



# 量子材料科学中心 International Center for Quantum Materials Weekly Seminar

## Graphene Nanoribbon electronic devices and quantum wires

Time

Venue

Graphene Nanoribbons (GNRs) have attracted much interest because of their unique one-dimensional structures with magnetic edge states and tunable bandgaps, which are desirable for electronic device applications. This talk will present our results on the synthesis, electron transport and devices of GNRs down to a few nanometers wide. We have developed several approaches to synthesize GNRs, including chemical sonication, unzipping carbon nanotubes and lithographic patterning. Chemical methods could obtain sub-5nm semiconducting GNRs. Based on the chemically derived GNRs, we have demonstrated both p- and n-type high on/off ratio field-effect transistors. On the other hand, lithographic patterned GNR arrays could be useful for large scale device integration. Finally, we employ unzipping of multi-walled carbon nanotubes to produce high quality GNRs. Many nanoribbons have ultrasmooth edges as revealed by aberration-corrected transmission electron microscopy. Different from lithographic with defects and dangling bonds along the edges, at low temperatures, some of the high quality GNRs exhibited well-defined quantum transport phenomena, including Coulomb blockade, the Kondo effect, clear excited states up to  $\sim 20$  meV. Our data indicate that these nanoribbons behave as clean quantum wires at low temperatures, and are not dominated by defects.

2004

John Rogers

Phys.Rev.Lett. 4000  
JACS

2010

Hongjie Dai

Science Nature Nature

2010 -2011  
2011

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