

Promotion of time-domain astronomy with coordinated observations

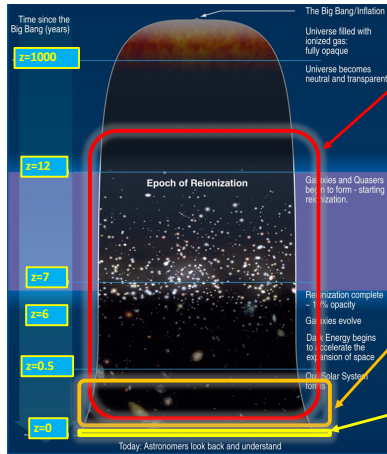
High-redshift Gamma-ray bursts for Unraveling the Dark Ages Mission

- HiZ-GUNDAM -

D. Yonetoku^{1,2}, A. Doi², T. Mihara³, T. Sakamoto⁴, M. Arimoto¹, K. Tsumura⁴, H. Matsuhara², S. Gunji⁶, T. Sawano¹, on behalf of HiZ-GUNDAM Collaboration (1: Kanazawa Univ, 2: ISAS/JAXA, 3: RIKEN, 4: Aoyama Gakuin Univ, 5: Tokyo City Univ, 6: Yamagata Univ)

Overview of HiZ-GUNDAM

Time domain & multi-messenger astronomy



Gamma-ray bursts as a probe:

- First stars (Pop-III)
- Epoch of Reionization
- Synthesis of heavy elements

Gravitational wave events

- NS-NS, NS-BH, BH-BH macronovae (r-process)
- TeV/PeV neutrino events
- SN shock break out
- Tidal disruption
- Fast Radio burst

- Stellar flare
- Galactic X-ray transients

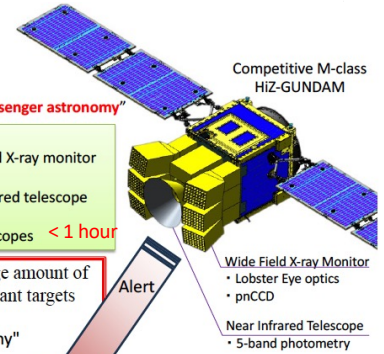
Mission: Time Domain Astronomy

"Exploration of the early universe" and "Multi-messenger astronomy"

Observation strategy

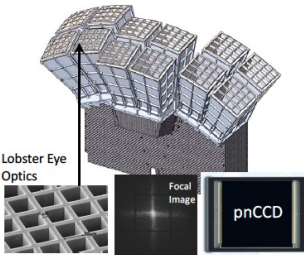
- (1) Discovery of GRBs/transients with the wide field X-ray monitor
- (2) Automatic reporting
- (3) Identification of counterpart with the near infrared telescope
- (4) Alert message
- (5) Spectroscopic observation with large area telescopes < 1 hour

We will discover treasured targets from a large amount of transient sources, and provide them as important targets to large area telescopes. We will promote "early space exploration" and "MM astronomy" with all the power of astronomy.

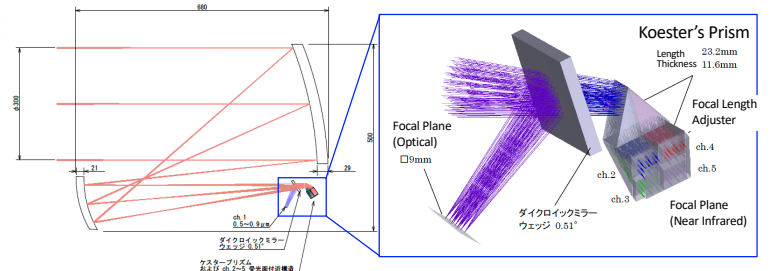
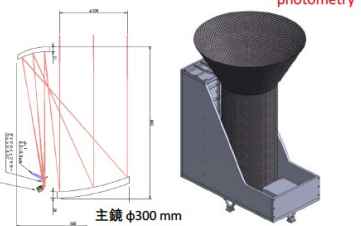


