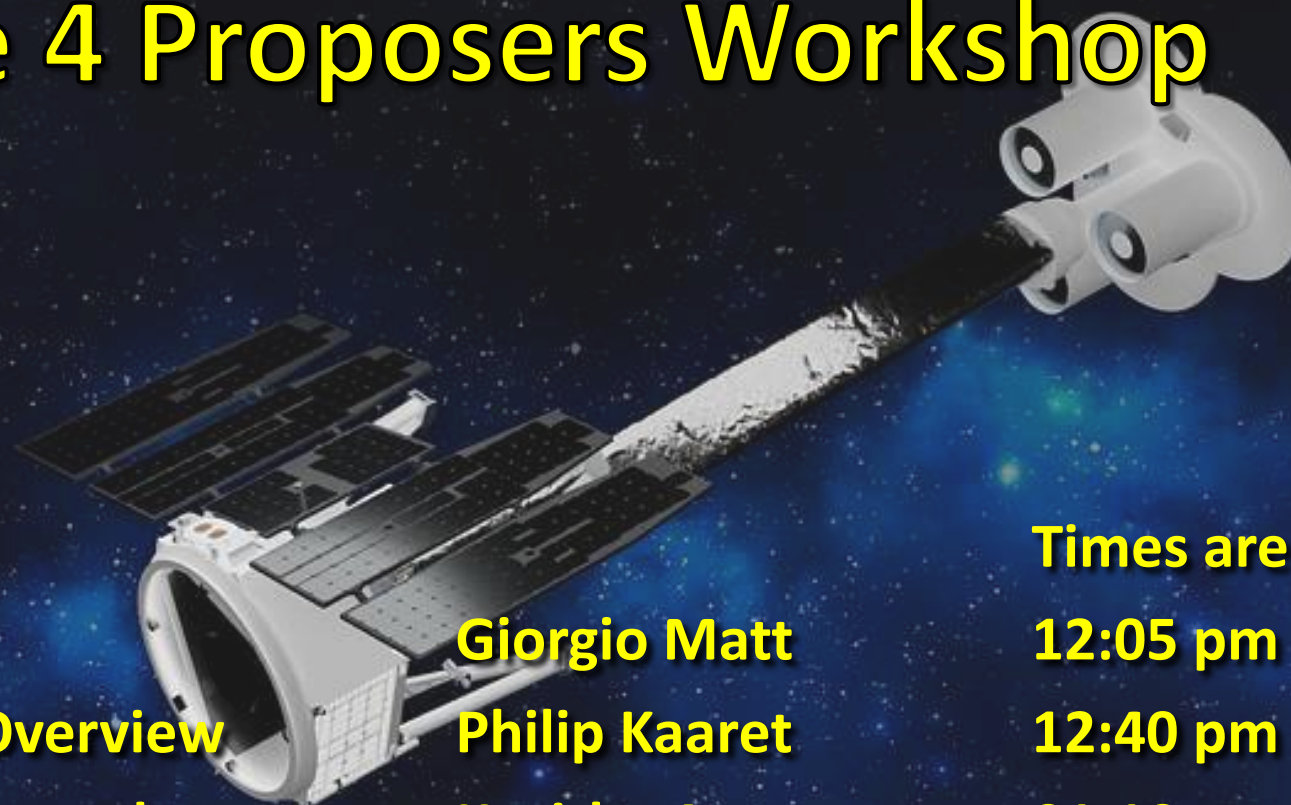


Imaging X-ray Polarimetry Explorer Cycle 4 Proposers Workshop



IXPE Science Highlights

IXPE Mission and Cycle 4 Overview

GO Proposal Submission Procedures

Tools for Proposals and Analysis

Ixpeobssim for Proposals

Questions

Giorgio Matt

Philip Kaaret

Kavitha Arur

Douglas Swartz

Michela Negro

Times are Eastern US

12:05 pm - 12:35 pm

12:40 pm - 01:10 pm

01:10 pm - 01:30 pm

01:30 pm - 02:00 pm

02:00 pm - 02:30 pm

02:30 pm - 03:00 pm

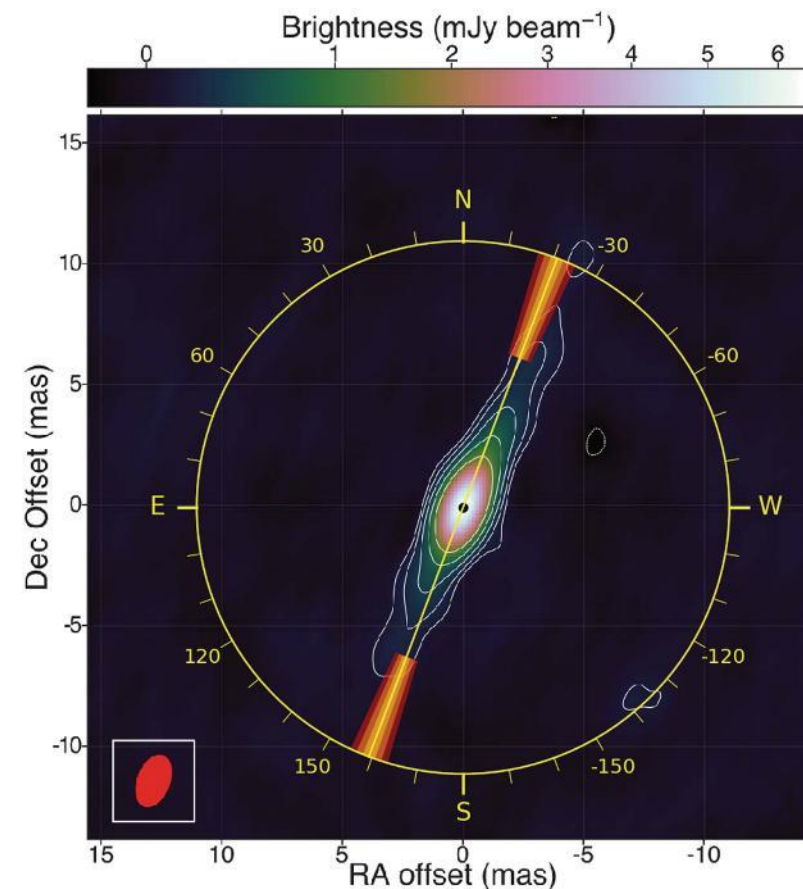
Imaging X-ray Polarimetry Explorer General Observer Program Cycle 4



Philip Kaaret (MSFC) IXPE Principal Investigator

Science Productivity

- **Results now driven by community**
- Proposal oversubscription > 6×.
- 368 refereed papers published with > 7000 citations.
- A second Rossi Prize!
- Henric Krawczynski won the 2026 Rossi Prize of the High Energy Astrophysics Division (HEAD) for pioneering contributions to the theory, instrumentation, and scientific interpretation of X-ray polarimetry, including the first hard X-ray polarization measurements with XL-Calibur and enabling landmark IXPE discoveries.



Spacecraft and Instrument Status

Spacecraft health is nominal.

- High observatory availability (> 98%).
- Operations changes increased life to at least FY30.

Instrument is 3 pairs of X-ray mirrors/gas pixel detectors.

- Detector Units #1 and #3 are nominal.
- Detector Unit #2 suffered an anomaly in April 2025 that affected the pixel gain, noise, and created two rows of (nearly) dead pixels. We have now recovered and are delivering DU2, including reprocessing of data since the anomaly.

Currently studying changes to South Atlantic Anomaly (SAA) detector turn-off region that could offer a few 100 ks increase in observing time per year. This would mean more C targets observed.

