Carbon Nanotubes as a Ionizing Radiation Sensor

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Abstract: Modern semiconductor radiation detectors rely on the collection of charge within their active detection volume leading to the use of large bulk semiconductor crystals to achieve acceptable detection efficiency and complete energy deposition. Due to this constraint, nanostructured materials have found limited application in radiation detection. This project aims to build a vertically aligned carbon nanotube (CNT) based detector that senses the charge carriers generated in a traditional semiconductor detection volume. When placed in the presence of ionizing radiation, the charge carriers generated in detection volume change the CNT conductivity. Thus, ionizing radiation is detected as a change in current flowing through the device. The current CNT-based detector prototype responds weakly when exposed to radiation. To improve device response, current leakage was reduced by overhauling the fabrication process and introducing new device designs that test the effect of "channel length" on the device performance.