



Weekly Seminar

Time-Reversal Symmetry Breaking Pairing in Iron-Chalcogenide Superconductors

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Time: 3:00pm, Nov. 24, 2021 (Wednesday)

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Abstract

The symmetries of superconducting gap functions remain an important issue in iron-based superconductivity. Motivated by the recent angle-resolved photoemission spectroscopic measurements of iron-chalcogenide superconductors, we investigate the constraints to the gap function symmetries from the experimental measurements on the topological surface states. The surface Dirac cone has been observed to open a gap in the superconducting phase, it implies magnetization induced from time-reversal symmetry-breaking pairing via spin-orbit coupling. Based on the crystalline symmetry constraints on the Ginzburg-Landau free energy, the gap function symmetries are among the possibilities of $A1g(u) \pm iA2g(u)$, $B1g(u) \pm iB2g(u)$, or $Eg(u) \pm iEg(u)$. This time-reversal symmetry-breaking effect can exist in the normal state very close to T_c with the relative phase between two gap functions locked at $\pm\pi/2$. This study provides the connection between the gap function symmetries and topological properties of the surface state.

Reference:

1. Meng Zeng, Lun-hui Hu, Hong-Ye Hu, Yi-Zhuang You, Congjun Wu, "Phase-fluctuation Induced Time-Reversal Symmetry Breaking Normal State", arXiv:2102.06158.
2. N. Zaki, G. Gu, A. M. Tselik, **Congjun Wu**, P. D. Johnson, "Time Reversal Symmetry Breaking in the Fe-Chalcogenide Superconductors", PNAS 118, e2007241118 (2021)
3. Lun-hui Hu, P. D. Johnson, **Congjun Wu**, "Pairing symmetry and topological surface state in iron-chalcogenide superconductors", Phys. Rev. Research 2, 022021(R).
4. Wei-cheng Lee, Shou-cheng Zhang, and **Congjun Wu**, "Pairing State with a Time-Reversal Symmetry Breaking in FeAs-Based Superconductors", Phys. Rev. Lett. 102, 217002 (2009).

About the speaker

Congjun Wu received his Ph.D. in physics from Stanford University in 2005, and did his postdoctoral research at the Kavli Institute for Theoretical Physics, University of California, Santa Barbara, from 2005 to 2007. He became an Assistant Professor in the Department of Physics at the University of California, San Diego (UCSD) in 2007, an Associate Professor of Physics at UCSD in 2011, and a Professor of Physics at UCSD in 2017. In 2021, he became a Chair Professor at School of Science, Westlake University, Hangzhou. He was elected to be a Fellow of American Physical Society in 2018. His research interests are exploring new states of matter and revealing their organizing principles, including quantum magnetism, superconductivity, topological states, mathematical physics, and the numerical method of quantum Monte Carlo simulations.