Mission Status



- IXPE was extended for three years in the 2025 NASA Senior Review of Operating Mission
- Covers completion of General Observer (GO) Cycle 2, Cycle 3, Cycle 4, and most of Cycle 5..
- **Enables us to release call for GO Cycle 4.**
- **IXPE science is driven by your ideas and the GO proposals that you write.**

IXPE GO Cycle 4 Highlights

- ≈ 11 Msec for regular GO
- ≈ 4 Msec for Large Proposals (exposure > 1.5 Ms)
- Joint with NuSTAR, Swift, XRISM, NRAO, **XMM-Newton (new)**
- Regular, Large, and Multi-cycle proposals
- ToO proposals of known and unknown targets
- **Can request up to 6 months exclusive-use, does not affect peer review**
- Theory proposals not solicited this cycle
- **Require one paragraph anonymized work plan in scientific justification**
- **Due on 17 September 2026.**

New! - Joint Program with XMM-Newton

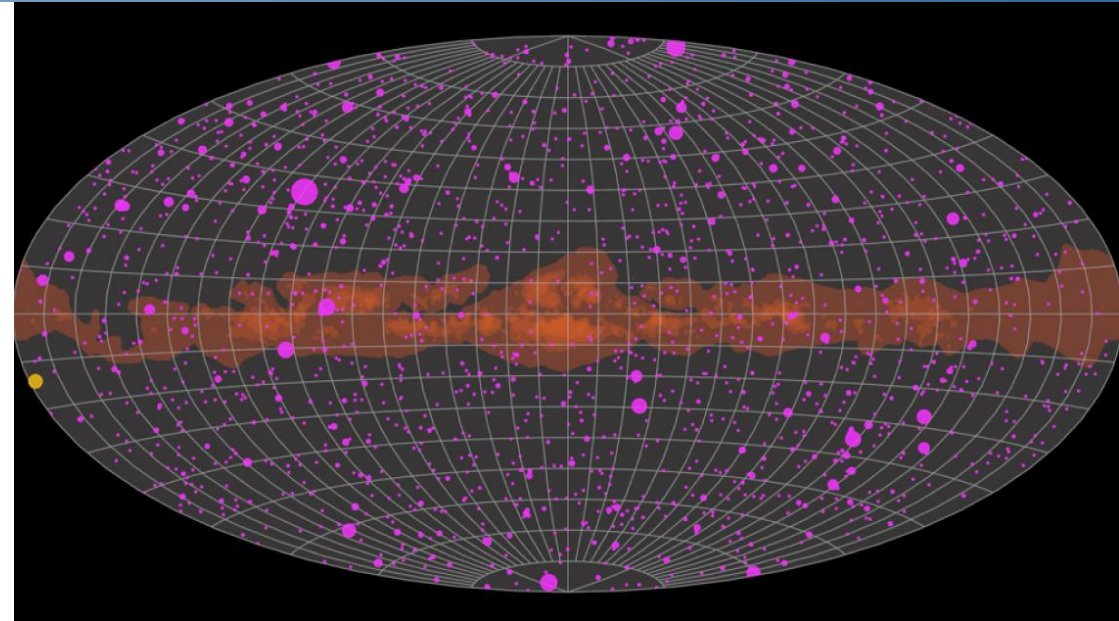
- IXPE can award up to a total of 200 ks of XMM-Newton observing time.
- XMM-Newton can award up to a total of 500 ks of IXPE observing time.
- Joint proposals must provide a compelling justification of the need for both the IXPE and XMM-Newton data for achieving the primary science goals. No XMM-Newton observing time will be awarded without the need for IXPE observing time on the same target.

Targets of Opportunity

- ToO proposals for known and unknown targets
- Multiple triggers allowed per proposal (max 3)
- Maximum exposure is 1.5 Msec per trigger

Trigger Priority:

- High: begin within 9 days of trigger
- Medium: begin 9 days to 4 weeks after trigger
- Low: begin more than 4 weeks after trigger
- Expect to execute ≈ 1 high and ≈ 7 medium ToOs



Credit: NASA MSFC/Daniel Kocevski

Often need multiple observations of a source to catch different states.

- Given limitations on ToO's due to staffing demands, need to modify approach.
- Encourage low priority ToO's (> 4-week response) for slowly varying sources.
- Encourage multiple observations from one ToO trigger.

