# Highlights

Superconductivity —2017

## Signatures of unconventional superconductivity in the $LaAlO_3/SrTiO_3$ two-dimensional system

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In the two-dimensional electron gas (2DEG) at the LaAlO3/SrTiO3 (LAO/STO) interface, the combination of 2Dsuperconductivity and Rashba spin-orbit coupling (SOC) is expected to give rise to an unconventional superconducting ground state, including a mix of spin-singlet and spin-triplet components. The nature of superconductivity in LAO/STO and its interplay with SOC are, however, still largely unexplored.

We have used nanoscale Josephson junctions as an ultrasensitive spectroscopic tool to probe the superconducting gap and the order parameter symmetry of the 2DEG. The conductance spectra of the junctions (Figure 1) and their critical current vs. temperature behavior indicate the presence of two superconducting gap structures. Moreover, the critical current magnetic patterns show anomalies that can be accounted for by only assuming the presence of an unconventional order parameter.

Although more experimental work is needed in order to firmly establish the details of the superconducting state of LAO/STO, our results are in agreement with theoretical predictions of mixed singlet-triplet superconducting order parameters in 2D systems hosting Rashba SOC and pave the way to a deeper understanding of these systems. The ability to create and study elusive unconventional superconducting states is a confirmation of the fascinating possibilities offered by engineered oxides for the study of exotic excitations and the realization of novel quantum electronics.

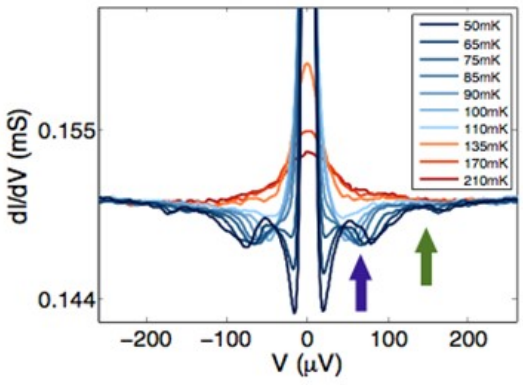


Fig.1: Conductance spectra of a LAO/STO based junction. The arrows indicate the two gap structures

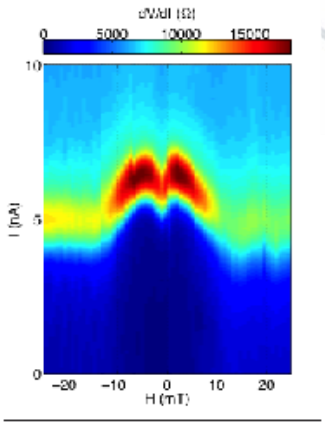


Fig.2: Critical current magnetic pattern showing a minimum at zero magnetic field