

XRISM General Observer – Cycle 1

Scope of Program

1.1. Overview

This program element solicits proposals for participation in the ISAS/JAXA program for the conduct of space science observations using X-Ray Imaging and Spectroscopy Mission (XRISM). The XRISM mission is led by ISAS/JAXA, with significant contributions from NASA and ESA. The primary goal of the XRISM mission is to investigate the nature and physics of astrophysical objects as revealed through detailed observations of their high-energy emission. A broad range of astrophysical sources will be studied, including stars, X-ray binaries, diffuse galactic emission, active galactic nuclei, and clusters of galaxies.

JAXA is responsible for allocating the Japanese share of XRISM observing time during the mission via this and subsequent solicitations. The Japan-allocated observing time following the completion of the Performance Verification (PV) phase will be awarded competitively (with a few exceptions, such as international Science Team PV-phase observations carried over to Cycle 1 [see 1.3]). Allocation of the U.S. observing time will be the responsibility of NASA. Allocation of time awarded to proposers from European Space Agency (ESA) member state countries will be the responsibility of ESA. This Call solicits proposals for observations using one or both instruments comprising the XRISM scientific payload.

1.2 The XRISM Mission

1.2.1 Overview

XRISM, the seventh Japanese X-ray Astronomy satellite, is a collaborative mission between ISAS/JAXA and GSFC/NASA, with contributions from over 70 institutions in Japan, the U.S., Canada, and Europe. XRISM, with the unprecedented combination of spectral resolution of the Resolve instrument and the wide field of view of the Xtend instrument, will execute a diverse and exciting program of astrophysical research.

The mission is divided into three distinct operational phases: In-orbit Checkout and initial calibration (“IOC”; ~4 mos.), Performance Verification (“PV”; ~6 mos.), and General Observations (“GO”; see section 1.3.1). At the time of issue of this solicitation, the mission is in the IOC phase. Upon its completion, the international XRISM Science Team will execute the PV observing program, followed by the initiation of the Cycle 1 General Observer program. Contingent upon the successful completion of the IOC and PV phase activities, Cycle 1 will commence about August, 2024, and last for a period of approximately 12 months.

1.2.2 The XRISM Observatory

The XRISM scientific payload is comprised of two co-aligned instruments placed on the focal plane of the X-ray Mirror Assemblies (XMAs), lightweight foil telescopes similar in design to those flown on ASCA and Suzaku, but with an improved half-power diameter (HPD) of ~1.3

arcmin. The cryogenically cooled 6 x 6 microcalorimeter array of Resolve covers a field of view (FOV) of 3 x 3 arcmin² with a spectral resolution of approximately 5 eV over its 0.3 -12 keV bandpass. The spectral capability is the best yet achieved at energies above 3 keV for observations of celestial sources outside the Solar System; in addition, unlike grating instruments, Resolve can observe spatially extended X-ray sources with the same spectral resolution across the FOV. The CCD-based Xtend at the focus of the second XMA has a wide (38 x 38 arcmin²) FOV over the 0.4 -13 keV energy range.

For detailed information about the instruments and the currently available data relevant to their in-orbit performance, proposers should consult the XRISM Proposer's Observatory Guide, which will be accessed at the JAXA XRISM website for proposers.

(<https://xrism.isas.jaxa.jp/research/proposer/announcement/index.html>).

1.2.3 Science Operations

The XRISM spacecraft has a mass of 2,300 kg and was launched on September 7, 2023, from Tanegashima Space Center (TNSC) in Japan. A JAXA HII-A rocket placed the observatory into an approximately circular orbit with an inclination of ~31 degrees and an altitude of ~575 km. XRISM operations are managed by scientists and engineers at ISAS/JAXA. The operations team is responsible for scheduling of the observations, command/control of the satellite, collection of the data, and monitoring of the health of the spacecraft and scientific payload. Spacecraft operations are carried out from the Uchinoura Space Center (USC) in Japan, where direct contact with the satellite is possible for five orbits per day. It is anticipated that typical observations will last 1 – 2 days. The onboard data recorder has a capacity of 12 Gbits, and telemetry can be downlinked to USC at a rate of 8 Mbps for approximately 500 s per contact. The data are routed to ISAS/JAXA, where pre-processing tasks are performed, including FITS conversion and generation of orbit and attitude files. The resultant data are transmitted to the processing pipeline at NASA/GSFC, where calibration data will be applied to the pre-processed science data. Subsequently, the processed data will be copied to identical mission archives at ISAS/JAXA and NASA/GSFC in an encrypted form, at which time their address and the decryption key will be made available to the PI of the observation. At the end of the 1-year proprietary period, the associated data files in the archive will be decrypted and made publicly accessible. It is anticipated that XRISM will generate ~1 Tbyte of data per year, although the total daily data volume rate may approach 8 Gbytes.

