PURDUE UNIVERSITY

Birck Nanotechnology Center

Spintronics and Nanophysics Seminar

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Title: Josephson effect through van der Waals Ferromagnetic barrier

Friday, January 5th, 2018
10:30am – 11:30am
WANG 1004

Abstract: Van der Waals (vdW) material has been attracted much attention recently because of their unique features including the accessibility to atomically thin and flat single-crystalline heterostructure. The two-dimensional (2D) nature of these heterointerfaces often enhances quantum effect. The 2D spintronic effect in vdW heterostructures is remained largely unexplored as most of the ferromagnetic in vdW materials are found to be insulating, and thus inter-layer coupling is weaker than their metallic counterpart. In this presentation, we report that vdW ferromagnet can provide a unique opportunity to study the interplay of superconductivity and magnetism. We fabricated ferromagnetic tunneling device consisting of vdW ferromagnet and superconductor. We observed that the devices exhibit Josephson coupling through magnetic tunneling across 1-6 atomically thin ferromagnetic insulating layers. Our observation is in contrast with the lack of Josephson coupling reported across traditional ferromagnetic insulating materials such as EuS [1]. We also observed that our superconductor/ferromagnet hybrid devices show the hysteretic critical current against magnetic field sweep. Finally by fabricating SQUID device, we observed spin-mixing, i.e., additional Josephson phase is appeared in two superconducting wave functions. These observations open an opportunity to utilize a variety of spintronic effect to control the phase of Josephson coupling.

[1] K. Senapati, M. G. Blamire, and Z. H. Barber, Nat. Mater. 10 849 (2011).

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