Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Dipole induced conductance modulation in chromophore-functionalized single-walled carbon nanotubes YUANCHUN ZHAO, Department of Physics, University of Wisconsin-Madison, Madison, Wisconsin 53706, CHANGSHUI HUANG, MYUNGWOONG KIM, PADMA GOPALAN, Department of Materials Science and Engineering, University of Wisconsin-Madison, Madison, Wisconsin 53706, MARK ERIKSSON, Department of Physics, University of Wisconsin-Madison, Madison, Wisconsin 53706 — Single-walled carbon nanotubes (SWNTs) are highly sensitive to local electrostatic environments, making SWNT field-effect transistors (FETs) of interest for a number of sensor applications and optoelectronic devices. Here we demonstrate a direct correlation between the conduction of SWNTs and their surrounding dipolar environments. We use azobenzene-based dipolar chromophores, Disperse Red 1 (DR1) and its derivatives to functionalize the sidewalls of SWNTs. The chromophores are coupled with a pyrenebutyric group for realizing noncovalent attachment and to attempt to direct their dipole moments. The functionalizing chromophores produce a dipole field that shifts the threshold voltage (Vth) of the nanotube FET. Under light illumination, these molecules isomerize from the ground trans state to the excited cis state, leading to a decrease of their dipole moments. This dipole moment change acts as an additional gate, causing a shift in Vth. Our results provide a new insight into the photogating mechanisms of the nanotube-chromophore hybrid devices, and they reveal the possibility to modulate optoelectronic properties of nanotube-hybrid devices by designing chromophores with required photosensitive features.

Yuanchun Zhao
Department of Physics, University of Wisconsin-Madison,
Madison, Wisconsin 53706

Date submitted: 27 Nov 2012 Electronic form version 1.4