1.2.4 Mission Phases

The XRISM Mission is divided into three phases. The initial four months, Phase 0, are dedicated to in-orbit activation, checkout, and calibration of the spacecraft and the instruments. The following six months, Phase 1, consists of the Performance Verification (PV) phase, which is reserved time for the XRISM Science Team (XST) to observe astrophysical sources of interest. Phase 2, which begins approximately 10 months after launch, consists of the GO program. Phase 2 runs until the end of the mission.

1.3 XRISM Cycle 1 General Observer (GO) Program

Individuals affiliated with Japanese institutions at the time of the proposal deadline are invited to submit, as Principal Investigators (PIs), proposals for science observations using the XRISM instruments by responding to this solicitation. If a proposer is affiliated with multiple institutes, the eligibility for being a PI of Japanese investigation is determined based on her/his *primary affiliation*. For professors, postdocs, or any other research staff, an institute which pays at least 50% of their salary is defined (within this solicitation) as their primary affiliation. Any temporary or remote status, such as visiting professor or visiting research fellow, is not considered as a primary affiliation status. Individuals affiliated with institutions outside Japan, US/Canada, or ESA member states in Europe at the time of the proposal deadline are also eligible to submit proposals as PIs. In such a case, however, the proposers *must* designate a co-PI who is affiliated with Japanese institutes. Note also that the relative time allocation to non-Japanese PI's investigations is limited to no more than 4% of the total GO time.

Proposals for investigations based upon observations of celestial sources utilizing the XRISM observatory will be solicited and executed on an annual basis. Cycle 1 observations will be initiated about August, 2024 and will last for a period of approximately 12 months.

The relative time allocations for the various categories of Cycle 1 observing time are as follows:

- Observatory time (Calibration, Director's Reserve, Target of Opportunity (TOO))- 10%;
- Science Team (Carryover of remaining PV observations from Phase 1) - 15%; and,
- GO time - 75%.

The Cycle 1 allocation of GO time among the mission partners is as follows:

- Japanese investigations (including other partners) - 48%.
- U.S. investigations (including Canadian partners) - 44%;
- ESA investigations – 8%;

Each recommended GO target will be assigned a priority grade of A, B, or C by the International Merging Panel based on the recommendation by the Science peer review panel (see 2.1). Note that multiple targets accepted through a single proposal may be assigned different priority grades. Priority A and B targets are guaranteed to be observed; best efforts will be made to schedule such targets within the Cycle 1 period. Those Priority A/B targets that cannot be scheduled during Cycle 1 will automatically be carried over to the subsequent cycle. Note, however, that this practice does not apply to TOO targets: observations of such targets that are unable to be scheduled during Cycle 1 must be re-proposed to a future observing cycle. Priority C targets will have the lowest priority for scheduling; observations of such targets that are not scheduled during Cycle 1 must be resubmitted to a future observing cycle. The available Cycle 1 GO time will be allocated as follows: Priority A = 50%, Priority B = 40%, and Priority C = 50%, resulting in an oversubscription of 40% of the nominal total GO time. Accordingly, C targets will nominally have a 20% probability of being observed during a given cycle, although the actual fraction may be greater if the observing efficiency is higher than predicted.

The Phase 1 (PV) target list was published in February 2021 and is available at the following website (<https://xrism.isas.jaxa.jp/research/proposer/approved/pv/index.html>). It is anticipated that the Science Team carryover time during Phase 2 will be dedicated primarily to the completion of observations of targets initiated during Phase 1. A small number of PV targets have been designated Priority C (and Priority A ToO), for which scheduling of the corresponding observations is not guaranteed. General Observers may propose to observe unscheduled Priority C PV targets or Priority A ToO targets during Cycle 1; however, if the observation is subsequently scheduled during Phase 1, the data rights will remain with the Science Team.

Note that, as a general policy, proposals for scheduled observations of PV Phase A or C targets are permitted. Such proposals must provide a convincing justification of the need for additional observations of the target, e.g., observations during a different binary phase or source state, or of different locations within extended sources. Similarly, proposers may request multiple observations of the same target for a specific investigation. However, such requests will be approved only if a clear scientific and logistical justification of the need for separate observations is provided in the proposal.

In cases where the same target is selected in more than one national program (JAXA, NASA, ESA), the feasibility of merging the two (or three) investigations will be explored. In all instances where feasible, a single observation of the target will be awarded to both proposing teams, a single, Prime PI (PPI) will be designated, and the time will be accounted for based on the nationality of that individual. The PPI will assume the responsibility for planning of the observation, and both teams will have access to the processed data. Alternatively, PIs have the option of indicating on their proposal that they do not wish their proposed observation to merge. In such cases, if one or both of the accepted proposals are so marked, only one will be selected for observation.

PIs will be granted exclusive access to the data resulting from their approved observations for a period of one year. Subsequently, the data will be publicly available in a public archive.

Note that a target form providing details of the requested observation, including the source coordinates, required exposure time, instrument mode, any observing constraints, etc., must be completed for each target to be observed as part of the proposed investigation.

1.3.1.1. Observing Constraints

Proposals may be submitted for investigations requesting observations that can be executed within the one-year period of Cycle 1; proposals for investigations requiring observations beyond the period of Cycle 1 will not be accepted under this solicitation. Best efforts will be made to schedule observations of proposals awarded multiple targets during a contemporaneous time interval; however, this may not be feasible in some cases due to operational constraints.

