

**Opportunity Title:** X-ray Studies of Galaxy Clusters, Active Galaxies and Diffuse Background

**Opportunity Reference Code:** 0024-NPP-NOV23-GSFC-Astrophys

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

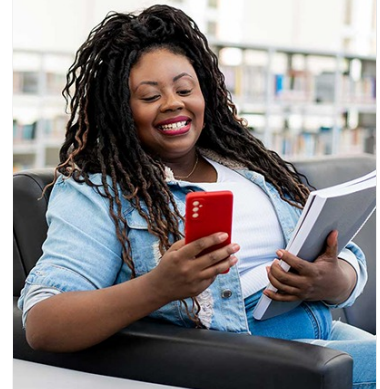
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**Application Deadline** 11/1/2023 6:00:59 PM Eastern Time Zone

**Description** Clusters of Galaxies. The distribution of galaxy clusters as a function of mass and redshift probes the large-scale structure of the Universe and provides competitive constraints on cosmological models. Because cluster cosmological constraints are only as good as our understanding of the cluster astrophysics, we are conducting detailed observational and theoretical studies of the X-ray emitting intergalactic medium across the mass scales from galaxies to superclusters. We study shock fronts and other dynamic phenomena, as well as the cluster nonthermal components, to determine how clusters and galaxies work and how to make their mass estimates more accurate. We are using X-ray, optical, Sunyaev-Zeldovich and radio data, with the X-ray data coming primarily from the Chandra, XMM-Newton, Swift, Suzaku and NuSTAR X-ray observatories. Our lab built the mirrors and the microcalorimeter detectors for Hitomi and its successor XRISM, and is developing a microcalorimeter for Athena. We take full advantage of this hardware expertise and involvement in those missions, having recently analyzed the high-resolution spectra of Perseus from Hitomi. We are also performing high spatial resolution MHD simulations of clusters to compare with the X-ray and radio observations and to prepare for the forthcoming X-ray missions.

Active Galaxies. An ongoing program concentrates on analyzing Chandra, XMM-Newton and NuSTAR AGN data. Research comprises a wide variety of topics, including fitting the broadband (0.6 keV to > 30 keV) spectra of broad-line active galaxies and BL Lac objects; searching for correlated temporal/spectral variations; and determining the nature of X-ray emission from Seyfert IIs and LINERs. We also have extensive correlative studies involving infrared astronomical satellite and Hubble Space Telescope observations.

Diffuse X-Ray Background. The HEAO-1 and ROSAT all-sky databases continue to provide unique opportunities to study high-latitude and unresolved X-ray background emission. The absolute intensity of the diffuse background measures the accretion history of the Universe, spatial fluctuations in the HEAO-1 background measure nearby cosmological structures, and temporal fluctuations in the ROSAT background measure interactions in the heliosphere via Charge Exchange emission. These topics are explored by correlating these databases with other experiments, notably the powerful imaging Chandra and XMM-Newton observatories, and by participation in the design of new missions and observations from sounding rockets, CubeSats, Explorer and Flagship missions. We continue to explore cross-calibration between observatories as well as instrumental and observational effects which might contribute to the discrepancy between the extragalactic background flux measured by collimated instruments designed for sensitivity to surface brightness and the extragalactic background flux as estimated from the source counts.



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**Location:**

Goddard Space Flight Center  
Greenbelt, Maryland

**Field of Science:** Astrophysics

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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.