P. Gegenwart, submitted.

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