Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Magnetic Susceptibility Anisotropy of Metallic Carbon Nanotubes T.A. SEARLES[1], J. KONO, Rice University, Y. IMANAKA, T. TAKAMASU, National Institute for Materials Science, J.A. FAGAN, E.K. HOBBIE, NIST, H. AJIKI, Osaka University — Metallic single-walled carbon nanotubes (SWNTs) are predicted to possess exotic orbital magnetism, arising from Aharonov-Bohm-phase-induced gap opening (in a parallel field) in addition to the large graphite-like diamagnetism (in a perpendicular field). Their magnetic susceptibilities are calculated to be a sensitive function of the applied magnetic field, the Fermi energy, and the field orientation. Here, through magnetic linear dichorism spectroscopy in high magnetic fields, we have determined the magnetic susceptibility anisotropy of metallic SWNTs for the first time and found it to be 2-4 times greater than values for semiconducting SWNTs. The measurements were made on length-sorted, (6,5)-enriched CoMoCAT SWNTs in magnetic fields up to 35 T. The observed large magnetic anisotropy, consistent with theoretical predictions, is due to the large orbital paramagnetism of electrons in metallic nanotubes in a parallel magnetic field. We also compared our values with those obtained in previous work for semiconducting nanotubes, which confirm a break from the prediction that the magnetic susceptibility anisotropy increases linearly with the diameter.

[1]Travel support from NSF IGERT for Nanophotonics

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Date submitted: 08 Dec 2009 Electronic form version 1.4