

**Opportunity Title:** Solar System Exploration: Chemistry and Physics of Circumstellar, Interstellar and Protostellar Matter

**Opportunity Reference Code:** 0008-NPP-NOV23-GSFC-PlanetSci

**Organization** National Aeronautics and Space Administration (NASA)

**Reference Code** 0008-NPP-NOV23-GSFC-PlanetSci

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

**Description** This is a broad program of experimental and theoretical research related to the chemistry and physics of circumstellar, interstellar early solar system solids. High concentrations of refractory vapors are condensed in the laboratory to produce particles that are laboratory analogs of freshly condensed grains. The composition and structure of these particles are then studied as a function of various metamorphic processes such as thermal annealing or hydration. Diagnostic infrared spectral signatures have been observed in the annealing of amorphous MgSiO grains, and similar experiments are in progress for more complex grains. Mass independent oxygen isotopic fractionation has been seen in the presence of plasma and new experiments are planned to investigate possible chemical reaction mechanism(s) responsible for the observed fractionation. Finally, we have found that condensation occurs at metastable eutectic chemical compositions for Fe-Mg-silicates. Additional experiments are planned to see if this phenomenon also occurs for other refractory species such as Fe-Mg-aluminates. Theoretical calculations have been performed to model molecule and grain formation in circumstellar envelopes. The current computer codes calculate SiO nucleation rate and cluster growth as a function of stellar radius for a circumstellar outflow using a full radiative transfer model. We also calculate grain evaporation, nucleation, grain growth and aggregation for transient events in the solar nebula such as lightning discharges without a treatment of radiative transfer effects

**Location:**

Goddard Space Flight Center  
Greenbelt, Maryland

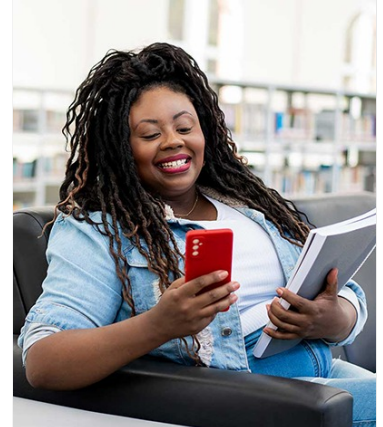
**Field of Science:** Planetary Science

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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>.



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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.