Abstract Submitted
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Observation of the Collapse of the Cooper Pair Phase Coherence Length at a Superconductor to Insulator Transition[1] JAMES VALLES, Brown University, SHAWNA HOLLEN, The Ohio State University, GUSTAVO FERNANDES, JIMMY XU, Brown University — Experiments on ultrathin amorphous Bi films provided one of the best known examples of a Superconductor to Insulator quantum phase transition (SIT). Nevertheless, controversy persists over whether this thickness tuned SIT is "fermionic" or "bosonic". Early data suggested fermionic with the suppression of the amplitude of the superconductor order parameter creating a weakly-localized, phase incoherent, single electron insulator. However, recent work on other uniformly disordered materials suggests that bosonic physics universally dominates at the SIT to produce insulators of locally phase coherent Cooper pair islands. To address this issue, we used a technique that previously revealed local Cooper pair phase coherence in insulating non-uniformly thick films. We measured the strength of flux periodic magneto-resistance oscillations of ultrathin a-Bi films patterned with a nano-array of holes. The data indicate that the Cooper pair phase coherence length collapses at this SIT. This collapse is inconsistent with the continuous decrease of the phase coherence length expected for a bosonic SIT. It is consistent with the order parameter amplitude disappearing at a fermionic SIT.

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