Materials Science and Technology Division
Materials Theory Group

"Understanding the superconducting state at LaAlO3/SrTiO3 interfaces: Possible two-band superconductivity"

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Abstract

We examine the superconductivity produced at the complex oxide interface of LaAlO3 and SrTiO3 (Tc = ~0.3 K). Through a mean-field approach, we investigate the effects of local and global electric fields on the superconducting order parameter, carrier density, and transition temperature for this system. We show that the general shape of the superconducting dome can be reproduced through basic electrostatics and a standard BCS formalism using the density of states. Given the similarity between the transition temperature for the interface and bulk SrTiO3, we provide evidence that the interface superconductivity is intrinsic to SrTiO3 and we infer that superconducting mechanism must also be similar. By examining bulk SrTiO3, we show that the superconductivity may be described through weakly-coupled, two-band model. Finally, we predict that the superconductivity at the interface is most likely produced through a two-band coupling of the surface states of SrTiO3 provided by an electron doping from a carrier source (in this case LaAlO3).

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