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Carbon-Based Zero-Bandgap Tunnel Transistors[1] YOUNGKI YOON, SAYEEF SALAHUDDIN, University of California, Berkeley — Tunnel field-effect transistors (TFET) have been proposed as a means of breaking the classical limit of voltage requirement and energy dissipation in electronic devices. However, a tunnel barrier severely reduces the current and hence the speed at which the transistor can be operated. In this work, by performing an atomistic quantum simulation, we propose a novel transistor involving a unique interface between a graphene nanoribbon (GNR) and a metallic carbon nanotube (CNT), such that (i) at low voltages it acts exactly like a tunnel transistor reducing voltage requirement below the classical limit and (ii) at a larger voltage the tunnel barrier is dramatically diminished, resulting in a large flow of current [Appl. Phys. Lett. **97**, 033102 (2010)]. Indeed, experimental fabrication of such an interface could be possible using recently demonstrated methods where carbon nanotubes are unzipped to open up narrow graphene ribbons. Our results show that orders of magnitude improvement in ON current can be obtained in this structure.

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