

Abstract Submitted
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Studies of Insulating Superconductors¹ S.M. HOLLEN, JAMES JOY, MAURA LYNCH, H.Q. NGUYEN, M.D. STEWART, JR., J. SHAINLINE, Brown University, Department of Physics, AIJUN YIN, J.M. XU, Brown University, Division of Engineering, J.M. VALLES, JR., Brown University, Department of Physics — We present data that shows evidence of superconductivity in a peculiar place: an electrical insulator. By evaporating Sb and then Bi onto a patterned substrate at 8K, we create amorphous 2D films with regular, nanometer-sized holes. A phase transition occurs with added Bi: the thinnest films insulate and the thickest superconduct. Surprisingly, the insulating films appear to contain the fundamental constituents of a superconductor: Cooper pairs of electrons. Their very high resistance oscillates in magnetic field with a period expected for charge $2e$ carriers. We present evidence that nanometer-sized undulations in film thickness localize the Cooper pairs to islands to prevent long range phase coherence from developing. In future experiments we will attempt to control the Cooper pair localization using tailored film thickness variations on rippled substrates and by using novel nanopatterning techniques on our existing holey substrates.

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