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Enhancing inter-tube conductivity in carbon nanotube networks[1]

ARASH MOSTOFI, Departments of Materials and Physics and the Thomas Young Centre, Imperial College London, UK, ROBERT BELL, MIKE PAYNE, Cavendish Laboratory, University of Cambridge, UK — Retaining the remarkable electronic transport properties of individual carbon nanotubes (CNTs) when scaling up to macroscopic CNT networks for use in devices remains a significant challenge. As no single tube spans the device, electrons must travel between CNTs to contribute to the conductivity. Conductivity between CNTs of different chirality is suppressed due to the requirement of momentum conservation. Using a combination of analytic theory and tight-binding, I will show that this limitation can be overcome by supplying a weak perturbation to the system, resulting in order of magnitude increases of conductivity[2]. I will present practical realizations of such perturbations, which I will demonstrate using Landauer-Buttiker transport simulations based on large-scale density-functional theory calculations[3].

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[2]Phys. Rev. B 89, 245426 (2014)
[3]Comput. Phys. Commun. 193, 78 (2015); www.onetep.org

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