

理学研究科セミナー

日時: 3月7日(金) 10:30-11:30

場所: 研究棟 7階 739 室

Exploring thin flakes of vanadium-based kagome superconductors with hydrostatic pressure

Swee K. Goh

Department of Physics, The Chinese University of Hong Kong, Hong Kong SAR, China.

Vanadium-based kagome superconductors AV_3Sb_5 ($A=K, Rb, Cs$) feature a rich interplay between superconductivity and charge ordering. These phases can be effectively disentangled by applying hydrostatic pressure. I will discuss our approach to probe the normal state and the superconductivity of AV_3Sb_5 by transport current under pressure. Magnetoresistance up to ~ 31 T reveals quantum oscillations, allowing the analysis of the Fermi surface. In particular, large frequencies >8000 T emerge when the charge order is suppressed by pressure, revealing the pristine Fermi surface before the reconstruction [1,2]. In the superconducting state, our self-field critical current measurements in CsV_3Sb_5 exhibit a temperature dependence that can be understood with a nodeless superconducting gap, which is consistent with our finding that T_c is insensitive to sample purity [3]. Finally, the self-field critical current at the zero-temperature limit shows a drastic enhancement near the border of the charge order where T_c is also enhanced, hinting at the role of charge fluctuations on superconductivity [4].

- [1] W. Zhang, T. F. Poon, C. W. Tsang, W. Wang, X. Liu, J. Xie, S. T. Lam, S. M. Wang, K. T. Lai, A. Pourret, G. Seyfarth, G. Knebel, W. C. Yu, & S. K. Goh, *Large Fermi surface in pristine kagome metal CsV_3Sb_5 and enhanced quasiparticle effective masses*. Proceedings of the National Academy of Sciences **121**, e2322270121 (2024).
- [2] Z. Wang, L. Wang, K. Y. Yip, Y. K. Tsui, T. F. Poon, W. Wang, C. W. Tsang, S. M. Wang, D. Graf, A. Pourret, G. Seyfarth, G. Knebel, K. T. Lai, W. C. Yu, W. Zhang, & S. K. Goh, *Discovery of a new phase in thin flakes of KV_3Sb_5 under pressure*. Advanced Science (in press, 2025).
- [3] W. Zhang, X. Liu, L. Wang, C. W. Tsang, Z. Wang, S. T. Lam, W. Wang, J. Xie, X. Zhou, Y. Zhao, S. M. Wang, J. Tallon, K. T. Lai, & S. K. Goh, *Nodeless Superconductivity in Kagome Metal CsV_3Sb_5 with and without Time Reversal Symmetry Breaking*. Nano Letters **23**, 872-879 (2023).
- [4] W. Wang, L. Wang, X. Liu, C. W. Tsang, Z. Wang, T. F. Poon, S. M. Wang, K. T. Lai, W. Zhang, J. L. Tallon, & S. K. Goh, *Quantum phase transition as a promising route to enhance the critical current in kagome superconductor CsV_3Sb_5* . Advanced Science **11**, 2410099 (2024).

お問い合わせ先: 中井祐介(大学院理学研究科) nakai@sci.u-hyogo.ac.jp