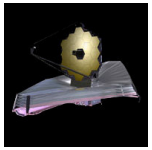

2926 - A pathfinder study of the physical properties of the earliest galaxies. MIRI spectroscopy of GN-z11, a galaxy at redshift 11

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Luis Colina Robledo (PI) (ESA Member)	**Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.**
Prof. Goeran Oestlin (CoI) (ESA Member)	Stockholm University
Dr. Javier Alvarez-Marquez (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.
Dr. Alejandro Crespo Gomez (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.
Dr. Arjan Bik (CoI) (ESA Member)	Stockholm University
Dr. Leindert Boogaard (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Luca Costantin (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.
Gillian Wright (CoI) (ESA Member)	United Kingdom Astronomy Technology Centre
Prof. Jens Hjorth (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute
Dr. Sarah E. I. Bosman (CoI) (ESA Member)	Max Planck Institute for Astronomy
Prof. Pablo G. Perez-Gonzalez (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.
Mr. Danial Langeroodi (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute
Prof. Paul van der Werf (CoI) (ESA Member)	Universiteit Leiden
Dr. Steven Richard Gillman (CoI) (ESA Member)	Technical University of Denmark-DTU Space
Prof. Andreas Eckart (CoI) (ESA Member)	Universitat zu Koln
Mr. Pierluigi Rinaldi (CoI) (ESA Member)	Kapteyn Astronomical Institute
Dr. Florian Peissker (CoI) (ESA Member)	Universitat zu Koeln
Dr. Alvaro Labiano (CoI) (ESA Member)	ESA-European Space Astronomy Centre
Dr. Thomas Greve (CoI) (ESA Member)	Cosmic Dawn Center, DTU Space
Dr. Almudena Alonso-Herrero (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.
Macarena Garcia Marin (CoI) (ESA Member) (US Admin CoI)	Space Telescope Science Institute - ESA - JWST

Name	*Institution*
Prof. Karina Caputi (CoI) (ESA Member)	Kapteyn Astronomical Institute
Dr. Fabian Walter (CoI) (ESA Member)	Max Planck Institute for Astronomy

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
MIRI - GNz11				
	1	GNz11-MRS-short	MIRI Medium Resolution Spectroscopy	(1) GNZ11
	2	GNz11-MRS-medium	MIRI Medium Resolution Spectroscopy	(1) GNZ11

ABSTRACT

JWST has already revolutionized the study of the early galaxy formation in the Universe with the unambiguous spectroscopic identification of several galaxies at redshifts above 10 and up to 13.2. High-redshift ($7 < z < 9.6$) sources do show strong Hbeta+[OIII] emission lines, characterized by extremely high rest-frame equivalent widths ranging from 1000A to 3200A. The MIRI spectrograph (MRS) is the only instrument onboard JWST that can, for the first time, provide the opportunity of detecting these strong optical emission lines ([OIII]4959,5007A, Halpha, Hbeta) at the highest redshifts ($z > 10$), during the early phases of the formation of galaxies and reionization in the Universe. We propose MRS spectroscopy of GN-z11, the brightest known galaxy at redshift beyond 10. Key properties such as the nebular extinction, star formation rate, ionization conditions, dynamical mass, metallicity, ionizing photon rate and production efficiency will be spectroscopically derived for the first time in a galaxy at a redshift of 11. This proposal represents a pathfinder study of the earliest galaxies when the universe was less than 500 million years old. The proposed observations will use the unprecedented and unique capabilities of MIRI/JWST to investigate the physical properties of the population of the earliest bright or weak-lensed galaxies in the Universe, into the early phases of the Epoch of Reionization of the Universe.

OBSERVING DESCRIPTION

The proposal request MIRI spectroscopy of GN-z11 using two of the three configurations: the Short and Medium configurations to obtain the spectrum of the main optical emission lines(Hbeta, [OIII] and Halpha) shifted into the MRS spectral range. A 4-point dither for a point source with the two configurations (NEGATIVE and POSITIVE) is used.

