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The Fast Auroral Imager Experiment on the ePOP Mission: the Dynamics of Nighttime Optical Aurora

LEROY L. COGGER[1], JOHN S. MURPHREE[1], ANDREW W. YAU[1] and TROND S. TRONDSEN[1]

[1]*Institute for Space Research, University of Calgary, Calgary, Alberta Canada T2N1N4*

The Fast Auroral Imager (FAI) consists of two CCD cameras: one designed to measure the 630 nm emission of atomic oxygen in aurora and enhanced night airglow; and the other designed to observe the prompt auroral emissions in the 700 to 900 nm range from which the auroral dynamics can be monitored. High throughput will be realized through the combination of fast lens systems (f/0.8) and the implementation of CCDs that are designed for high quantum efficiency. Both cameras have a common 27 degree field of view that provides images of about 400km by 400km when the aurora will be observed from about 1000km above the Earth.

The imager will have several pointing options: the default mode will maintain the fields of view in the nadir direction; the target mode will slew the field of view to keep it fixed on an earth-based target; and the limb mode will permit the vertical structure of aurora and airglow to be observed. In nadir viewing the near infrared camera will provide multiple images per second at a spatial resolution of a few kilometres and will therefore be a valuable tool to study such phenomena as substorm onset, vortices and multiple narrow arcs. It will also be critically important for providing the auroral context for the complementary *in situ* measurements that will be obtained by the other ePOP instruments. The default operating mode for the 630nm camera will provide images once per minute with an exposure time of 0.5sec. While nadir viewing, this camera will not only image auroral forms such as discrete arcs that are produced by soft electrons, but it will also measure the locations of the auroral oval and polar cap boundaries. With onchip pixel binning it will also be possible to investigate polar cap phenomena such as polar arcs and patches, features such as SAR arcs and detached arcs equatorward of the oval, and even enhanced airglow produced by artificial heating of the ionosphere. Overall, this instrument represents the application of the best available technology to the study of nighttime auroral phenomena and holds great promise as both a stand-alone instrument and as a monitoring instrument for complementary measurements of auroral parameters.

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