National Aeronautics and Space Administration

IXPE IMAGING X-RAY POLARIMETRY EXPLORER

NASAfacts

The Imaging X-ray Polarimetry Explorer (IXPE) is a space observatory built to discover the secrets of some of the most extreme cosmic objects – the remnants of supernova explosions, neutron stars, powerful particle streams ejected by feeding black holes, and more.

IXPE is NASA's first mission to study the polarization of X-rays from many different types of celestial objects. Measuring the polarization of X-rays traces the story of where this light came from, including the geometry and inner workings of its source.

Science

X-rays are a high-energy form of light that is invisible to human eyes. Like all light, X-rays are electromagnetic waves that oscillate, or vibrate, in different directions as they travel through space. The light from the Sun or a lamp, for example, is a chaotic mix of waves vibrating in all directions. Polarized light is more organized, with electric fields vibrating in just one direction — like the reflective glare created by sunlight bouncing off a lake or ocean.

IXPE builds on the discoveries of NASA's Chandra X-ray Observatory and other space telescopes by measuring the amount and direction of polarization of X-ray light. IXPE's polarization measurements will help scientists answer questions such as:

- How do black holes spin?
- Was the black hole at center of the Milky Way actively feeding on surrounding material in the past?
- How do pulsars shine so brightly in X-rays?
- What powers the jets of energetic particles that are ejected from the region around the supermassive black holes at the centers of galaxies?

IXPE will also serve as a unique tool to study the laws of nature in extreme conditions that we cannot recreate in a laboratory on Earth. IXPE's polarization measurements might even hold clues to longstanding questions about the rules that govern high-energy physics on both a large scale and a very small, or quantum, scale.

Observatory

The Imaging X-Ray Polarimetry Explorer carries three identical telescopes. Each telescope includes a set of cylindrical mirrors, or optics, and a sensitive detector. The mirrors collect X-rays from celestial objects and focus them onto the detectors, which make an image of the incoming X-rays and measure the polarization. All three mirror sets are separated from their corresponding detectors by a deployable 12-foot (3.7-meter) boom.

Soon after launching from NASA's Kennedy Space Center in Florida, IXPE will deploy its solar arrays and begin commissioning of the spacecraft. After about a week, IXPE will extend its boom. About a month after launch, IXPE will be ready to begin its two-year science mission. IXPE's "first-light" target will be the supernova remnant Cassiopeia A, which was also Chandra's first-light observation. IXPE will study approximately 40 celestial objects during its first year in space, with more detailed follow-up observations during the second year.

IXPE is an international collaboration between NASA and the Italian Space Agency. Hundreds of engineers and scientists from more than 12 countries worked together to make IXPE a reality. The mission is led by principal investigator is Dr. Martin C. Weisskopf at NASA's Marshall Space Flight Center. Ball Aerospace is the main industry partner.

Quick Facts

Launch date: Dec. 9, 2021

Launch time: 1 a.m. EST

Launch site: Kennedy Space Center

Launch Complex: 39A

Primary Mission Length: Two years

Spectral band: X-ray
(2-8 kilo electron volts)

Orbit: About 375 miles (600 kilometers) altitude, orbiting around Earth's equator

Mirrors: Three assemblies of 24 nested mirror shells

Instrument: Three polarization-sensitive detectors and a service unit that packages the data

For more information visit: https://www.nasa.gov/ixpe

FS-2021-11-54-MSFC