

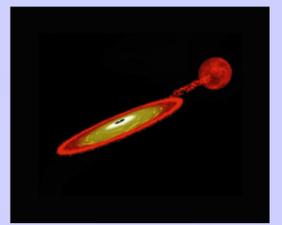
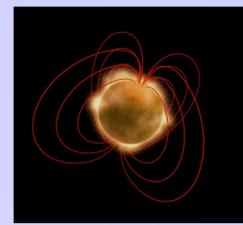
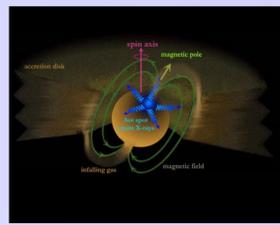
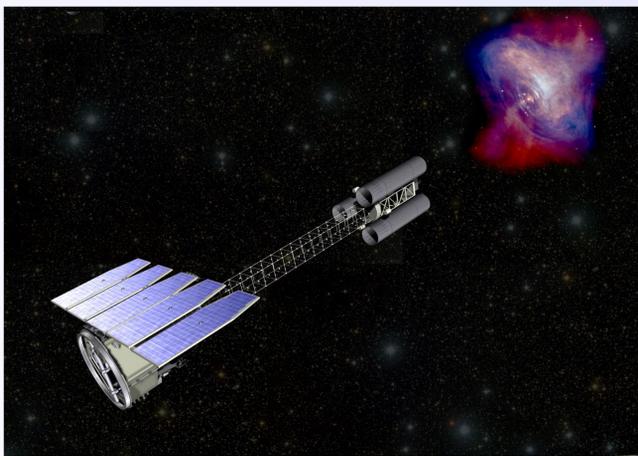
# IXPE – the Imaging X-Ray Polarimeter Explorer: Expanding Our View of the Universe

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## Abstract

The Imaging X-ray Polarimetry Explorer (IXPE) will transform our understanding of the most energetic and exotic astronomical objects—especially neutron stars and black holes. To do this, IXPE will measure X-ray linear polarization as a function of energy, time, and position. As the first dedicated X-ray-polarimetry observatory, IXPE will significantly enlarge the observational phase space, probing fundamental questions concerning high densities, high temperatures, nonthermal particle acceleration, strong magnetic and electric fields, and strong gravity. IXPE is ideally suited for NASA's Small Explorer (SMEX) program: It is uncomplicated and uniquely complements all current and planned X-ray missions.

IXPE can discriminate amongst pulsar models using phase-resolved polarimetry of the Crab and provide spatially resolved polarimetry of the pulsar's jet.

