CSU Condensed Matter Physics Seminar

“Exotic superconductivity upon transformation of orbitals into bands”

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Tuesday, February 25th at 2:00pm

120 Engineering (Hammond Auditorium)

Abstract

Magnetic quantum criticality of 4f electron systems has been proven to produce novel metallic states such as non-Fermi-liquids and exotic superconductivity. However, most of the studies have been limited to those due to the instability associated with the ordering of magnetic dipoles.

On the other hand, it is an interesting and highly non-trivial question whether or not the multipolar degrees of freedom such as quadrupolar moments or orbitals may induce anomalous metallic states and novel superconductivity through their strong hybridization with conduction electrons. In this talk, we will show that such a case is indeed verified experimentally in the study of the nonmagnetic quadrupolar heavy fermion states of the Pr-based cage compounds PrT2Al20 (T: transition metals such as Ti, V). In particular, our systematic study in high magnetic field and high pressure has revealed that quadrupolar quantum criticality as well as heavy fermion superconductivity emerges as a result of the competition between quadrupolar ordering and possible multi-channel Kondo effect. This is based on the collaboration with A. Sakai, Y. Matsumoto, Y. Shimura, M. Tsumimoto, K. Matsubayashi, Y. Uwatoko, T. Sakakibara, T. Sato, D. Okuyama, Y. Nakanishi, M. Yoshizawa, M. Takigawa, and T. Taniguchi.