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Microwave Kinetic Inductance Detectors (MKIDs) for Exoplanet Direct Imaging

Abstract:

Microwave Kinetic Inductance Detectors (MKIDs) are ultraviolet, optical, and near-IR (UVOIR) photon counting, energy resolving detectors for ground and space-based astronomy. Typical semi-conductor based detectors are fundamentally limited by the band gap of the semiconductor and thermal noise sources from their relatively high operating temperatures. Cryogenic detectors, such as MKIDs, allow the use of superconductors with gap parameters roughly 10,000 times lower than semiconductors while operating at millikelvin temperatures. MKIDs can count single photons with no false counts while simultaneously determining the energy and arrival time (to within a microsecond) of the photon. Additionally, MKIDs have the distinct advantage of being able to perform frequency domain multiplexing - the ability to read out large arrays through a single microwave cable. This sensitivity, energy resolution, and scalability make MKIDs the ideal tool for high contrast direct imaging of exoplanets.