



Weekly Seminar

Atomic-Layer Superconductors with Molecule-based van der Waals Heterostructures and the Rashba Effect

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Time: 4:00pm, April 4, 2018 (Wednesday)

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4:00

Venue: Room W563, Physics building, Peking University

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Abstract

Metal atomic layers on semiconductor surfaces constitute of a unique family of two-dimensional (2D) electron system. The recent discovery of superconductivity in this class of atomic-layer materials offers fresh opportunities for studying 2D superconductors [1-4]. In this talk I will report on two recent developments in our group on this type of atomic layer superconductors. First, we found that highly ordered layers of metal-phthalocyanine (MPc, M = Mn, Cu) molecules can modify the superconducting transition temperature (T_c) of the indium atomic layers on Si(111) surfaces in a controllable manner [5]. This 2D system can be considered a molecule-based van der Waals heterostructures. Second, we performed magneto-transport measurements of the same atomic layer superconductor down to the lowest sample temperature of 900 mK and the largest magnetic field of 5 T. We found that the superconductivity is highly robust when a magnetic field was applied to the sample in an in-plane direction. The very likely influence of the Rashba effect will be discussed based on a spin-split Fermi surface of this atomic layer superconductor.

References:

- [1] T. Zhang et al., Nat. Phys. **6**, 104 (2010).
- [2] T. Uchihashi et al., Phys. Rev. Lett. **107**, 207001 (2011) [Editor's Suggestion and featured in Physics].
- [3] S. Yoshizawa, TU et al., Phys. Rev. Lett. **113**, 247004 (2014) [Editor's Suggestion and featured in Physics].
- [4] T. Uchihashi, Supercond. Sci. Technol. **30**, 013002 (2017) [Topical Review].
- [5] S. Yoshizawa, TU et al., Nano Lett. **17**, 2287 (2017).

About the speaker

Takashi Uchihashi is the group leader of Surface Quantum Phase Materials Group, International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Japan. He received a doctor degree in 1995 from the University of Tokyo. He started working as a researcher at National Research Institute for Metals, a former institute of NIMS, in 1995. He was a visiting researcher at Institute of Experimental and Applied Physics, Christian-Albrechts-Universität zu Kiel, Germany in 2006, and has been a visiting professor at Yokohama City University since 2015 and at Hokkaido University since 2018. His main research fields are surface science, nanotechnology, and low temperature physics.