

High-Level Data Processing of Scientific Satellites

Report Number: R23EDU10503

Subject Category: Space and Astronautical Science

URL: <https://www.jss.jaxa.jp/en/ar/e2023/23645/>

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● Abstract

Maximize the scientific results obtained from the data by performing higher-order processing and simulation of data acquired by JAXA's scientific satellites

● Reasons and benefits of using JAXA Supercomputer System

(1) Routine analysis of large amounts of data

Determination of physical parameters describing a large amount of observed data or its error.

(2) Large-scale simulation

Performs large-scale simulations to compare with observed data

(3) Large-scale pipeline processing

Generate standard higher-order data by changing the format of satellite telemetry data or applying various calibrations.

● Achievements of the Year

(1) X-ray astronomy satellite data analysis

Energy spectra of X-ray sources acquired by Suzaku, XMM, NICER, etc. show complex variations. We applied precise physical models to a large number of energy spectra divided into fine time intervals to determine physical parameters and their error ranges.

(2-1) X-ray Astronomy Data Simulation

In order to reproduce the observed spectra acquired by X-ray astronomy satellites, spectra from ionized plasmas were calculated by Monte Carlo simulations, assuming various parameters.

(2-2)Cosmology simulation

In order to determine the specifications of the LiteBIRD satellite planned by JAXA, various instrument parameters were assumed and the expected observation data were simulated.

(3) Reprocessing of all data from the XRISM satellite

As the on-orbit instrument calibration information was updated for the XRISM satellite launched in September 2023, it became necessary to reprocess all data; by using JSS, all data pipeline processing was completed in a short time and ready for distribution to team members.

● Publications

- Peer-reviewed papers

Spectral Modeling of the Supersoft X-Ray Source CAL87 Based on Radiative Transfer Codes", Tsujimoto et al. (DOI: 10.3847/1538-4357/ad0bfa)

"X-Ray Spectral Variations of Circinus X-1 Observed with NICER throughout an Entire Orbital Cycle", Tominaga, et al. (DOI:10.3847/1538-4357/ad0034)

"Origin of the complex iron line structure and spectral variation in Mrk 766", Mochizuki, et al. (DOI:: 10.1093/mnras/stad2329)

- Oral Presentations

*Mochizuki, Y., Mizumoto, M., Ebisawa, K., Origin of the complex iron line structure in Mrk 766, Tracing the SMBH growth: outlook beyond the HSC-SSP, and future collaborations, Session5, Kagoshima University, November and December 2022

*Y. Nagano (Okayama U.), M. Bortolami (Ferrara U.), "Model of beam convolution with a HWP", CMB-INFLATE workshop (23/09/25-26@Roma Sapienza Univ.

* M. Bortolami (Ferrara U.), Y. Takase (Okayama U.), "Pointing systematics in LiteBIRD", (23/09/25-26@Roma Sapienza Univ.

- Poster Presentations

*Mochizuki, Y., Mizumoto, M., Ebisawa, K., Origin of the complex iron line structure and spectral variation in Mrk 766, East-Asia AGN Workshop, p14, Kagoshima University, September 2023

*Yuki Sakurai (Okayama University) / Nicolo Raffuzzi (University of Ferrara)

"Description of Half Wave Plate imperfections", CMB-INFLATE workshop (23/09/25-26@Roma Sapienza Univ.

● Usage of JSS

● Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	1 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources*1(%): 1.15

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	5,424.80	0.00
TOKI-ST	9,032,725.36	9.75
TOKI-GP	21.75	0.00
TOKI-XM	280.63	0.15
TOKI-LM	36,062.65	2.75
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	2,105.00	1.75
/data and /data2	132,686.67	0.82
/ssd	44,431.33	4.20

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	12.45	0.04

*1: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

*2: Fraction of Usage : Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage ^{*2} (%)
ISV Software Licenses (Total)	0.00	0.00

^{*2}: Fraction of Usage : Percentage of usage relative to each resource used in one year.