Mission Payloads and Proposed Plan

Wide Field X-ray Monitor

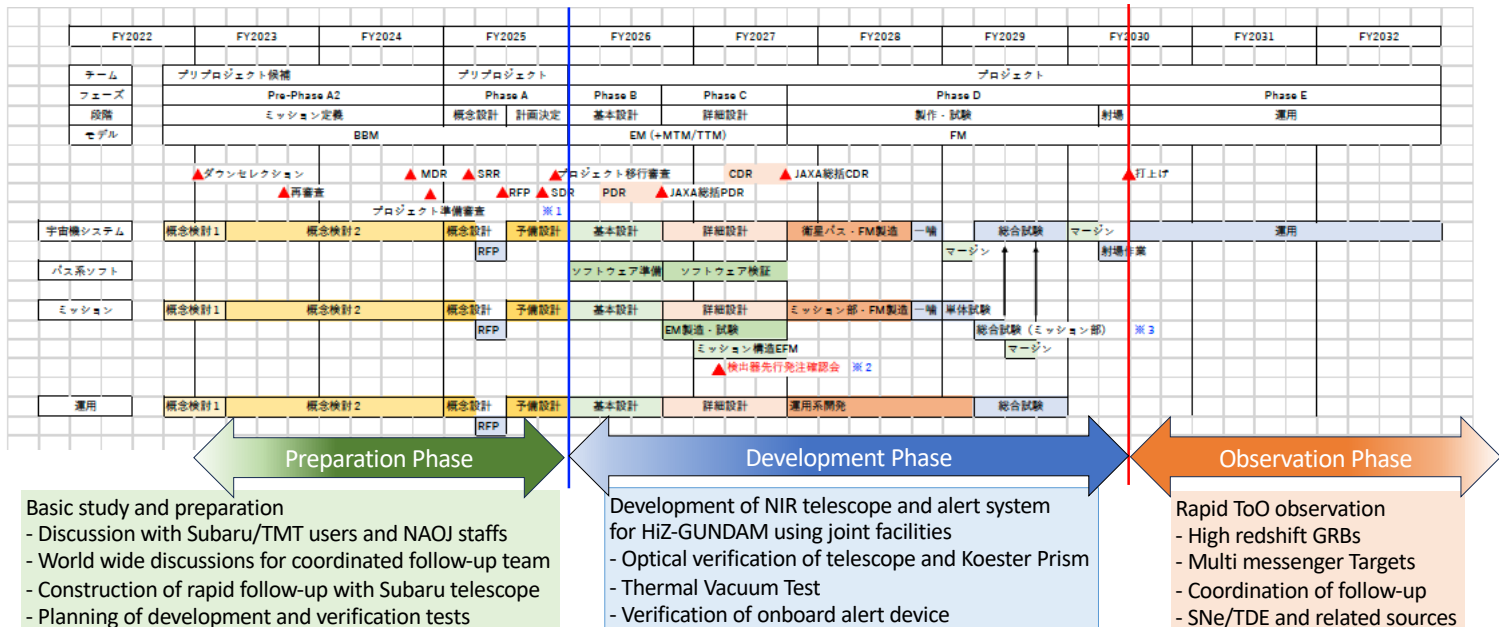


Near Infrared Telescope



Items	Parameters	Items	Parameters
Energy band (keV)	0.4 - 4 keV	Telescope type	Offset Optics
Telescope type	Lobster Eye Optics	Aperture size	30 cm
Optics aperture	240 x 320 mm ²	Focal length	183.5 cm
Number of Unit	6	F number	F6.1
Field of View	> 0.5 str (6 units)	Field of view	15 arcmin × 15 arcmin
Focal length	300 mm	FoV per pixel	2 arcsec × 2 arcsec
Focal plane detectors	pnCCD array	Image size	3 pixel × 3 pixel
Number of modules	16	Integration time	10 minutes (2 minutes × 5 frames)
Sensitivity	1e-10 (erg/cm ² /s) For 100 sec	Observation Band (μm)	0.5-0.9, 0.9-1.3, 1.3-1.7, 1.7-2.1, 2.1-2.5
Position accuracy	3 arcmin	Limiting Magnitude mag (AB)	21.0, 20.6, 20.3, 20.2, 20.1
		Focal detector	HyVISI, HgCdTe (H1RG)

We will perform follow-up observation with large area telescopes, e.g. Subaru, TAO, and future 30-m class telescopes. **A project (group) that can lead rapid ToO observations is needed.** Including the development of NIR telescope and alert system aboard HiZ-GUNDAM, we propose to establish a group which strongly promotes the time domain astronomy in NAOJ. This is firmly related to the multi-messenger astrophysics group, so we plan to unify our proposal with the Multi-messenger Astronomy Group and work with NAOJ researchers in next year.



Preparation Phase
 Basic study and preparation
 - Discussion with Subaru/TMT users and NAOJ staffs
 - World wide discussions for coordinated follow-up team
 - Construction of rapid follow-up with Subaru telescope
 - Planning of development and verification tests

Development Phase
 Development of NIR telescope and alert system for HiZ-GUNDAM using joint facilities
 - Optical verification of telescope and Koester Prism
 - Thermal Vacuum Test
 - Verification of onboard alert device

Observation Phase
 Rapid ToO observation
 - High redshift GRBs
 - Multi messenger Targets
 - Coordination of follow-up
 - SNe/TDE and related sources