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Electronic and Magnetic Properties of Partially Open Carbon Nanotubes BING HUANG, Department of Physics, Tsinghua UniVersity, YOUNG-WOO SON, Korea Institute for Advanced Study, GUNN KIM, Department of Physics and Astronomy, Seoul National UniVersity, WENHUI DUAN, Department of Physics, Tsinghua UniVersity, JISOON IHM, Department of Physics and Astronomy, Seoul National UniVersity, DEPARTMENT OF PHYSICS, TSINGHUA UNIVERSITY TEAM, DEPARTMENT OF PHYSICS AND ASTRONOMY, SEOUL NATIONAL UNIVERSITY TEAM, KOREA INSTITUTE FOR ADVANCED STUDY COLLABORATION — We demonstrate that partially open carbon nanotubes (CNTs) observed in recent experiments have rich electronic and magnetic properties which depend on the degree of the opening. A partially open armchair CNT is converted from a metal to a semiconductor and then to a spin-polarized semiconductor by increasing the length of the opening on the wall. Some partially open zigzag CNT superlattices are by themselves giant magnetoresistive devices. In addition, external electric fields or chemical modifications are usable to control the electronic and magnetic properties of partially open CNTs. We show that half-metallicity may be achieved and the spin current may be controlled by external electric fields or by asymmetric functionalization of the edges of the opening.

Bing Huang
Department of Physics, Tsinghua UniVersity

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