Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Improving the conductivity of carbon nanotube wires through resonant momentum exchange ROBERT BELL, MIKE PAYNE, Theory of Condensed Matter Group, Cavendish Laboratory, University of Cambridge, UK, ARASH MOSTOFI, Departments of Materials and Physics, and the Thomas Young Centre for Theory and Simulation of Materials, Imperial College London, UK — Carbon nanotubes (CNTs) have remarkable properties that make them excellent candidates for nano-electronic devices. Retaining these properties in CNT networks scalable for manufacture is a significant challenge. Experiment shows that conductivities of CNT networks are at least an order of magnitude lower than the theoretical maximum based on single CNT performance. In a CNT network, typically no single tube spans the device. As a result, electrons must travel between CNTs in order to contribute to the conductivity. Optimizing the conductivity of CNT networks, therefore, requires a detailed understanding of inter-tube electron transport. To this end, we present theoretical investigations of inter-tube conductivity of CNTs. We find, in agreement with previous studies, that conductivity between CNTs of different chirality is strongly suppressed as a consequence of the requirement for momentum conservation. We show that this problem can be overcome by providing a weak perturbation to the system, resulting in increases in inter-tube conductivity by over one order of magnitude. We will discuss practical realizations of the required perturbation and its experimental relevance for enhancing the conductivity of CNT networks.

Robert Bell
Theory of Condensed Matter Group, Cavendish Laboratory,
University of Cambridge, UK

Date submitted: 12 Nov 2013 Electronic form version 1.4