

**Opportunity Title:** Heliophysics Science: High-Energy Aspects of Solar Flares

**Opportunity Reference Code:** 0032-NPP-NOV23-GSFC-HelioSci

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

**Reference Code** 0032-NPP-NOV23-GSFC-HelioSci

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

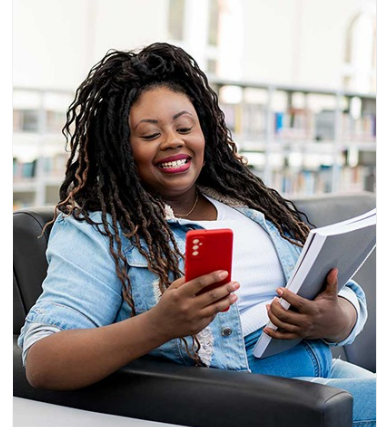
**Description** The acceleration of charged particles to high energies and their confinement, transport, and subsequent energy losses are among the fundamental processes of solar flares. We investigate these processes through observations of X-rays and gamma rays and through theoretical modeling.

Our most recent observational effort was the Reuven Ramaty High-Energy Solar Spectroscopic Imager (RHESSI), a Small Explorer mission operational from February 2002 through April 2018. It conducted the first high-resolution X-ray and gamma-ray imaging spectroscopy of solar flares using cooled germanium detectors and Fourier-transform imaging in the energy range from 3 keV to 20 MeV. It had ~2 arcsecond angular resolution, ~1 keV energy resolution, and sub-second time resolution. RHESSI obtained a wealth of observations of X-ray and gamma-ray flares that are reshaping our understanding of particle acceleration in flares.

We are also continuing to analyze data sets obtained with x-ray and gamma-ray instruments on the Solar Maximum Mission, the Compton Gamma Ray Observatory, the Japanese Yohkoh spacecraft, and the Fermi astrophysics mission. Data are available for tens of thousands of flares from these missions. Complementary observations of the same flares are also available from space instrumentation sensitive to other flare emissions and from ground-based radio and optical observations. This comprehensive array of observational data is available on-line at the Solar Data Analysis Center in Goddard's Solar Physics Branch, and its detailed analysis is providing critical tests of theoretical models of solar flares.

We are developing an integrated package of modular numeric codes and models for the analysis and interpretation of these data. The package focuses on the energetic electrons produced during the impulsive phase of flares. It computes both the bremsstrahlung X-ray/gamma-ray emission and the gyrosynchrotron radio emission from model flare configurations and initial electron distributions. Steady-state and time-dependent Fokker-Planck codes compute the transport of suprathermal electrons. A hydrodynamic code will compute the response of the flare plasma in the model configurations. The proposed computational package will allow for comprehensive modeling of energized electrons in different flare scenarios. The predicted emissions can be compared directly with x-ray/gamma-ray and radio images and spectra. The package provides the necessary framework for comparing electron acceleration models with flare data.

We also have research programs to develop (1) solid-state detectors that provide high spectral resolution and operate at or near room temperature, (2) high-spatial resolution scintillation detectors for use as image plane detectors for hard x-ray and gamma-ray observations, and (3) a new telescope concept that utilizes two high-Z Fresnel Zone Plates to image at



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hard x-ray energies.

The combination of instrument development, data analysis, and theoretical modeling makes this opportunity suitable for a wide range of talents. A solar physics background is an advantage but is not required.

**Location:**

Goddard Space Flight Center  
Greenbelt, Maryland

**Field of Science:**Heliophysics Science

**Advisors:**

Steven Christe  
steven.d.christe@nasa.gov  
301-286-7999

Albert Y. Shih  
albert.y.shih@nasa.gov  
301-286-1843

**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.