Abstract Submitted
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Electron Pairing Without Superconductivity[1] JEREMY LEVY, G. CHENG, M. TOMCZYK, S. LU, University of Pittsburgh, J.P. VEAZEY, Grand Valley State University, M. HUANG, P. IRVIN, University of Pittsburgh, S. RYU, H. LEE, C.-B. EOM, University of Wisconsin-Madison, C.S. HELLBERG, Naval Research Laboratory — Strontium titanate ($SrTiO_3$) exhibits an extremely low carrier density threshold for superconductivity, and possesses a phase diagram similar to high-temperature superconductorstwo factors that suggest an unconventional pairing mechanism. We describe transport experiments with nanowire-based quantum dots localized at the interface between $SrTiO_3$ and $LaAlO_3$. Electrostatic gating of the quantum dot reveals a series of two-electron conductance resonances–paired electron states–that bifurcate above a critical magnetic field B_p 1-4 Tesla, an order of magnitude larger than the superconducting critical magnetic field. For $B<B_p$, these resonances are insensitive to applied magnetic fields; for $B>B_p$, the resonances exhibit a linear Zeeman-like energy splitting. Electron pairing is stable at temperatures as high as $T = 900$ mK, far above the superconducting transition temperature (T_c 300 mK). These experiments demonstrate the existence of a robust electronic phase in which electrons pair without forming a superconducting state. Key experimental signatures are captured by an attractive-U Hubbard model that describes real-space electron pairing as a precursor to superconductivity.

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Jeremy Levy
University of Pittsburgh

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