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Transport Behavior of Ultrathin Films with NanoThickness Undulations in the Strongly Localized Regime

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Transport Behavior of Ultrathin Films with NanoThickness Undulations in the Strongly Localized Regime[1] J.C. JOY, S.M. HOLLEN, C. ZHAO, Department of Physics, Brown University, G. FERNANDES, J.M. XU, Division of Engineering, Brown University, J.M. VALLES, JR., Department of Physics, Brown University — Recent work on thin films of superconducting material grown on anodized aluminum oxide (AAO) has revealed the existence of a Cooper Pair Insulator (CPI), a state in which superconducting pair correlations survive, but with activated transport dominated by electron pairs. AFM data has revealed that the AAO substrates have a regular undulating structure, which causes films to grow with predictable variations in thickness. These thickness undulations, which have a spatial period greater than the superconducting coherence length, work to localize Cooper pairs in the insulating state. To gain insight into the properties of the normal state of the CPI, we are investigating the transport properties of Copper films grown on AAO substrates. Early data indicate activated transport with activation energies of approximately 20 K in the most insulating films.

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