MRSEC SEMINAR SERIES

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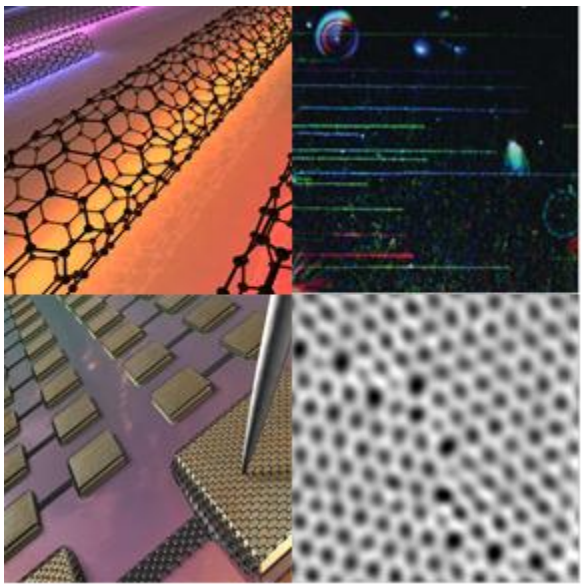
Atomically Defined Carbon Nanostructures

Despite decades of intense research efforts, utilizing carbon nanostructures for larger scale device applications remain difficult due to the enormous challenges unique to them: for instance, there are no high-throughput characterization methods for individual single-walled carbon nanotubes (SWNTs) or grain boundaries of single layer graphene. I will discuss two powerful characterization methods ("*new eyes*") that address these problems. We developed a novel on-chip Rayleigh imaging technique that accurately determines the electronic-types and chiral indices for individual SWNTs, and position and frequency of chirality-changing events. Using this, we observed a strong long-range intertube interaction between distant SWNTs and a uniform resonance optical conductivity near $8e^2/h$ all for the first time. In graphene, we used a combination of old and new transmission electron microscope (TEM) techniques to image and study its grain structures. Using atomic-resolution imaging, we determine the location and identity of every atom at a grain boundary, and we use diffraction-filtered imaging to rapidly map the location, orientation, and shape of several hundred grains and boundaries. The resulting images reveal an unexpectedly small and intricate patchwork of grains connected by tilt boundaries. These techniques open a new window for studies on the structure, properties and control of SWNTs and graphene.



Dr. Jiwoong Park is an Assistant Professor in the Department of Chemistry and Chemical Biology at Cornell University, with a PhD in physics from the University of California, Berkeley. Before coming to Cornell, he was a Junior Fellow at Rowland Institute at Harvard University. His research interests focus on the electronic and optical properties of nanoscale materials including semiconductor nanowires, carbon nanotubes and graphene. Dr. Park is a recipient of NSF CAREER award (2008), Presidential Early Career Awards for Scientists and Engineers (2009) and Alfred P. Sloan Research Fellowship (2010).

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