Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Bosonic Magnetic Field Driven Superconductor-Insulator Transitions in Amorphous Nano-honeycomb Films[1] M.D. STEWART, JR., AI-JUN YIN, J.M. XU, JAMES M. VALLES, JR., Brown University — We have observed multiple magnetic field driven superconductor-insulator transitions (SIT) in amorphous Bi films perforated with a nano-honeycomb (NHC) array of holes. The magneto-resistance across the SITs is periodic, with a period $H = H_M = h/2eS$, where S is the area of a unit cell of holes. These transitions are, therefore, boson dominated. In constant field the temperature dependence of the resistance can be parameterized by $R(T) = R_0(H)\exp(T_0(H)/T)$ on both sides of the transition so that the evolution between the superconducting and insulating states is controlled by the vanishing of $T_0 \to 0$. We compare these data to the thickness driven transition in NHC films and the field driven transitions in unpatterned Bi films, other materials, and Josephson junction arrays. Our results suggest a structural source for similar behavior found in some materials and that despite the clear bosonic nature of the SITs, quasiparticle degrees of freedom likely also play an important part in the evolution of the SIT.

[1]This work supported by the NSF through DMR-0605797and DMR-0203608 and by the AFRL and ONR.

M. D. Stewart, Jr
Brown University

Date submitted: 14 Nov 2007 Electronic form version 1.4