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Length dependent transport measurements in long channel semiconducting carbon nanotubes TAREK GHANEM, ELLEN WILLIAMS, MICHAEL FUHRER, Department of Physics and Center for Nanophysics and Advanced Materials, University of Maryland, College Park, MD 20742-4111, USA —
In order to understand the intrinsic electronic properties of CNTs, it is important to eliminate the contact effects from the measurements. We accomplish this by using a conductive-tip atomic force microscope cantilever as a movable electrode to obtain length dependent transport measurements. We report on the resistance versus length$R(L)$ for several long channel (L up to 130 μm) semiconducting CNTs at room temperature. In the on state,$R(L)$ of semiconducting CNTs is linear. In the depleted state, $R(L)$ is linear for long channel lengths (> 10 μm), but non-linear for short channel lengths due to the long depletion lengths in one-dimensional semiconductors. Transport remains diffusive under all depletion conditions, due to both low disorder and high temperature.

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