Opportunity Title: Infrared Spectroscopy and Radiation Chemistry of Ices in the Cosmic Ice Laboratory
Opportunity Reference Code: 0202-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 Our research group is part of the Astrochemistry Laboratory in the Solar System Exploration Division at NASA's Goddard Space Flight Center, and is a member of the Goddard Center for Astrobiology. We specialize in studying the spectra, the chemistry, and the physical properties of ices relevant to comets, icy satellites and planets, and the coatings of dust grains in the interstellar medium. Although many cosmic ices are dominated by H2O, they also contain ""prebiotic"" molecules such as CO, CO2, CH4, NH3, and CH3OH. In studying these molecules we are probing the early, ancient chemistry which eventually led to the origin of life.

In our laboratory we prepare ices by using a cryostat to condense gas-phase mixtures to temperatures as low as 10 K. The ices are made in a vacuum system to simulate the low pressure of outer space, and also to avoid undesirable contamination from the Earth's atmosphere. An infrared spectrometer is used to record spectra of an ice during experiments. Our laboratory set-up is unusual because it is interfaced not only to a Van de Graaff accelerator, that can produce protons at energies up to about 1 million electron volts (1 MeV), but also to a hydrogen-discharge lamp that supplies ultraviolet (UV) photons (energy ~10 eV). The high-energy protons simulate the magnetospheric or cosmic ray radiation exposure expected for planetary, cometary, and interstellar ices, while the UV photons from our lamp simulate the Solar or interstellar UV field. When either the protons or UV photons strike an ice sample they produce ionizations and excitations, resulting in chemical reactions to make new molecules. By comparing infrared spectra taken before and after this processing of an ice, we can identify molecules formed by either radiolysis or photolysis.

Opportunities that exist in our laboratory include

1. Proton irradiation of ices and ice mixtures to determine destruction rate constants of various organic compounds of astrobiological interest (amino acids, nucleobases, PAHs, etc). This involves creating mixtures of these compounds in an ice matrix relevant to different environments and performing irradiation experiments to measure their destruction rate constants at various concentrations and temperatures.

2. Proton irradiation of ices to determine formation pathways of molecules of interstellar, planetary, and/or astrobiological interest.

3. The determination of the near-, mid- and far- infrared optical constants of ices of interstellar and planetary interest. This involves the measurement of ice refractive indices, mass densities, transmission spectra, and band strengths.

4. Low-temperature reaction chemistry in ices relevant to Europa, Titan, Enceladus, and other places.

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Location:
Goddard Space Flight Center
Greenbelt, Maryland

Field of Science: Planetary Science

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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/oiir/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.