Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Nanotube-Metal Junctions: 2- and 3- Terminal Electrical Transport[1] SAN-HUANG KE, WEITAO YANG, HAROLD U. BARANGER, Duke University — We address the quality of electrical contact between carbon nanotubes and metallic electrodes by performing first-principles calculations for the electron transmission through ideal 2- and 3-terminal junctions, thus revealing the physical limit of tube-metal conduction. The structural model constructed involves surrounding the tube by the metal atoms of the electrode as in most experiments; we consider metallic (5,5) and n-doped semiconducting (10,0) tubes surrounded by Au or Pd. In the case of metallic tubes, the contact conductance is shown to approach the ideal $4e^2/h$ in the limit of large contact area. For three-terminals, the division of flux among the different transmission channels depends strongly on the metal material. A Pd electrode has nearly perfect tube-electrode transmission and therefore turns off the straight transport along the tube. The carrier injection is found to occur only at the edge of the contact region. Our results are in good agreement with some recent experimental reports and clarify a fundamental discrepancy between theory and experiment.

[1]Supported by the NSF (DMR-0103003 and DMR-0506953).

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Date submitted: 30 Nov 2005 Electronic form version 1.4