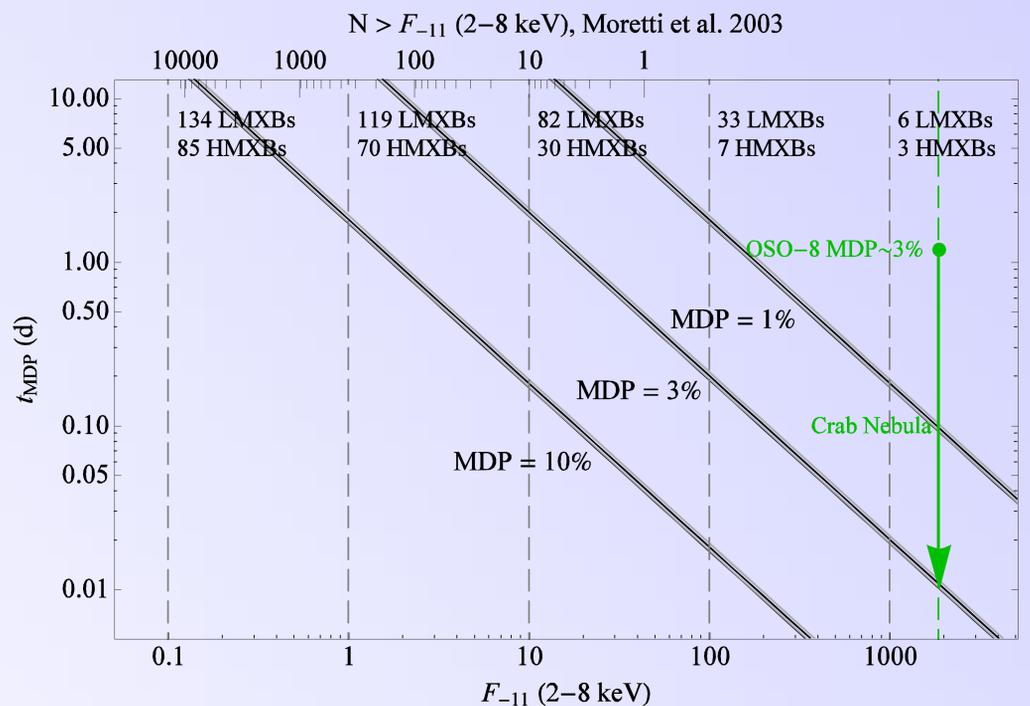


IXPE will provide unique and previously unattained data to investigate significant questions on cosmic sources and processes:

- What is the geometry and emission mechanism of AGN and microquasars?
- Where does the X radiation from radio pulsars originate?
- What are the magnetic-field structure and strength in magnetars & accreting X-ray pulsars?
- How are magnetic-field topology and particle spectra related in pulsar-wind nebulae?
- Are the polarization-transport predictions of GR and QED correct?

Over the proposed mission, IXPE will first survey representative sources from several categories of targets: magnetars, isolated pulsars, pulsar-wind nebulae and supernova remnants, accreting X-ray pulsars, microquasars, active galaxies, and the Galactic Center. The survey results will guide detailed follow-up observations of both survey and additional targets.

Hundreds of galactic and extragalactic sources are amenable to meaningful X-ray polarimetry with IXPE.

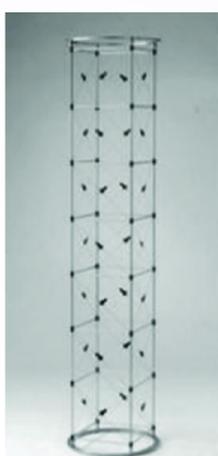


Time to obtain a specified minimum detectable polarization (MDP) at 99%-confidence versus source flux ( $10^{-11}$  ergs/cm<sup>2</sup>/s). The top axis identifies the all-sky number of *extragalactic* sources above the limiting flux on the bottom axis. Text near the top of each dashed line also gives the number LMXB and HMXB at that limiting flux. The green line denotes the Crab Nebula, with the green dot marking the time required for the OSO-8 polarimeter to achieve a 3% detectable polarization at 99%-confidence for the Crab without pulsar contamination.

To measure X-ray polarization, IXPE tracks photo-ejected electrons at the focus of an X-ray telescope.

| Telescope system                             |                                   |
|--|-----------------------------------|
| Angular resolution                           | < 25" half-power diameter         |
| Total mirror effective area                  | ≈ 900 cm <sup>2</sup> up to 7 keV |
| Field-of-view                                | 6.4' (detector-limited)           |
| Imaging Gas Pixel electron-tracking detector |                                   |
| Fill gas                                     | He/DME (20/80) @ 1 atm            |
| Read-out resolution                          | 50 μm                             |
| Number of pixels                             | 300 x 352                         |
| Absorption and drift depth                   | 10 mm                             |

IXPE mission-specific hardware is fully developed and qualified.



Extensible bench from ATK-Goleta (shorter than NuSTAR's mast)



Optics from MSFC (ART-XC)



Fully tested detectors from INFN (Italy)

IXPE is 100X more efficient than the polarimeter that first measured the Crab's polarization.

- Members of the IXPE Science Team have flight experience with polarimeters dating to the first rocket and satellite detections of X-ray polarization from astronomical objects.
- The Team involves an international group of active scientists to assure the scientific integrity and relevance of the results.
- The technical and management team leverages from the highly successful Chandra experience.