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Interfacial Charge Transfer and Persistent Metallicity of Ultrathin $SrIrO_3/SrRuO_3$ Heterostructures

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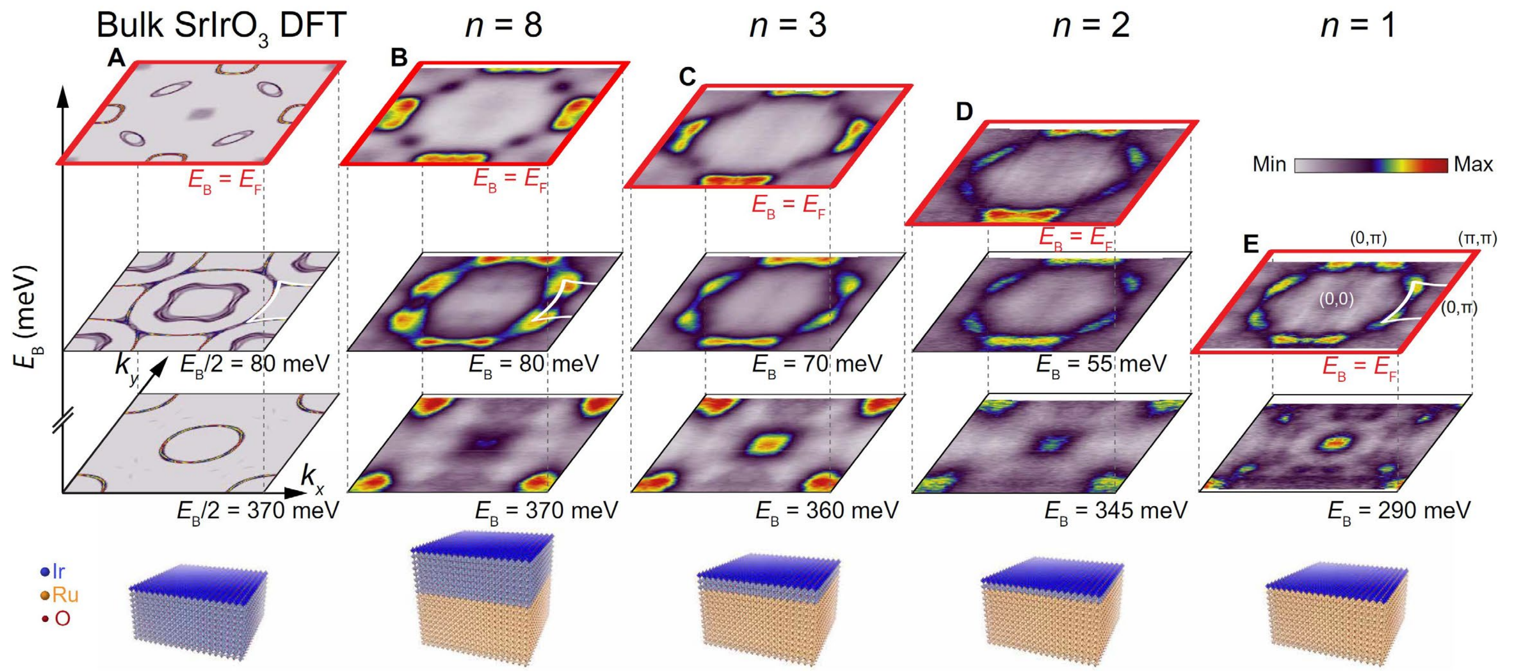
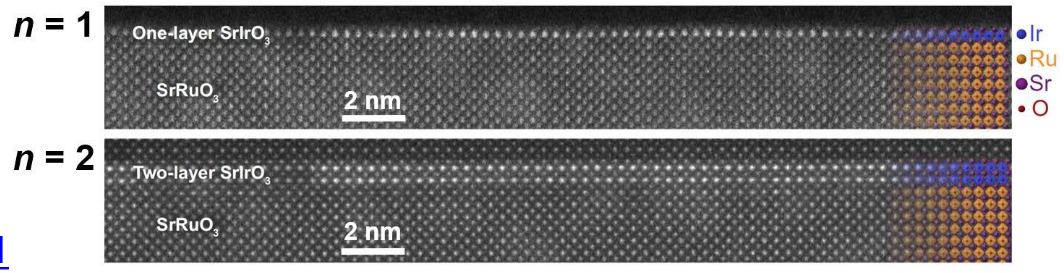
Ultrathin quantum materials present a unique platform for the control of electronic, magnetic, and topological properties. A commonly observed phenomenon in many ultrathin quantum materials is that an undesired crossover from a metallic to an insulating state occurs below a critical thickness. This presents a potential challenge for realizing ultrathin heterostructures of quantum materials when metallic properties are desired.

Here, members of PARADIM's In-House Research group use **angle-resolved photoemission spectroscopy (ARPES) and molecular-beam epitaxy (MBE)** to reveal the electronic structure, charge transfer, doping profile, and carrier effective masses in a layer-by-layer fashion for the interface between the Dirac nodal-line semimetal $SrIrO_3$ and the correlated metallic Weyl ferromagnet $SrRuO_3$.

It is shown here that metallicity can be preserved even down to a single $SrIrO_3$ layer, due to the structural similarities between $SrIrO_3$ and $SrRuO_3$, and the overlapping Ir and Ru *d* orbitals. In addition, ARPES reveals that electrons are transferred from the $SrIrO_3$ layer into the $SrRuO_3$, with an estimated screening length of λ = 3.2 ± 0.1 Å.





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