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19th May 2011 - 14:15

FLASH HALL (28c) - Seminar Room

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Emerging Properties of Quantum Matter - Case Studies of Topological and Superconducting Phases

Emerging property in quantum matter is a major theme of modern physics, with the hope that insights gained would have implications far beyond these materials. In this talk, I will discuss recent results from two interesting examples - topological and superconducting phase matters.

A class of new quantum matter, so-called topological insulators, has unique properties. It has a symmetry protected surface state in the absence of time reversal symmetry breaking, leading to dissipation less edge currents. The strong spin-orbit coupling provides an interesting way to manipulate spin through orbital current. This new class of materials provides a platform to study novel physics such as Majorana fermion, Axion physics, image magnetic monopole from a source charge, etc.. In addition, it also provides opportunities for possible applications ranging from spintronics to thermoelectric materials. In this talk, I will report angle-resolved photoemission data focusing on the following: i) realization of large gap topological insulator with a single dirac cone; ii) creation of massive Dirac fermion on the surface of topological insulator with broken time reversal symmetry; iii) observation of single Dirac cone topological surface state in a candidate topological superconductor.

References:

i) Y.L. Chen et al.; Science 325, 178 (2009); ii) Y.L. Chen et al.; Science 329, 659 (2010);
iii) Y.L. Chen et al.; Phys. Rev. Lett., 105, 266401 (2011)

As second part of my talk, I will report advances in understanding the competing phases in cuprate superconductors. It is now exactly 100 years since superconductivity was discovered and it took 45 years before a complete theory was formulated. High-Tc superconductivity was discovered 25 years ago and its remains a major unsolved physics problem today. I will present ARPES results from various parts of the high-Tc phase diagram that form the cornerstones for future theoretical development.

References:

ZX Shen et al., Phys. Rev. Lett. 70 1553 (1993) -- D.S. Marshall et al., Phys. Rev. Lett. 76, 4841 (1996) -- K. Tanaka, Science 314, 1910 (2006) -- W.S. Lee et al., Nature 450, 81 (2007) -- M. Hashimoto et al., Nature Physics 6, 414-418 (2010) -- R. He et al., Science, 331, 1579 (2011)

Host: Stefan Kaiser, CFEL, MPSD-CMD