Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

**Nonequilibrium giant loop currents and orbital magnetism in carbon nanotubes** NAOTO TSUJI, SHIGEHIRO TAKAJO[1], HIDEO AOKI, Department of Physics, University of Tokyo — Recent experiments have shown that carbon nanotubes can have large orbital magnetic moments ($\sim 10\mu_B$). Although isolated carbon nanotubes in equilibrium in external magnetic fields have been theoretically studied, nonequilibrium transport of nanotubes attached to electrodes has yet to be established. Based on Keldysh formalism, we analyze currents flowing in carbon nanotubes attached to electrodes with finite bias voltages. We show that large magnetic moments are generated from giant loop currents circulating around the tube, which makes carbon nanotubes "molecular solenoids". While this is an example of the quantum loop current when incident electrons are resonant to degenerate levels of molecules as proposed by Nakanishi and Tsukada [Surf. Sci. **438**, 305 (1999)], a speciality of the nanotubes is that they have inherent doubly-degenerate states (propagating clockwise and anticlockwise around the tube). We have further identified the full conditions for large loop currents that include the position of the electrodes and the chirality of the tube. The current-voltage characteristic and effects of external magnetic fields are also discussed.

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Date submitted: 20 Nov 2006 Electronic form version 1.4