Magnetism and superconductivity at LaAlO3-SrTiO3 interfaces

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Abstract:
Breaking the translation or inversion symmetry at surfaces and interfaces may lead to the formation of new charge, spin and orbital electronic states which are different than the bulk states. The emergence of these states is particularly relevant for oxides where the balance of competing interactions and the resulting stable electronic phase crucially depend on the local oxidation state near the interface. A prominent example is the interface of LaAlO3/SrTiO3 (LAO/STO). The formation of a metallic state at the interface of the band insulators LAO and STO has become a prototype for the reconstruction of electronic states which exhibit a variety of phenomena such as negative compressibility, superconductivity, and magnetism. With recent experimental evidence of magnetism coexisting with superconductivity, a novel challenge is to understand the structure of the magnetic state and the nature of the superconducting phase in the presence of ferromagnetism. Moreover, due to inversion symmetry breacking, oxide interfaces are often influenced by a Rashba type spin-orbit coupling (SOC), which is tunable by a transverse electric field. The combination of SOC and magnetism leads to asymmetric two-sheeted Fermi surfaces, on which either intra- or inter-band pairing is favored.