



Weekly Seminar

High-field studies of elemental semimetals –graphite and black phosphorus

Masashi Tokunaga

University of Tokyo

Time: 4:00pm, Dec. 7, 2015 (Wednesday)

时间: 2016年12月7日 (周三) 下午4:00

Venue: Room w563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

In the history of condensed matter physics, various fundamental phenomena (quantum oscillations, Seebeck effects, Nernst effects, etc.) have been found in elemental semimetals. In high magnetic fields, this class of materials is expected to realize anomalous quantum states caused by strong correlation between the coexisting electron and hole carriers.

In the first half of this talk, I will introduce sequential field-induced phase transitions in graphite. Our experimental results suggest that graphite is in the quantum limit state above 53 T. As a possible origin for the recently found gapped phase above 53 T, we discuss BCS-like condensation of the electron-hole pairs [1], which has been predicted as an excitonic phase since half a century ago.

In the second half, I will introduce magnetotransport properties of semimetallic black phosphorus under pressure. The observed positive magnetoresistance exceeds 800,000 % at 14 T and 2 K together with superposed Shubnikov-de Haas oscillations. We discuss the underlying electronic states in the semimetallic state of black phosphorus based on conventional theories.

[1] K. Akiba et al, J. Phys. Soc. Jpn. 84, 054709 (2015).

[2] K. Akiba et al, J. Phys. Soc. Jpn. 84, 073708 (2015).

[3] K. Akiba et al, arXiv:1611.04277v1.

About the speaker

Dr. Tokunaga is an associate Professor in the Institute of Solid State Physics (ISSP) in University of Tokyo. He graduated from Sophia University in 1988 and granted a PhD from University of Tokyo in 1997. After working in RIKEN as a postdoc researcher (1997-1999) and in University of Tokyo as a research associate (1999-2007), he became an associate Professor in an International MegaGauss Science Laboratory in ISSP of University of Tokyo (2007-present). Dr. Tokunaga has carried out high-magnetic-field experiments on superconductors, copper-germanite, manganites, multiferroics and semimetals, and is an author of more than 60 papers on these research topics.