

Call for XRISM Guest Scientist Program

The Institute of Space and Astronautical Science (ISAS), a part of the Japan Aerospace Exploration Agency (JAXA), is developing the X-Ray Imaging and Spectroscopic Mission (XRISM). With its unprecedented capability, XRISM will pioneer broad fields in astrophysical research, contributing to significant advances in physics in this decade. The major scientific goal of the XRISM mission is to reveal “the formation history of the large-scale structure in the universe and galaxy clusters,” “the history of baryonic circulation,” and “the mechanism of energy transportation and circulation in the universe.” XRISM will open a new window on high energy astrophysics with high-resolution X-ray spectroscopy. To achieve these goals, XRISM will observe energetic objects using the *Resolve* (microcalorimeter) and *Xtend* (CCD camera) instruments, both placed on the focal plane of the *X-ray Mirror Assembly (XMA)*.

1. The XRISM Guest Scientist (XGS) program [1]

XRISM will verify the instrumental performances and capabilities of the satellite bus system during the Performance Verification (PV) phase, which is defined to be a continuous ~6 months immediately following the commissioning phase. The PV phase observations will also be used for instrumental calibration, establishing data analysis procedures, and producing scientific outcomes. The prioritized list of the PV observation targets, which have been selected based on the internal discussion within the XRISM Science Team (XST), is now archived online [2]. For each of the PV targets, a Target Team is formed to lead observation planning, data analysis, and publication of scientific results.

The XGS program offers an opportunity to participate in the scientific activities related to the PV phase observations, including observation planning, data analysis, and publication, to scientists who are not members of the XST. Proposals for the XGS are solicited by JAXA and its international partners NASA and ESA simultaneously. JAXA will select up to one XGS for each individual target. (The total number of the XGSs allocated to JAXA is 20 maximum.) The selected XGS will have a data right to the single PV target where the XGS is selected as a member.

It is expected for XGSs to enhance the scientific return of the XRISM PV observations by bringing unique expertise that includes but is not limited to: complementary data on the target from other X-ray observatories or other wavebands, substantial theoretical insight, or specialized data analysis techniques. For more details, please refer to the Appendix, a list of expertise desired from prospective XGS, as well as the abstract of the PV observations science plan [3].

2. XGS proposal solicitation

Interested scientists are invited to apply to the XGS program by responding to this solicitation. It is expected for applicants to significantly contribute to the activities in the particular Target

Team to produce outstanding scientific achievements. Each applicant can suggest up to three targets to participate, though she or he will be selected for up to one PV target.

Applicants are encouraged to read the following documents:

[1] XRISM Guest Scientist (XGS) Program

[2] XRISM PV Target List

[3] Science Objectives of the XRISM Performance Verification phase target teams science plan

Please check the official website of the XRISM project (<https://xrism.isas.jaxa.jp/research/>). Should you have any questions concerning the XGS program, please contact our helpdesk by sending an email to [Z-xrism-xgs-helpdesk@ml.jaxa.jp].

Number of vacancies: up to 1 person for each PV Target Team, and up to 20 persons for whole XGSs selected by JAXA.

Eligibility: (1) Scientists who belong to Japan-based universities/institutes or (2) scientists who have Japanese nationality and are not eligible to apply to the XGS program through NASA's or ESA's solicitation, at the time of the application.

Selection process: Director of ISAS will make the final decision by considering the recommendation by the XGS selection committee assigned by ISAS/JAXA.

Selection criteria: Based on their research record and proposal, the committee will evaluate if applicants can significantly contribute to the activities of the PV Target Team for producing scientific outcomes. Applicants who can bring expertise that complements the existing one on the XST will be highly valued.

Due date: July 4th, 2022

The application should be documented in English and should contain the following information.

