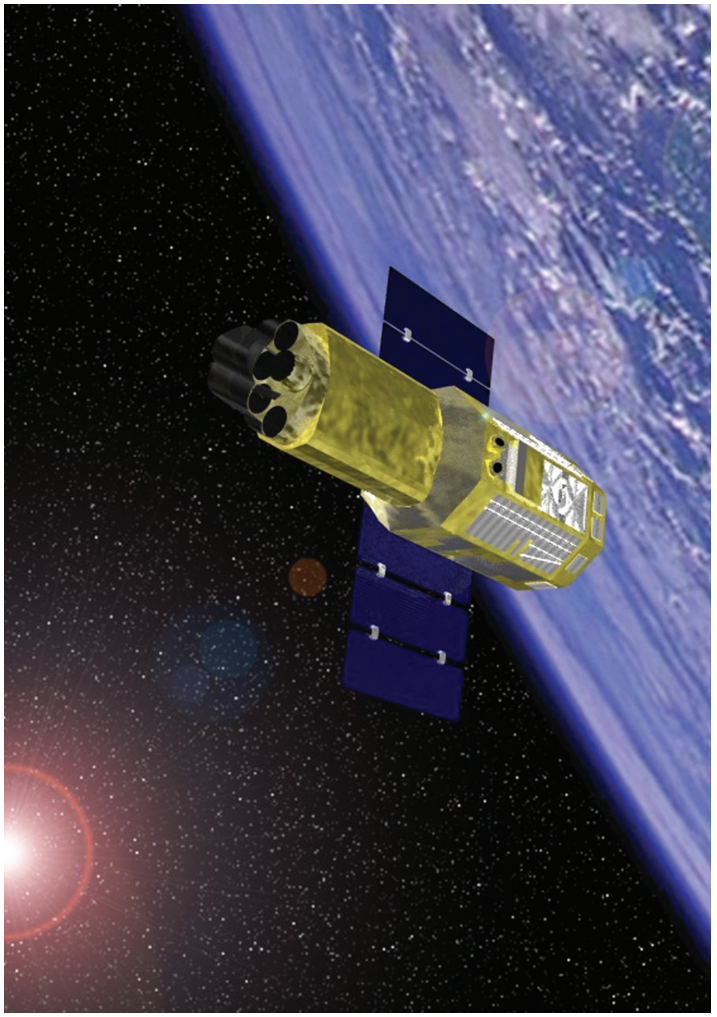
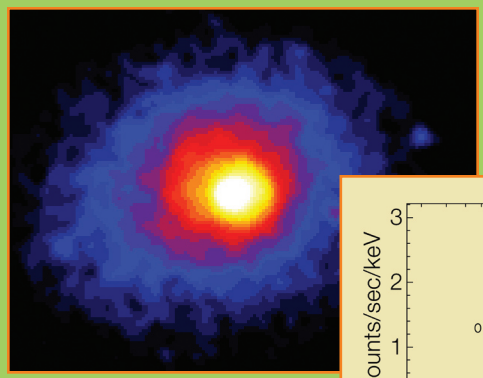
National Aeronautics and Space Administration
Explore. Discover. Understand.

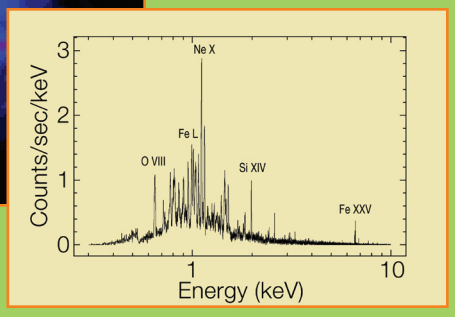
Astro-E2

Astro-E2 is a powerful orbiting observatory for studying extremely energetic processes in the universe. Sensitive x-ray spectrometers will enable precise measurements of high-energy processes in stars, supernova remnants, galaxies, clusters of galaxies, and the environments around neutron stars and black holes. NASA's Goddard Space Flight Center and the Institute of Space and Astronautical Science of the Japan Aerospace Exploration Agency are jointly developing Astro-E2 for launch in 2005. Astro-E2 will feature the high-resolution X-Ray Spectrometer (XRS), a new type of device based on the x-ray microcalorimeter that detects individual x-ray photons thermally and measures their energies with extraordinary precision and sensitivity. The instrument utilizes a three-stage cooling system that provides enough cooling power for at least two years of operation in space. The X-ray Imaging Spectrometer (XIS), developed jointly by MIT, ISAS and other institutions in Japan, is comprised of four individual CCD x-ray cameras to provide high sensitivity imaging over a larger field of view than the XRS, and will continue to be used after the cryogens in the XRS are exhausted. A Hard X-Ray Detector (HXD), developed in Japan, is also on the spacecraft for broadband spectroscopy up to the gamma-ray region. X rays are focused onto the XRS and XIS instruments using a set of five large-area, grazing incidence X-Ray Telescope modules (XRT), one for the XRS and four for the XIS cameras.