It is anticipated that XRISM will typically perform one pointing every 1–2 days (exposures of ~50–100 ks). In order to maintain a satellite observing efficiency, the minimum allowable observing time on a particular target is 10 ks. To maximize the breadth of scientific investigations undertaken with XRISM during Cycle 1, observations will be limited to 300 ks per pointing with

the total not to exceed 600 ks per proposal; it is anticipated that these restrictions will be relaxed over succeeding cycles.

Note that as the XRISM Project gains experience in operating the observatory and its instruments, additional operational constraints/clarifications regarding the scheduling of Cycle 1 observations may be issued. In such cases, the change(s) will be posted on the XRISM website.

1.3.1.2 Time-constrained observations

Time-constrained observations, that is, observations with scheduling constraints imposed either by the nature of the target or the requirement for coordination with other ground- or space-based observatories, place a special burden on XRISM mission planning and operations. To maintain the number of such observations at a manageable level, targets requiring time-constrained observations must receive the highest scheduling and scientific priority. Consequently, time-constrained observations must be designated Priority A. (For further discussion of such observations, see the XRISM Proposer's Observatory Guide, available from the JAXA XRISM page for proposers <https://xrism.isas.jaxa.jp/research/proposer/index.html>)

1.3.1.3 Target-of-Opportunity (TOO) observations

Observations of classes of targets involving outbursts from previously identified transient sources or changes in the intensity or spectral state of previously identified persistent sources (designated "pre-approved" Target-of-Opportunity observations) constitute another special category of XRISM observations. Note that, as with time-critical observations, TOO targets must be assigned a rating of Priority A to be eligible for scheduling. Due to the additional complexity associated with the scheduling of observations of time-constrained and TOO targets, a limit will be imposed on the total time awarded to such observations (currently expected to be ~10%). Approved TOO targets that are not triggered or otherwise unable to be scheduled due to observatory constraints during Cycle 1 will *not* be carried over to Cycle 2.

Details regarding the criteria for "triggering" a requested pre-approved TOO observation, as well as an estimate of the trigger probability during Cycle 1, must be provided in the scientific justification and summarized in the target form. Proposers may request observations for up to 10 candidate targets, where the proposed and/or accepted number of triggers need not be identical to the total number of candidate objects (e.g., proposers may request "up to three of the following 10 X-ray transients in outburst"). Even in such cases, the 300 ks limit per pointing and the 600 ks limit on the total requested observing time per proposal are applied.

Proposals for observations of previously unknown sources (the target coordinates cannot be specified) or unexpected phenomena, e.g., a previously unknown X-ray nova or supernova, are not solicited in Cycle 1. Such observations, designated as "generic TOO," will be conducted using the Director's Discretionary Time, through a real-time request. The procedure for requesting the generic TOO observations and the relevant data rights policy can be found at <https://xrism.isas.jaxa.jp/research/proposer/index.html>

2. Proposal submission guideline

Proposers must submit their proposals electronically through the ARK/RPS website at: <https://xrsv1.isas.jaxa.jp/ark/>.

Instructions for submitting proposals via ARK/RPS are provided on the same website.

Each proposal must contain:

- (1) Target Form (generated electronically via ARK/RPS), and
- (2) Scientific Justification

The scientific justification section should be provided in PDF format in A4 paper size, and is limited to 4 pages, with a font size of 11pt or larger. This section must be written in English. However, if the PI does not have a master's or higher-level degree, *and* if the proposers do not wish their proposed observation internationally merged, then the scientific justification written in Japanese is also accepted.

GO Proposals will be evaluated by a science peer panel based on criteria that include the following factors:

- Scientific significance of the proposed observations (background and objectives)
- Use for the XRISM observatory
- Feasibility and rationale for required exposure

In order to be included in the review of proposals for this cycle of the XRISM Guest Investigator Program, all proposal materials must be submitted electronically by 4:30 p.m., Japan Standard Time, April 4, 2024.

Eligibility:

Individuals affiliated with (1) Japanese institutions or (2) institutions outside Japan, US/Canada, or ESA member states, at the time of the proposal. For more details, see section 1.3.

Conditions of observations that can be proposed:

- The proposed observation can be conducted within the Cycle 1 period.
- The requested exposure for a single pointing is not less than 10 ks and does not exceed 300 ks. (If multiple pointings are requested, the net observing time should be 600 ks or less.)
- For TOO observations, the target coordinate must be known.

3. Supplemental Information

Further details concerning the proposal submission requirements and the process can be found on the JAXA XRISM website for proposers (<https://xrism.isas.jaxa.jp/research/proposer/index.html>). This website provides instructions for completing the required proposal forms. A detailed description of the XRISM mission, including technical information relevant to the observatory, instruments, and observation feasibility can be found on the same website. Answers to frequently asked questions can be found at (<https://xrism.isas.jaxa.jp/research/helpdesk/index.html>).