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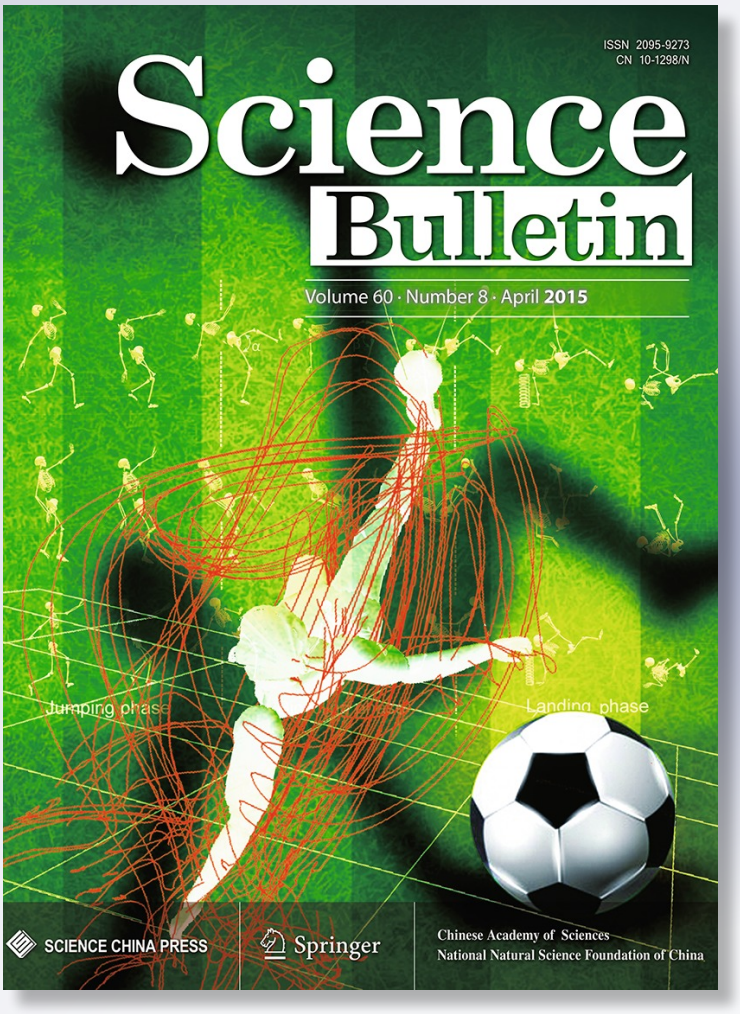

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Research Highlight

What drives superconductivity in Pt-doped $IrTe_2$?

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The emergency of superconductivity at the edge of charge density wave (CDW) state by pressure or chemical doping in 1T transition metal dichalcogenides (TMDs) has attracted much attention in past decade [1, 2]. The interplay of CDW and superconductivity has triggered the hot debate: why does superconductivity arise after suppressing the CDW and what's the driving force of the charge modulation? For the 5*d* transition metal ditelluride $IrTe_2$, a layered compound with trigonal symmetry, previous studies have shown an ordered superstructure below ~280 K, and a superconducting state when doped or intercalated with Pd or Pt [3, 4]. In $IrTe_2$, the Fermi surface nesting has been excluded as the impetus of superstructure; instead, splitting of Te orbitals by the crystal field [5] or destabilization of polymeric Te–Te networks was proposed [6], evident from the visualized periodic dimerization of Te atoms by scanning tunneling microscopy (STM) [7]. Meanwhile, a charge disproportionated CDW by covalent bonding Ir dimers was also presented [8]. However, though the origin of the superstructure formation becomes more and more clear, the underlying mechanism of the appearance of superconductivity by doping Pd or Pt is still obscure.

Recently, Ruan et al. [9] have studied the structural phase transition and electronic structure evolution in pure and Pt-doped $IrTe_2$ single crystals using low-temperature STM combined with first-principles calculations. The authors presented a clear evidence for a commensurate 1/6 charge modulation as the ground state of high-quality $IrTe_2$ single crystals, consistent with previous reports [7, 10]. By substituting Pt for Ir, the system exhibits long-range ordered 1/5 phase and then goes to a new threefold quasi-periodic phase. In addition to a full picture of phase evolution, the most important finding is that the Pt dopants actually act as chemical strain, generating local impurity states rather than injecting itinerant charge carriers [9]. The weakened intralayer Ir dimerization effectively leads to the recovery of polymeric Te bonds across layers, lifting the density of states at Fermi level and making the system more three-dimensional [9]. Therefore, it turns out that the higher dimensionality tips the balance in favor of superconductivity in this system. This work presents a coherent story and also stimulates us to think more about the role of strain in modulating new order.

K. Jin (✉)
Institute of Physics, Chinese Academy of Sciences,
Beijing 100190, China
e-mail: kuijin@iphy.ac.cn

K. Liu (✉)
Department of Physics, Renmin University of China,
Beijing 100872, China
e-mail: kliu@ruc.edu.cn

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