Unanticipated ToOs through DDT time

- ToO form on IXPE project website at MSFC at https://ixpe.msfc.nasa.gov/for_scientists/too.html

IXPE specific considerations

- Need lots of counts to measure polarization!
 - Observations ≥ 1 Msec are welcomed and encouraged!
- Telemetry limits
 - Roughly 75 ksec for the Crab, then takes one week to downlink
 - Long observations of bright sources must be broken up with observations of dimmer sources
- Galactic center is popular and the IXPE visibility window is very oversubscribed.
 - To check your target, apply the [HEASARC Viewing tool](#). If the visibility window **lies wholly** within the intervals 12 Feb – 25 Apr 2027 and/or 18 Aug – 25 Oct 2027, then your target is in the Galactic Center visibility window. Also, ToO targets in the Galactic source categories with unspecified coordinates are evaluated as being within the Galactic Center visibility window.

Constraints and Designations

- Accepted targets are ranked Category A ('priority') or C ('filler')
- Category A are 'guaranteed' to be observed.
- Joint proposals need to be designated Category A. Panels can choose to accept only IXPE observations in joint proposals and rank as Category C.
- Category C executed on best effort basis.
- Any time constraints/coordination are executed only on a best effort basis.
- New! - If observations of a category C target **are begun**, then the target will be automatically carried over to future cycles, if necessary, until at least 80% of the requested exposure is completed.
Cat C to date: #3089 1E 1145.1-61, #3234 FAIRALL 51, #3213 XB 1254-690
- Category **C targets that are not observed during a cycle will be dropped**, but may be re-proposed in cycle 4.

Legacy Projects

- Review panels will be **instructed to prioritize programs addressing legacy projects**,
https://heasarc.gsfc.nasa.gov/docs/ixpe/proposals/ixpe_prop.html#legacy
 - Programs can be Standard or Large.
-
- Deep observation of a rapidly rotating stellar-mass black hole in the soft state to search for EVPA rotation versus energy as predicted in General Relativity
 - Deep observation of the Crab pulsar to constrain the emission zone geometry thereby advancing our understanding of the pulse emission mechanism
 - Observation of a high accretion rate AGN to determine the Comptonizing medium geometry
 - Additional studies of stellar-mass BH and NS X-ray transients through all outburst phases to measure the evolution of the accretion geometry
 - Observation of a bright outburst of an accreting millisecond X-ray pulsar suitable for constraining the magnetic field geometry and improving constraints on the NS equation of state
 - Observation of magnetars, in quiescence or outburst, to search for definitive signatures of vacuum birefringence
 - Detection of neutron star free precession in additional accreting X-ray pulsars and extended campaigns to measure the coupling between the crust superfluid and the crust itself

Past Large Projects

Cycle 1

- A unique x-ray polarimetry target: the western hotspot of Pictor A

Cycle 2

- In search of unique polarization signals in the Perseus cluster

Cycle 3

- X-ray polarimetry of the highly accreting Seyfert Ark 564
- Deep IXPE polarimetry of radio-loud magnetar 1E 1547.0-5408: a legacy test of vacuum birefringence and vacuum resonance
- Constraining particle acceleration mechanisms in blazars via high-cadence IXPE observations

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Questions and Answers

Polarization values for previously unobserved sources

Q: According to theory, it was believed that in X-ray White Dwarf can't show polarization. But first time by IXPE observation, X-ray polarization was observed in EX Hya, which was unexpected. If I submit a GO proposal for a source type in which X-ray polarization is not expected, what kind of scientific justification will the evaluator expect, and what is the probability that it will be accepted?

A: Theoretical results in advance of the IXPE observation did suggest that X-ray white dwarfs would show polarization. The paper on the results (Gunderson et al. 2025) includes the sentence:

G. Matt (2004) predicted that the X-rays from polars will be polarized from both scattering within the accretion column and reflection off the WD surface.

Polarization values for previously unobserved sources

More generally, it is important to motivate either 1) polarization at a level detectable with IXPE is expected, or 2) an upper limit on the polarization from IXPE would advance our understanding of the source.

Some potential ways to motivate a target MDP:

- Theoretical models predicting polarization. Being able to distinguish between different models or different geometries based on an x-ray polarization measurement can be compelling.
- Polarization measurements at other wavebands, if the same emission mechanism applies. E.g., for sources that emit synchrotron radiation at both radio and X-rays, radio polarization measurements can be used to motivate the expected X-ray polarization.
- Drawing an analogy with other sources of the same class or other source classes with similar geometry.

