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Superfluid response of a gated $LaAlO_3$ / $SrTiO_3$ heterostructure SHASHANK MISRA, LUKAS URBAN, Princeton University, STEFAN THIEL, CHRISTOPH RICHTER, GERMAN HAMMERL, JOCHEN MANNHART, Universitat Augsburg, ALI YAZDANI, Princeton University — Disordered two-dimensional superconductors undergo a quantum phase transition into an insulating phase, with an unusual intervening metallic phase, upon the introduction of sufficiently large amounts of disorder or the application of a sufficiently strong magnetic field. The $LaAlO_3$ / $SrTiO_3$ heterostructure, because it can be gated, provides a new opportunity: to see how two-dimensional superconductivity is destroyed continuously as a function of carrier concentration. We build on the electrical transport measurements in other works, which demonstrated the existence of a superconductor-insulator transition upon decreasing the carrier concentration, by using a two coil mutual inductance technique to measure the complex ac conductivity. We will track the superfluid density, which can be derived from the complex conductivity, throughout parts of the carrier concentration- temperature-magnetic field phase diagram, and make comparisons with data from the field-tuned superconductor-insulator transitions in MoGe and InOx. This work is supported by the DOE and the DFG via SFB484.

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