Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Geometrically confined superconducting condensates in nanoscopic Al squares prepared by e-beam lithography NEAL STALEY, XINXIN CAI, YING LIU, Pennsylvania State University — Previous studies on mesoscopic superconductors with a sample size greater than the zero temperature coherence length, $\xi(0)$, and penetration depth, $\lambda(0)$, have revealed interesting features including quantized states in the H-T phase diagrams. These features are well described by a linearized Ginzburg-Landau formalism. However, work on the regime where the sample size becomes smaller than $\xi(0)$ and $\lambda(0)$ has been scant. Here, neither a spacially varying order parameter nor a magnetic field induced current is expected according to the Ginzburg-Landau theory. We will present electrical transport measurements on Al squares prepared by e-beam lithography with thicknesses of 20 nm and a length ranging from 130 nm to 530 nm. These devices had a $\xi(0)$ of $\sim$120 nm and $\lambda(0)$ of $\sim$130nm. The H-T phase diagram was constructed for each sample from the measurement on the superconducting to normal resistive transition as a function of both magnetic field and temperature. We observed evidence for the existence of quantized states in the smallest squares that were not anticipated from Ginzburg-Landau theory. Work supported by NSF.

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Date submitted: 20 Nov 2009 Electronic form version 1.4