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Recent advances in UV and soft X-ray photon counting MCP detectors

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Photon counting detectors with Microchannel Plates (MCPs) provide unique capabilities in astronomy applications where detection of photons with very low dark count rate, large dynamic range, high spatial and timing resolution is required. Over the years development of this type of sensor has substantially improved giving enhanced counting rate capabilities, lifetime, spatial and temporal resolution and large / curved formats. Instrument requirements vary widely, from low power, long lifetime, radiation hard, planetary missions to large area, high spatial resolution, ultra low background sensors in earth orbit. The adaptable nature of the MCP sensor configurations is a key element that has enabled many successfully flown instruments. New enhancements for these sensors include Atomic layer deposited MCPs with long lifetime, high stability, ultra low background (<2 events/pixel/fortnight) and improved quantum efficiency. Photon counting imaging readout technologies of several types have been employed, with some as large as 20 cm x 20 cm^2. Readouts can be pixelated ROICs (Readout Specific Integrated Circuits), enabling high resolution (5 μm) of photons at very high counting rates (GHz levels per detector) at low gain of 10^5, as well as detection of multiple simultaneous photons. Recent Timepix4 chips which are 4-side buttable with all the contacts to the die provided Through Silicon Vias (TSV can support large active areas (e.g. 10x10 cm^2). Cross strip and cross delay line readouts with formats up to 20 cm and modest spatial resolution (20μm) can operate at MHz rates, and can be implemented with low power / ASIC electronics. These sensor properties are established without cooling or out of bandpass filtering. Such large area, high counting rate, low dark count detectors are being developed further for high precision astronomical sensors for a number of selected and prospective future NASA missions.

contribution subject matter

(Other)

Keywords for your contribution subject matter (this will assist SOC in accurately characterizing your contribution)

Photon counting, High resolution, Low dark count rate, Large format, Microchannel Plates

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