Charge-density-wave induces electronic nematicity in Kagome superconductor

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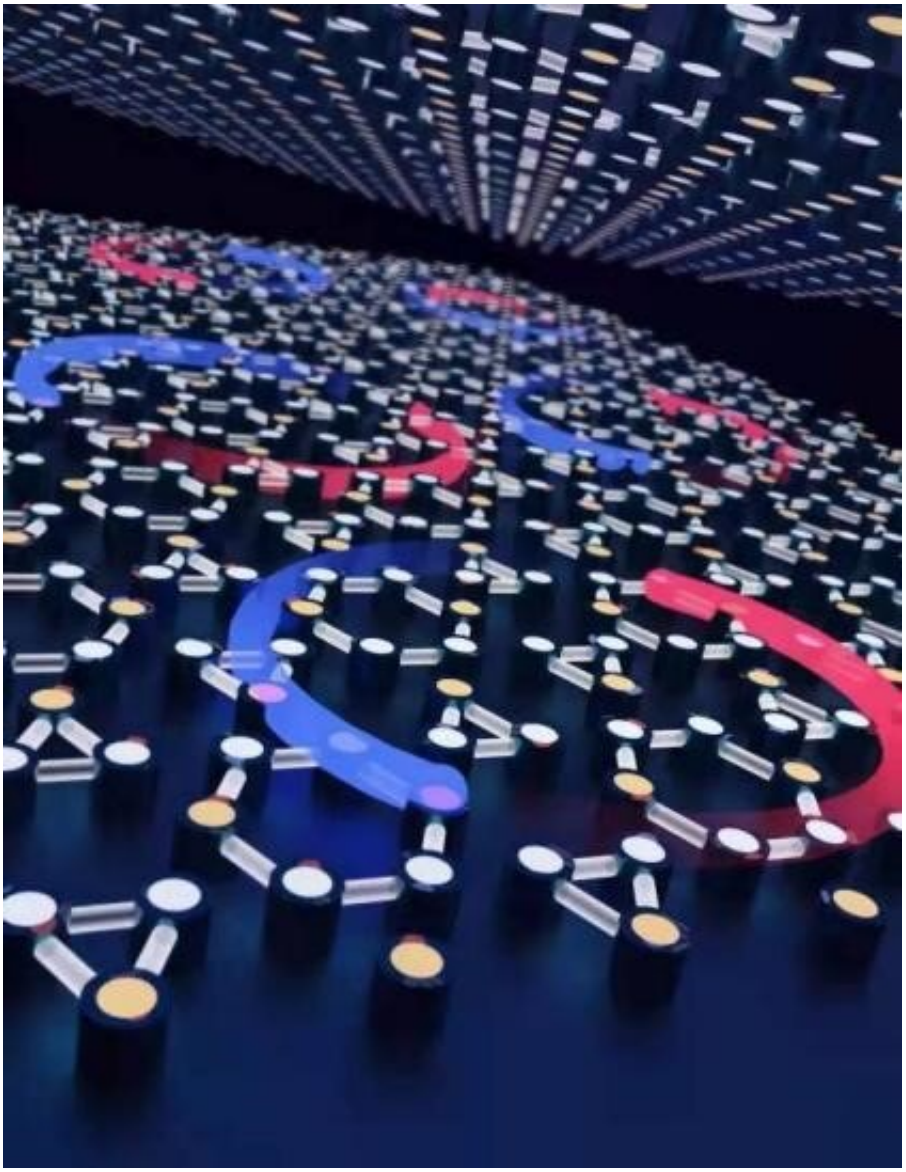

Credit: University of Science and Technology of China

In a recent article published in *Nature*, a research team led by Prof. Chen Xianhui, Wu Tao and Wang Zhenyu from the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences found the key evidence for phase transition in a kagome superconductor CsV_3Sb_5. At a low temperature, the team observed a transition from charge-density-wave (CDW) order to electronic nematicity which was firstly described by a three-state Potts model.

On the heels of the team's previous research on triple-Q modulation of kagome superconductors and the unusual competition between superconductivity and charge-density-wave order, the team made another progress in discovering new states of electronic nematicities. They discovered that the triple-Q charge density wave state would evolve into a thermodynamically stable electron nematic phase before entering the superconducting state. They also managed to determine the transition temperature to be 35 Kelvin.

It is noteworthy that the electronic nematicity the team recently found was disparate from the nematicity in high-temperature superconductors (HTS). The electronic nematicity in HTS is the Ising type with Z_2 symmetry; in contrast, the nematic phase found in CsV_3Sb_5 had Z_3 symmetry. This particular state is theoretically described by the three-state Potts model, thus it is also called Potts nematic phase. Interestingly, this novel nematicity was also observed recently in bilayer corner graphene system.

The discovery of this phase transition not only demonstrated a novel electronic nematicity, but provided fundamental experimental evidence for further understanding of the competition between superconductivity and CDW order in kagome systems. The findings also cast new light on the understanding of pair density wave (PDW) state in HTS.

More information: Linpeng Nie et al, Charge-density-wave-driven

electronic nematicity in a kagome superconductor, *Nature* (2022). DOI: 10.1038/s41586-022-04493-8