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Observation of Pairing Correlations in Strongly Localized Amorphous Films M.D. STEWART, JR., J.M. VALLES, JR., AIJUN YIN, J.M. XU, Brown University — We have measured the Superconductor to Insulator Transition (SIT) as a function of thickness at dilution refrigerator temperatures in ultrathin Bi/Sb films perforated with a regular honeycomb array of holes separated by 100 nm. The presence of these perforations profoundly influences the character of the transition. In particular, on the insulating side of the SIT, the resistance as a function of temperature, R(T), rises monotonically and becomes activated below 1K. Closer to the SIT, a minimum develops in the R(T) suggestive of strong superconducting fluctuations and the onset of Cooper pairing. Simultaneously, the perpendicular field magnetoresistance begins to oscillate with a period that corresponds to the superconducting flux quantum. Yet thicker films exhibit a relatively broad R(T) transition toward a zero resistance state. This behavior constitutes direct evidence that the superconducting ground state of this amorphous film system emerges from an insulating state containing localized Cooper pairs. This work has been supported by the NSF through DMR-0203608, and DMR-0605797, AFRL, and ONR.

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