Desirable proposals

Q: What types of proposals are most sought after/desirable?

- Proposals to address the legacy projects
- Source classes from which X-ray polarization has not been measured and would be scientifically interesting
- The NRAO joint program is underutilized. Proposing NRAO observation may not help get the proposal accepted, but we would like to see the joint program used.

Sensitivity and analysis

Q: Sensitivity estimation, simulations, data analysis

A: For sensitivity estimate and simulations, see the talks by Swartz and Negro in this meeting. For data analysis, see the GOF Analysis page, the IXPE Quick Start Guide, and the ixpeobssim documentation.

- <https://heasarc.gsfc.nasa.gov/docs/ixpe/analysis/>
- https://heasarc.gsfc.nasa.gov/docs/ixpe/analysis/ixpe_quickstart.pdf
- <https://ixpeobssim.readthedocs.io/en/latest/overview.html>

Also, see the talks in the Friends of IXPE Forum and attend future Forums

<https://heasarc.gsfc.nasa.gov/docs/ixpe/friendsofixpe/>

The next Forum will be Thursday, July 16, and feature a talk by Jack Dinsmore of Stanford University on “IXPE Polarimetry of Pulsar Wind Nebulae”. We are still deciding on the analysis part and would be happy to consider suggestions.

Sensitivity and analysis

Q: Pulse profiles and pulse-phase-dependent analysis capability

A: Both the HEASoft tools, e.g. Xselect, and ixpeobssim can be used to generate pulse profiles. At the current time, pulse-phase-dependent polarization analysis is easier in ixpeobssim. (We should work on making that easier with the HEASoft tools.)

Exclusive use periods

Q: What are the expected data-release timelines for Cycle 4 GO observations, and will there be any proprietary-period extensions for large or time-critical programs?

- Data are released as soon as they are fully processed, typically within two weeks.
- Data from Large Programs and Director's Discretionary Time (DDT) observations have **no** exclusive use period.
- By default, IXPE data from Standard Programs, including GO-approved Targets of Opportunity (ToO's) have no exclusive use period. However,
- **GO proposers may request an exclusive use period of up to 6 months. Such requests are not considered in the proposal evaluation. We encourage requests for exclusive use periods.** Requests for an exclusive-use period must be noted on the proposal cover sheet and justified in the "Expertise and Resources Not Anonymized" document. See the IXPE Cycle 4 Guide for Proposals for more details, including acceptable criteria, <https://heasarc.gsfc.nasa.gov/docs/ixpe/proposals/c4/propguide.html#expertise>

Imaging X-ray Polarimetry Explorer General Observer Program Cycle 4



We look forward to receiving your proposals!

Time constrained IXPE observations

Q: Target of opportunity observations, multi-target proposals, multiwavelength campaigns (time constrained IXPE exposures)

- Time constrained observations must be ranked Category A.
- Proposals that request coordinated observations (via a joint program) can be approved at Category C, in which case the joint observations are not approved.
- Target of opportunity observations can be either for generic or specific targets. Trigger criteria must be clearly defined.
- For multiwavelength campaigns, it is best to describe any constraints in the proposal, e.g. avoid ± 3 days around the full Moon. IXPE observations tend to be long, so usually other observatories follow the IXPE Long Term Plan (LTP). The LTP is usually published about 3 months out. Check the LTP for your target. The LTP is subject to change for ToO's and other events. We do try to keep times for Cat A targets fixed, particularly if the observations are coordinated or otherwise time critical.
- Any coordination or time constraints for Cat C targets are implemented on a best effort basis.

Multi-cycle proposals

Q: Tell me about multi-cycle proposals

- Proposals may request that observations be scheduled over 2- or 3-cycle period.
- The Cycle 4 review may award up to 1 Ms of GO time in each of Cycles 5 and 6.
- Multi-cycle proposals may NOT request ToO observations.
- Multi-cycle proposals may NOT request joint observations.
- If a multi-cycle program is not strongly justified in the proposal text it might be evaluated as a Cycle 4-only proposal.