

Opportunity Title: Optical and Compositional Studies of Titan's Stratospheric Ices

Produced from Thin Films of Pure and Mixed Organics

Opportunity Reference Code: 0146-NPP-NOV23-GSFC-PlanetSci

Organization National Aeronautics and Space Administration (NASA)

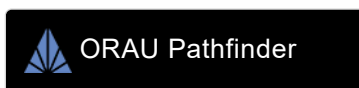
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Application Deadline 11/1/2023 6:00:59 PM Eastern Time Zone

Description The US portion of the Cassini Composite InfraRed Spectrometer (CIRS) team resides at NASA Goddard Space Flight Center (GSFC). A subgroup of the US CIRS team consists of a small Titan atmospheric research group that utilizes remote observations of Titan's stratosphere from Cassini CIRS in order to better understand the formation mechanisms, the spatial dependences, and the impact that all types of particulates, both volatile and refractory, have on Titan's atmosphere. These particulates are exceptionally important opacity sources that play a critical role in Titan's radiation budget. For example, Titan's aerosol absorbs 40% of incident solar photons, resulting in the most extreme stratospheric thermal inversion of any object in the solar system, while Titan's nitrile ices are significant far-infrared (far-IR) radiative coolers in the winter polar stratosphere, leading to significant and unexpected alterations to Titan's vertical temperature structures.

We are seeking a postdoctoral applicant to work in our Spectroscopy for Planetary ICes Environments (SPICE) laboratory, which resides in the Planetary Systems Laboratory (693) in the Solar System Exploration Division (690). This position is strictly laboratory based and the NPP project will focus on generating thin film ice measurements of Titan-relevant nitrile and hydrocarbons, both pure and mixed species, at Titan-relevant temperatures. From CIRS limb observations in the far-IR, we are able to employ radiative transfer algorithms to retrieve the vertical and spectral dependences of Titan's stratospheric ices. From these types of analyses, we depend on laboratory measurements to determine and characterize the stratospheric ices observed. Laboratory spectra of thin film ices serve as a first approximation to the identification of observed ice features from CIRS observations. Thus, measurements of multiple relevant ices (pure and mixtures) are needed for the interpretation of these data.

The current experimental system in the SPICE laboratory, which includes the ice chamber and far-IR/mid-IR spectrometer, is currently being built. A qualified NPP candidate is critical to help construct and optimize the ice chamber set-up. Once the experimental system is operational, the NPP fellow will collect the thermal IR transmittance spectra of thin ice films (less than about 10 μm) of vacuum-deposited nitrile and hydrocarbon gases between 1000 to 30 cm^{-1} , with an emphasis on the far-IR ice features between 100 and 300 cm^{-1} . Expertise on vacuum and cryo systems as well as IR spectroscopy are essential for this position. The refractive index will be determined for each ice mixture using a Kramers-Kronig analysis of the measured transmittance spectra. This makes use of a second experimental system (still to be built) designed to determine the real part of the refractive index at 670 nm using two lasers directed at the sample at different angles of incidence. The candidate will work closely with Dr. Anderson and the Cassini CIRS team to help with the interpretation of the observed ice features as well as advise on the chemistry and composition of ices in this



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environment. Familiarity with hydrocarbon and nitrile synthesis is encouraged, as the candidate will be expected to synthesize species that are not commercially available.

Location:

Goddard Space Flight Center
Greenbelt, Maryland

Field of Science: Planetary Science

Advisors:

Carrie Anderson
carrie.m.anderson@nasa.gov
301-286-6925

Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: <https://www.nasa.gov/oiiir/export-control>.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Eligibility Requirements

- **Degree:** Doctoral Degree.