

A Near-Infrared and Thermal Imager for Mapping Titan's Surface Features

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Approximately 10% of the solar insolation reaches the surface of Titan through atmospheric spectral windows. We will discuss a filter based imaging system for a future Titan orbiter that will exploit these windows mapping surface features, cloud regions, polar storms. In the near-infrared (NIR), two filters (1.28 μ m and 1.6 μ m), strategically positioned between CH₄ absorption bands, and InSb linear array pixels will explore the solar reflected radiation. We propose to map the mid-infrared (MIR) region with two filters: 9.76 μ m and 5.88-to-6.06 μ m with MCT linear arrays. The first will map MIR thermal emission variations due to surface albedo differences in the atmospheric window between gas phase CH₃D and C₂H₄ opacity sources. The latter spans the crossover spectral region where observed radiation transitions from being dominated by thermal emission to solar reflected light component.

The passively cooled linear arrays will be incorporated into the focal plane of a light-weight thin film stretched membrane 10 cm telescope. A rad-hard ASIC together with an FPGA will be used for detector pixel readout and detector linear array selection depending on if the field-of-view (FOV) is looking at the day- or night-side of Titan. The instantaneous FOV corresponds to 3.1, 15.6, and 31.2 mrad for the 1, 5, and 10 μ m channels, respectively. For a 1500 km orbit, a 5 μ m channel pixel represents a spatial resolution of 91 m, with a FOV that spans 23 km, and Titan is mapped in a push-broom manner as determined by the orbital path. The system mass and power requirements are estimated to be 6 kg and 5 W, respectively. The package is proposed for a polar orbiter with a lifetime matching two Saturn seasons.