**New Material Systems for Neutron Dosimetry.** E. C. Frey[1], P. N. First[2], Z. Jiang[2], and T.M. Orlando[1,2], [1]School of Chemistry & Biochemistry, [2]School of Physics, Georgia Institute of Technology, 901 Atlantic Dr., Atlanta, GA 30332, United States.

**Abstract:** Radiation remains one of the most challenging obstacles towards sustained human presence on non-terrestrial bodies. One of the more damaging forms of ionizing radiation is galactic cosmic rays (GCRs), which are high energy charged particles that converge on the solar system from various points in the galaxy. Because of their extremely high energies, attempts to shield astronauts from GCRs at the spacesuit level may be infeasible; however, it remains crucial to quantify astronaut exposure so as to limit the radiative dose taken. Given the trajectory of human space exploration in the upcoming decades, there is much potential application for robust dosimeters that can be incorporated into spacesuit designs at varying locations to measure accumulated, tissue-specific dose. With this in mind it was proposed to investigate novel 2D and topological-insulator materials for application to low-power, lightweight, and real-time radiation devices [1]. Our initial effort focuses on utilizing graphene's unique conductivity and $^{10}$B's large neutron capture cross-section to develop a resistive sensor or graphene field effect transistor (gFET) capable of detecting and measuring neutrons produced by GCR secondary reactions. Upon impact with the boron-nitride absorber layer, the neutron causes $^{10}$B atoms to split into $^{7}$Li and alpha particles. Both of these particle ejecta are capable of causing charge defects and thus local electrical fields beneath the conducting graphene layer [2]. If this has a measurable effect on the conductivity of the graphene layer, then this resistance change can be correlated to neutron exposure. Graphene-based neutron detectors have been theoretically considered in the past [2] but never produced, likely due to limitations in graphene production technology. It should be noted that unlike Si MOSFET predecessors—which are susceptible to short-circuiting should radiative particle impacts cause permanent charged fields to gather underneath the oxide layer [3], graphene remains conductive even after particle implantation or defect damage. Although gFETs will reflect the event with a corresponding Dirac point shift [4], they should remain operational and thus offer mission-length lifetime. If this BN gFET system holds for relevant neutron energy spectra, it would complement current radiation monitoring systems and offer a flexible dosimetry scaffolding conducive to spacesuit integration.

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