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Magnetic response and enhanced Tc in the 1D to 2D crossover regime of mesoscopic superconducting aluminum rings. NICHOLAS C. KOSHNICK, HENDRIK BLUHM, Stanford University, MARTIN E. HUBER, University of Colorado, Denver, KATHRYN A. MOLER, Stanford University — We have studied more than 40 mesoscopic Aluminum rings by positioning a scannable SQUID susceptometer over each ring individually, and have found a striking non-monotonic dependence of Tc on linewidth. By measuring the magnetic response, or current in the ring, as a function of applied flux and temperature, it is possible to extract $\lambda(T)$ and $\xi(T)$. The rings vary in width (40-350nm) and diameter (1-4um) with a nominal thickness of 35nm. For rings with linewidths above 150nm ($\approx 2\xi(T=0)$), the extracted superfluid density shows a high-temperature tail up to temperatures as high as 15% above the 1D and bulk thin film critical temperatures. In this regime, we also find evidence for the saturation of $\xi(T)$ on the order of the ring's linewidth. We speculate that these results indicate the particular importance of Tc disorder in the crossover from quasi-1D to 2D superconductivity.

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