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Charge-Vortex duality at the LAO/STO interface

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The conducting gas that forms at the interface between the two insulating oxides LaAlO₃ (LAO) and SrTiO₃ (STO) shows a rich variety of behavior, including an electric-field dependent conductivity, superconductivity, gate-controlled superconductor-to-insulator transition, and ferromagnetism. Recently, we showed for the first time the coexistence of superconductivity and ferromagnetism at the LAO/STO interface, which manifests itself as a superconducting phase diagram that is hysteretic in the applied magnetic field. We show that the coexistence of ferromagnetism and superconductivity enables a novel demonstration of the concept of charge-vortex duality in the superconductor-to-insulator transition, which shows up as a magnetic field sweep-rate dependence of the magnetoresistance in the superconducting and insulating regimes. If time permits, I will also talk about our more recent work on the magnetic field tuned superconductor-to-insulator transition in this system.