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Temperature-Dependent Subthreshold Characteristics in Graphene Nanoribbon Tunneling Transistors YOUNGKI YOON, SAYEEF SALAHUDDIN, University of California, Berkeley — Recently there has been significant interest in band-to-band tunneling field-effect transistors (TFETs) as a means of reducing supply voltage and power dissipation. It is often assumed that the tunneling current should be independent of temperature. By performing an atomistic, self-consistent, quantum transport simulation, we show, to the contrary, that the ballistic tunneling current in a Graphene Nanoribbon (GNR) tunneling transistor should exhibit unique non-linear temperature dependence. Our results show that, in stark contrast to a conventional FET where the subthreshold swing (S) increases linearly with temperature (T), the swing vs. temperature in a GNR TFET is highly non-linear and shows a negative slope below a certain drain current. This negative slope is in good agreement qualitatively with a previous experimental observation in a carbon nanotube TFET, which is a very closely related material system. A method to characterize the distinguishing non-linearity with temperature and drain current is also proposed.

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