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Multi-Amplifier Sensing CCD (MAS-CCD) Detector Concept for the Habitable Worlds Observatory

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The 2020 Decadal Survey of Astronomy and Astrophysics (Astro2020) recommended technology development for a large, 6-m class, infrared/optical/ultraviolet space telescope as its highest priority for strategic space missions. The search for evidence of life on other worlds using spectroscopic biosignatures is a key science aim. Many important biosignatures; including H₂O and O₂, are strong in the visible and near-IR. However, even with 6-m of aperture, this science is photon starved. Sensitive single photon detectors are required. Moreover, the detectors must survive and operate in the harsh space radiation environment.

In this presentation, we describe notional requirements and their rationale for a Multi-Amplifier Sensing CCD (MAS-CCD) optimized for such a mission. We describe the MAS-CCD's architecture, and how we would operate it to meet requirements in space. MAS-CCDs evolved from p-channel Skipper CCDs to mitigate the readout time challenges that Skippers face for space and other applications. MAS-CCDs use many Skipper-like amplifiers in parallel to deliver the photonic performance and radiation tolerance of p-channel Skipper CCDs, but without the very long readout time penalty that is otherwise associated with using multiple non-destructive reads to achieve photon counting.

contribution subject matter

CCD sensors

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

CCDs, Space Missions

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