

Carbon based graphitic nanomaterials such as carbon nanotubes and graphene have been provided us opportunities to explore exotic transport effect in low-energy condensed matter systems and the potential of carbon based novel device applications. The unique electronic band structure of graphene lattice provides a linear dispersion relation where the Fermi velocity replaces the role of the speed of light in usual Dirac Fermion spectrum. In this presentation I will discuss experimental consequence of charged Dirac Fermion spectrum in two representative low dimensional graphitic carbon systems: 1-dimensional carbon nanotubes and 2-dimensional graphene. Combined with semiconductor device fabrication techniques and the development of new methods of nanoscaled material synthesis/manipulation enables us to investigate mesoscopic transport phenomena in these materials. The exotic quantum transport behavior discovered in these materials, such as ballistic charge transport and unusual half-integer quantum Hall effect both of which appear even at room temperature. In addition, I will discuss electronic transport measurements in patterned locally gated graphene nanoconstrictions with tunable transmission and bipolar heterojunctions. We observe various unusual transport phenomena, such as energy gap formation in confined graphene structures which promise novel electronic device applications based on graphitic carbon nanostructures.