1. Name and affiliation of the applicant
2. Research record
 - a. Outline the research achievements relevant to this application within a single page of A4 paper
 - b. Attach the list of relevant papers (up to 5).
3. Name of PV Target Team(s) that the applicant would like to join (up to three with the priority order)
4. Describe how you would like to contribute to the Target Team you selected above, within 1 page of A4 paper. If you apply for more than one targets and if your contribution plans are different between the targets, provide a one-page description for each of the targets.

Applicants are required to apply by sending the above document via email to the following email address, with the subject "XRISM XGS application."

Z-xrism-xgs@ml.jaxa.jp

Contact information:

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Toru Yamada, Director of the Space Astronomy and Astrophysics Department, ISAS/JAXA
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(Please replace [at] with @)

Appendix: Expertise desired for XGS candidates

1. Data analysis technique

The *Resolve* enables, for the first time, high-resolution X-ray non-dispersive spectroscopy with an unprecedented energy-resolution and signal-to-noise ratio, in particular in the 0.3-10 keV energy band. Data analysis will most likely present new challenges. Moreover, the moderate angular resolution of the XRISM telescope implies that the analysis of the *Resolve* data of extended sources will be particularly complex. Therefore, the XRISM Science Team welcomes expertise from scientists who have knowledge or experience on, for instance (but not limited to):

- Machine learning approach for line detection, transient search, Point Spread Function deconvolution etc.
- Data cube modeling and analysis
- Modeling line broadening due to complex spatial and velocity structures (in, e.g., galaxy clusters, SNRs)
- Transfer function modeling for time lag analysis (AGN)
- Doppler tomography (in compact binary objects)
- Cross-calibration with other X-ray operational missions

2. Spectral diagnostics and atomic physics

The unprecedented spectral resolution of the *Resolve* will also allow us to detect spectral features that are unexpected or uncertain in currently available spectral codes due to the paucity of experimental data or limitations in theoretical calculations. Therefore, experts on theoretical or experimental atomic physics related to the following topics are welcome.

- Charge exchange
- Dust X-Ray Absorption/Scattering Fine Structure (XAFS/XSFS)
- Multiple ionization process by ion-ion interaction
- Extremely low ionization or overionized non-equilibrium plasma
- Non-Maxwellian plasma
- Photoionization

3. Theoretical insight and/or numerical simulations

The *Resolve* spectroscopic data will push the boundaries of our knowledge of astrophysics in several areas. The XRISM Science Team expects that the XRISM results will fundamentally challenge existing paradigms, and welcome experts on theoretical models and simulations to support the interpretation of the data, and – in return – contribute to an advancement of the theoretical understanding in our field. The required expertise includes, but is not limited to, the following aspects

For Extragalactic diffuse (galaxies, clusters) science:

- Feedback from active galactic nuclei in cool cores
- Hydrodynamic modeling of the intracluster medium (e.g. turbulence/stripping/sloshing/cold front)

- Hydrodynamic modeling of starburst winds
- Supernova nucleosynthesis modeling

For Galactic diffuse (SNRs, ISM) science:

- Supernova nucleosynthesis modeling
- Dust creation and destruction in SNe and SNR shocks
- Hydrodynamic modeling of SNR evolution
- Shock physics including collisionless heating and cosmic-ray acceleration

For Extragalactic compact (AGN) science:

- Accretion disk theory
- Formation and structure of Broad and Narrow Line Regions and the “torus” in Active Galactic Nuclei (AGN)
- AGN outflows/jets and their interaction with the nuclear environment and the Interstellar Medium
- AGN/star formation connection

For Galactic compact (stellar objects) science:

- Winds launching mechanisms, including line driven winds and MHD simulations in binary systems
- Disk reflection modelling
- Relativistic jets in galactic objects
- Simulations of colliding winds in binaries and binary systems evolution
- State-of-art mass-radius relations models in white dwarfs

4. Multiwavelength observations of specific PV targets

Applications are welcome from scientists who have access to, and expertise in the analysis of complementary multiwavelength data that can facilitate the interpretation of the XRISM data of a specific PV target.