The total integration of about 25 ksec per setting is divided in 6 iterations of 4-point dithers (3 NEGATIVE and 3 POSITIVE), with 2 integrations per dither and 22 groups in SLOWR1 readout mode per integration. In addition, simultaneous internal imaging is taken in FASTR1 mode in three different filters F560W, F770W and F1000W.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	GNZ11	RA: 12 36 25.4600 (189.1060833d) Dec: +62 14 31.40 (62.24206d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies, Primordial galaxies]
Extended=NO

Observation

Proposal 2926, Observation 1: GNz11-MRS-short Mon Aug 07 17:02:28 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	GNZ11	RA: 12 36 25.4600 (189.1060833d) Dec: +62 14 31.40 (62.24206d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies, Primordial galaxies]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	ALL	YES	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	POINT SOURCE	NEGATIVE
2	4-Point	POINT SOURCE	POSITIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F560W	FASTR1	128	3	1	Dither 1	4	12	4284.662	
1	SHORT(A)	MRSLONG		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
1	SHORT(A)	MRSSHORT		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
2		IMAGER	F560W	FASTR1	128	3	1	Dither 2	4	12	4284.662	
2	SHORT(A)	MRSLONG		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
2	SHORT(A)	MRSSHORT		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
3		IMAGER	F770W	FASTR1	128	3	1	Dither 1	4	12	4284.662	
3	SHORT(A)	MRSLONG		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
3	SHORT(A)	MRSSHORT		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
4		IMAGER	F770W	FASTR1	128	3	1	Dither 2	4	12	4284.662	
4	SHORT(A)	MRSLONG		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
4	SHORT(A)	MRSSHORT		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
5		IMAGER	F770W	FASTR1	128	3	1	Dither 1	4	12	4284.662	
5	SHORT(A)	MRSLONG		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
5	SHORT(A)	MRSSHORT		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
6		IMAGER	F770W	FASTR1	128	3	1	Dither 2	4	12	4284.662	
6	SHORT(A)	MRSLONG		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
6	SHORT(A)	MRSSHORT		SLOWR1	22	2	1	Dither 2	4	8	4300.186	

Special Requirements

Same Aperture PA 1, 2

Observation

Proposal 2926, Observation 2: GNz11-MRS-medium Mon Aug 07 17:02:28 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	GNZ11	RA: 12 36 25.4600 (189.1060833d) Dec: +62 14 31.40 (62.24206d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies, Primordial galaxies]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	ALL	YES	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	POINT SOURCE	NEGATIVE
2	4-Point	POINT SOURCE	POSITIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F1000W	FASTR1	125	3	1	Dither 1	4	12	4184.76	
1	MEDIUM(B)	MRSLONG		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
1	MEDIUM(B)	MRSSHORT		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
2		IMAGER	F1000W	FASTR1	125	3	1	Dither 2	4	12	4184.76	
2	MEDIUM(B)	MRSLONG		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
2	MEDIUM(B)	MRSSHORT		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
3		IMAGER	F1000W	FASTR1	125	3	1	Dither 1	4	12	4184.76	
3	MEDIUM(B)	MRSLONG		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
3	MEDIUM(B)	MRSSHORT		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
4		IMAGER	F1000W	FASTR1	125	3	1	Dither 2	4	12	4184.76	
4	MEDIUM(B)	MRSLONG		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
4	MEDIUM(B)	MRSSHORT		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
5		IMAGER	F1000W	FASTR1	125	3	1	Dither 1	4	12	4184.76	
5	MEDIUM(B)	MRSLONG		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
5	MEDIUM(B)	MRSSHORT		SLOWR1	22	2	1	Dither 1	4	8	4300.186	
6		IMAGER	F1000W	FASTR1	125	3	1	Dither 2	4	12	4184.76	
6	MEDIUM(B)	MRSLONG		SLOWR1	22	2	1	Dither 2	4	8	4300.186	
6	MEDIUM(B)	MRSSHORT		SLOWR1	22	2	1	Dither 2	4	8	4300.186	

Special Requirements

Same Aperture PA 1, 2