SPOSH-V : An optical detector assembly for detecting meteors in the Venusian night side atmosphere from orbit

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Precious, but little, information has been gleaned to-date regarding meteor activity at planets other than the Earth [1,2,3]. This is partly due to the fact that space-qualified instrumentation designed to detect meteors has,to-date, not been available. Hence the distribution of large, meteor-producing meteoroids (0.1mm-1m in size as opposed to micron-sized dust particles) at heliocentric distances other than 1 AU is unknown. Detection of off-Earth meteor showers is particularly relevant to cometary science, as the meteors trace the dynamical and physical evolution of their cometary parents.

Here we describe a camera specifically designed to detect meteors in Venus' atmosphere from orbit around the planet. The camera design is based on the existing Smart Panoramic Optical Sensor Head (SPOSH) cameras built jointly by Jena Optronik and the German Aerospace Center (DLR) under contract with the European Space Agency [4] in 2004. These feature a 1k x 1k back-illuminated CCD sensor, a customized optical system offering an effective >170^o circular field of view (≈120°x120° on the CCD) and sophisticated control protocols that allow a selectable frame update frequency of up to 16 Hz (maximum 1Hz in unbinned mode). In parallel, autonomous event identification and memory-efficient storage alleviate greatly the burden on the downlink bandwidth. Several camera breadboards have already been built and extensively tested during a series of field campaigns [5]. A space-qualified version of SPOSH (already designed in the context of the contract) can be realized with limited resources and at low risk for a journey to Venus.

Recent work on the ablation of meteoroids in the atmosphere of Venus bodes well for the detectability of meteors from orbiting cameras [6,7]. Maximum meteor brightness is reached at altitudes of 105-125km, well above the Venusian cloud decks and haze layers. Moreover, meteors are intrinsically brighter at Venus mainly due to the smaller density scale height of the atmosphere compared to the Earth's. The plethora of predictions that now exists for strong Venusian meteor showers related to known comets [6,8,9,10,11] enable us to assess expected camera performance at Venus and show that the proposed meteor survey will yield an extremely rich and unique dataset.

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