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Balloon Demonstrator Imaging Fourier Transform Spectrometer for the Measurement of Methane and Carbon Dioxide over the Arctic

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Arctic climate is changing more rapidly than expected. Multi-year ice is melting and opening the way for shipping and exploration activity for natural resources which in turn increases air pollution. Observing greenhouse gases on a global scale is essential to monitor climate change, especially in the Arctic. Several space missions monitor trace gasses but are in low-earth, sun synchronous orbits and do not have a 24/7 view of northern latitudes. The Canadian Space Agency (CSA), along with other Canadian government departments, is proposing the Polar Communications and Weather (PCW) satellite to provide weather, communication and atmospheric composition information over the Arctic. The use of two satellites in out-of-phase highly elliptical three-apogee orbits with an apogee at $\sim$40,000 km over the Arctic, will provide continuous quasi-geostationary viewing of the northern latitudes. The planned meteorological instrument for the PCW mission is a 21-channel spectral imager with UV, visible, NIR and MIR channels, similar to MODIS and ABI, capable of measuring several different trace gasses. This paper will focus on the development of an Imaging Fourier Transform Spectrometer (IFTS) to be flown on a high-altitude balloon to demonstrate the capacity to monitor methane and carbon dioxide in the Arctic as part of the PHEOS-WCA (Polar Highly Elliptical Orbit Science - Weather, Climate and Air quality) instrument suit; a science complement to the PCW mission.
Funding through the CSA Flights for the Advancement of Science and Technology (FAST) program is in place to develop the demonstrator IFTS to show that measurements of methane and carbon dioxide can be collected from space in the 1.6 μm band. The characteristics of the instrument and plans for the balloon flight will be discussed and details of the PCW mission and PHEOS-WCA component will be presented. The authors acknowledge support of the PHEOS-WCA science team.