Topology and exotic electronic phases in two-dimensional kagome superconductor CsV_3Sb_5

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Abstract: Kagome compounds provide a fertile playground to explore the rich interplay between geometry, topology and electronic correlations. In this talk, we focus on a topological two-dimensional kagome metal CsV_3Sb_5 which exhibits cascade of symmetry-breaking electronic phases, including charge density wave, electronic nematicity and superconductivity. A giant anomalous Hall conductivity is observed exactly following the CDW transition, and the superconductivity shows an unusual competition with this CDW state under pressure. Deeply in the CDW state, we found the emergence of electronic nematicity that intertwines with CDW and superconductivity. A new CDW phase induced by pressure, evolving from the electronic nematicity in ambient-pressure triple-Q CDW state, is observed. Meantime, we perform soft point-contact spectroscopy (SPCS) measurements and find that the superconducting gap is significantly enhanced between the two SC domes, suggesting strong Cooper pair phase fluctuations. At low temperatures, the topological surface states cooperate with superconductivity, and Majorana zero modes can be realized inside the vortex cores. Our results point to the essential role of charge degree of freedom in the development of intertwining electronic orders, thus provides new constraints for theories. All these results establish CsV_3Sb_5 as an ideal playground to study the topology and correlation driven exotic electronic orders.

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Bio: Professor Xianhui Chen obtained his PhD degree at University of Science and Technology of China (USTC) in 1992. Now he is a professor at USTC, an academician of the Chinese Academy of Sciences, and a Fellow of the World Academy of Sciences. He has been a Humboldt Scholar at the Karlsruhe Research Center in Germany and the Max Planck Institute for Solid State Physics in Stuttgart, a visiting professor at the Japanese National Institute of Advanced Studies (Hokuriku), Texas Superconductivity Research Center at the University of Houston, and the National University of Singapore. He yielded the National Outstanding Youth Fund in 1998 and was appointed as a "Yangtze River Scholar" Distinguished Professor by the Ministry of Education of China in 2002. His main research interests focus on exploration of novel functional materials and the physics therein, such as superconductors, strong correlated electronic materials and topological quantum materials. Professor Xianhui Chen has published more than 470 SCI papers, including Nature (8 papers), Science (2), Nature serie- journals (24) and Physical Review Letters (41). He was awarded the Cheung Kong Scholar Achievement Award granted by the Ministry of Education and the Li Ka-shing Foundation in 2008, the Group Award for Outstanding Achievement in Science and Technology granted by the Qiushi Technology and Science Foundation in 2009, the First Prize of National Natural Science Award in 2013, the Bernd T. Matthias Prize in International Superconducting Materials in 2015, the National Innovation and Progress Medal, the Ho Leung Ho Lee Prize for Scientific and Technological progress in 2017, and the TWAS Prize in Physics in 2019.