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A Compact Imaging Spectrometer for Planetary Remote Sensing

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Abstract

We have developed a concept for a compact, low weight and power, dual band hyperspectral imaging spectrometer with an integrated cooling system and with performance exceeding that of currently available single focal plane sensors. This instrument operates from 2.5μm to >12μm, enabling key objectives in planetary remote sensing missions, including geological and mineralogical mapping, atmospheric chemistry measurements, and thermal imagery with spectral discrimination of materials and species. These measurements address crucial science goals at diverse targets, including primitive bodies, satellites, and planets. Here we present anticipated sensor performance and preliminary sensor parameters for a subset of possible science goals that can be achieved using this instrument.

Our innovative instrument design combines cryocooler concepts which build on proven space-qualified Northrop Grumman cryocooler systems, a unique compact optical design, space qualifiable electronics, and novel Si:As focal plane array technology. This system delivers spatial resolution as well as contiguous, high spectral resolution over a large range of thermal wavelengths with capabilities out to 28μm, and the exact wavelength range and spectral resolution can be tailored to specific mission needs. The engineering design goals include a total mass <30kg and power <45W; the resulting instrument provides smaller, less massive, lower power, and improved performance relative to traditional multi-focal plane instruments.