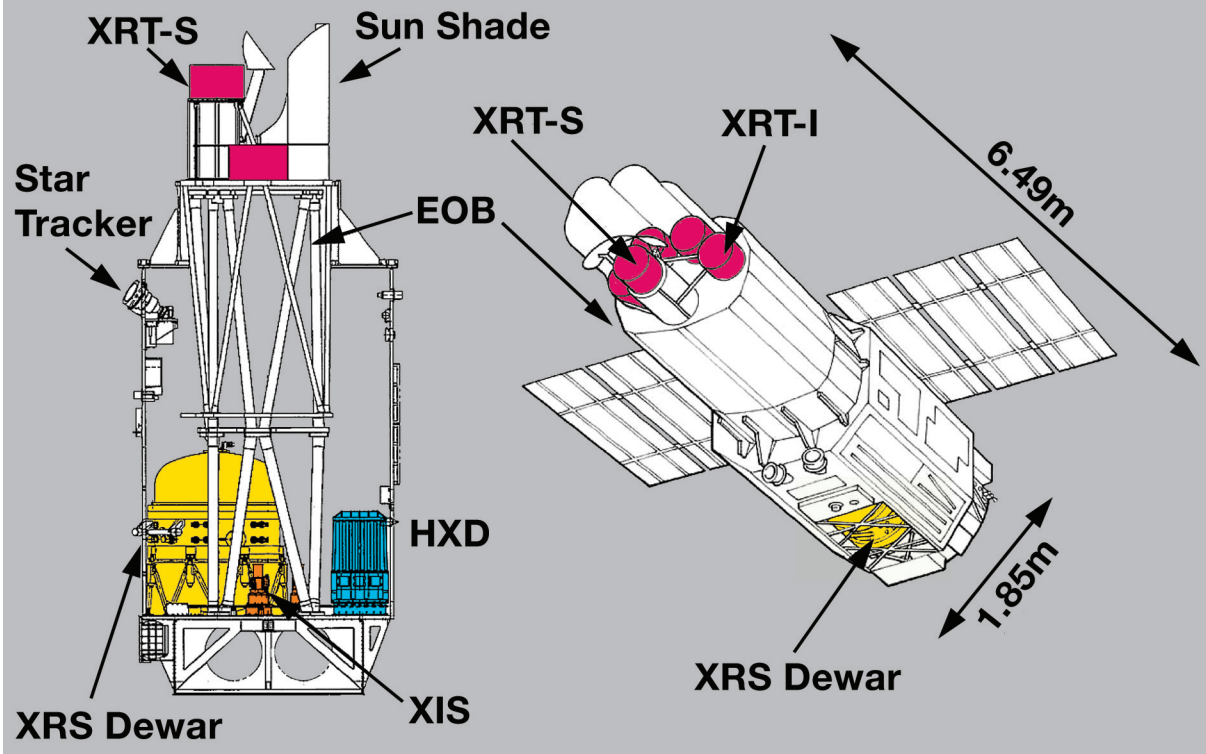


Astro-E2 Science





The two images show an optical (left) and x-ray (right) image of a nearby cluster of galaxies. Clusters of galaxies are the largest bound systems in the universe and most of the normal matter in these systems lies in gas that is 50 million degrees, causing it to radiate x rays. The expected spectrum of this x-ray emission is shown in the lower right corner and illustrates the ability of Astro-E2 to measure the spectral signatures of the elements contained within this gas. Spectra like these, and from many different kinds of objects, will allow scientists to measure the quantity of the elements present, their temperatures, and how fast they are flowing. Such information is crucial for understanding how these objects came to be and their likely evolution.



Astro-E2 is a relatively large x-ray astronomy satellite, standing 6.5 meters tall after extension of the Extendable Optical Bench (EOB) and weighing 1.7 metric tons. The overall mission lifetime is expected to be 5 years with the XRS instrument in operation during the first 2-3 years of the mission. The EOB will be deployed in orbit to bring the XRS and XIS instruments into focus. The EOB extends by 1.8 meters. Astro-E2 will be placed into a circular orbit at 560 km altitude and 32 degrees inclination.

The **X-Ray Spectrometer (XRS)** will measure the spectrum of celestial objects with very high resolution.

The 4 **X-ray Imaging Spectrometers (XIS)** are CCD cameras sensitive to x-ray energies.

The **Hard X-ray Detector (HXD)** will observe the hard (high energy) x-ray spectrum.

The 5 **X-Ray Telescopes (XRT)** will will focus x rays onto the XIS and XRS detectors.

These three instruments will provide powerful tools to observe dynamical phenomena in the Universe, such as the coalescence of galaxies in galaxy clusters and extremely high-temperature gas that is flowing into the black hole at the center of galaxies.

http://www.nasa.gov/astro-e2
http://www.isas.jaxa.jp/e/enterp/missions/astro-e2/

Japan started its x-ray astronomy mission in 1979. Since then, four satellites have been launched to perform space-based observations of x-ray sources. Astro-E, launched in February 2000, was supposed to be the fifth in the series of Japanese x-ray astronomy satellites, but failed to reach orbit. Following much of the original design plan, the Astro-E2 satellite is now complete and is scheduled for launch aboard an M-V-6 launch vehicle in 2005.