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The Canadian RADiation Impacts on Climate and Atmospheric Loss Satellite (RADICALS) Mission

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The RADiation Impacts on Climate and Atmospheric Loss Satellite (RADICALS) is a low-Earth orbiting Canadian small satellite mission investigating the transport of space radiation into the atmosphere, and its impact on Earth's climate. Scheduled for launch in late 2026, the mission will launch into a polar orbit with an integrated payload comprising two back-to-back look direction High Energy Particle (HEP)telescopes, two back-to-back X-Ray Imagers (XRI) to remote sense energetic particle precipitation using back-scattered Bremsstrahlung X-rays, and boom mounted FluxGate Magnetometer (FGM) and Search Coil Magnetometers (SCM). Using an innovative Thomson spin-stabilized configuration, the satellite will sample the pitch angle distributions in the spin-plane twice per spin. The back-to-back HEP look directions allow for a contemporaneous view of the down-going and back-scattered up-going electrons, at the same time as XRI remote-senses the related Bremsstrahlung, and the magnetometers provide in-situ magnetic signatures of a range of plasma waves. The key measurement of the pitch angle resolved energetic electron precipitation (EEP) and related back-scatter, including a resolved loss cone, will allow a detailed assessment of the energetic particle energy input to the atmosphere. Measurements of EEP, in addition to measurements of solar energetic particle (SEP) precipitation, will represent a critical data set for assessing the role of space radiation in the climate system, for example through the catalytic destruction of ozone in the middle atmosphere by NOx and HOx. Accurately quantifying the impacts of this space radiation on climate requires accurate and loss cone-resolved characterization of the flux of these precipitating energetic particles for inclusion into whole atmosphere models. The RADICALS explorer will also enable research into potentially catastrophic space-weather radiation effects on satellite infrastructure, and assess impacts on space weather-related interruptions to high frequency radio communications including in relation to aircraft operations in polar regions.

Solicited or Contributed

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