

Revealing Hidden Quantum States via Nonlinear Electrical Probes

Daniel A. Rhodes, Jun Xiao, Ying Wang, University of Wisconsin-Madison

Wisconsin MRSEC researchers in IRG 2 have discovered that the compound TaIrTe_4 , a transition metal dichalcogenide, when made only a few atomic layers thick and cooled to cryogenic temperatures, transitions into an unusual state called a one-dimensional charge density wave. A charge density wave state exhibits variation in the local density of electrons over distances significantly longer than the distances between the atoms.

This new quantum state is important because it produces a gigantic nonlinear Hall effect, with a response orders of magnitude larger than in conventional materials. Such a giant nonlinear Hall response can enable compact, highly sensitive electronic and radiation-sensing technologies. This discovery strengthens IRG 2's efforts to understand how ultrathin quantum materials respond to external fields and electromagnetic radiation, including related membranes where radiation may be used to control magnetic behavior.

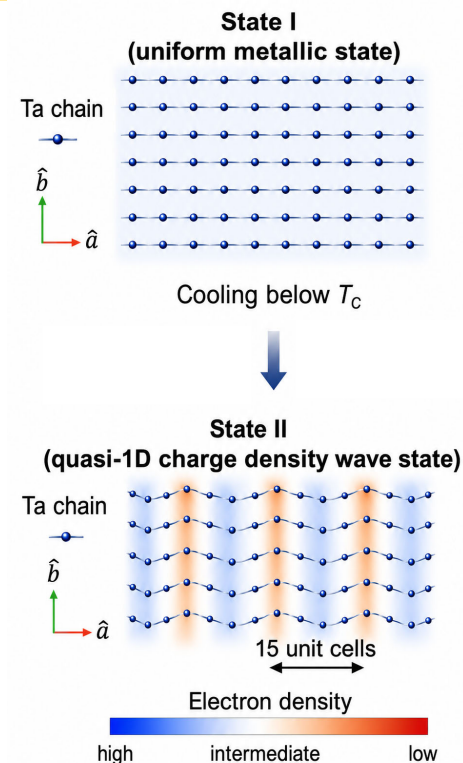


Illustration of the transition from a uniform metallic state to a quasi-one-dimensional charge density wave state