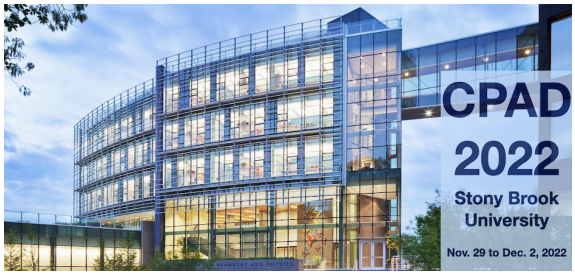

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Cs3Sb and Ag-O-Cs as Diode Detectors for Low Energy Photon and Particle Detection

Wednesday, 30 November 2022 13:55 (20 minutes)

Diode detectors for photons and photon energy use Si, Ge and many others. For very low energy photons, Si(Ge) pair energy Ep=3.6 eV(2.98eV) are too large for many applications. Semiconductor materials used for vacuum photocathodes have much lower Ep: Cs3Sb (S-11)~2eV pair energy; Cs-Ag-O (S-1) averaged pair energy/work function Ep=0.7 eV, and studies have shown that in small patches that the pair energy/work function is a remarkable Ep = 0.4 eV. We study atomic layer assembly techniques [ALD, MBE, low-temp pulsed-CVD] to make precisely structured Ag-Cs-O to achieve the lowest pair energy, and Cs3Sb for sensors with low energy threshold operating at room temperatures. Cs3Sb bandgap Eg =1.6 eV, larger than the Eg =1.1. eV of Si, yet a lower Ep=2 eV. That large Eg inhibits thermal energy from promoting carriers above the Fermi level, thereby operating with minimal or no cooling for detecting low energy photons.Atomic layer assembly techniques can be used to protect the cesiated materials from air and water vapor with films that are effectively transparent to radiation – single layer graphene is a standard deposited material; 1 layer excludes He. Graphene has been deposited on Cs3Sb photocathodes for protection from air and degradation.

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