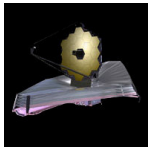

6073 - JWST as a time machine: weighting the carbon produced exclusively by massive stars

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	OB1-JADES	NIRSpec Fixed Slit Spectroscopy	(2) JADES_10058975
	2	OB2-RX	NIRSpec Fixed Slit Spectroscopy	(3) RX_11027

ABSTRACT

Carbon is one of the most abundant elements in the Universe and can be produced both by low/intermediate mass stars (1 < Msun < 8) and massive stars (>8 Msun). The relative contribution of the two channels, however, is still undefined. The interpretation of observations of individual stars and

galaxies is complicated by the fact that it is impossible to separate the two contributors, as any stellar population older than 500 Myr can release carbon into the ISM through both channels.

With JWST we now have the unprecedented opportunity to “travel back in time” and observe stellar populations in which only massive stars could have contributed to the release of carbon. This is because low/intermediate mass stars can significantly contribute to the C budget only at times older than ~ 500 Myrs.

We propose to study the C/O abundance in four spectroscopically confirmed galaxies at $9.1 < z < 9.5$, when the Universe is only 500 Myr old, and only MS contribute to the release of C. We will obtain 28.3 hrs (including overheads) of NIRSpec+G235M spectroscopy on 2 targets, and use archival data for the remaining two. All galaxies have rest-frame optical emission lines, but lack the UV C III]1909 and O III]1666 lines required for measurement of C and O abundances. The proposed observations will constrain the carbon and oxygen yields at early times, shedding light on the nature of the first stars responsible for the pre-enrichment of the ISM.

OBSERVING DESCRIPTION

At $9.1 < z < 9.5$, the OIII]1666 doublet and CIII]1909 doublet are redshifted to 1.68-1.75 and 1.92-2 micrometer, respectively. Therefore, we will observe our targets using NIRSpec in fixed slit mode with the G235M/F170LP grating/filter combination. From existing NIRCam images, the sources' radius is smaller than 0.2", therefore we will observe them with the S200A1 slit. Using the JWST Exposure time calculator, we need 28.31 hours (including overheads) to reach the required S/N in the O III] line (S/N~6), which will correspond to a S/N on CIII]/OIII] of ~ 5. In the calculations, we assumed medium background, and the observational strategy consists of :

JADES 10058975: 230 groups*6 integration * 5 dithers. 46740 exposure time , 58513 sec charged.
RX-ID11027: 200 groups * 6 integration * 5 dithers. 37395 sec exposure time, 47680 sec charged.

5 dithers are chosen to facilitate the background subtraction.

To acquire the target on the slit we will use the Wide Aperture Target Acquisition (WATA) using clear filter and NRSRAPID readout.
For both targets we will first acquire on the nearest star and then slew to our targets.
We chose an M-type star at a distance from the target smaller than 55".

The acquisition object for RX-11027 is a M star at (21:29:42.2060, DEC: +00:05:14.99), which is 21" from the target. The star has J = 15.4 Mag_Vega, and the acquisition image will have S/N=71 using NRSRAPID readout.

The acquisition object for JADES 10058975 is a compact galaxy at (03:32:28.00, -27:46:39.60), which is 17.4" from the target. The star has J = 16.7 Mag_Vega, and the acquisition image will have S/N=24 using NRSRAPIDD6 readout.

This method corrects any errors in absolute telescope pointing (and absolute knowledge of the source coordinates) by centroiding the acquisition target (which may not be the science target) in the aperture and then calculating the to move the science target directly to the desired science aperture position for the first science observation.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	JADES_10058975	RA: 03 32 26.9844 (53.1124350d) Dec: -27 46 28.65 (-27.77463d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[High-redshift galaxies]*				
(3)	RX_11027	RA: 21 29 41.1750 (322.4215625d) Dec: +00 05 30.07 (.09169d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[High-redshift galaxies]*				
(4)	ACQ_RX_11027	RA: 21 29 42.1966 (322.4258192d) Dec: +00 05 15.08 (.08752d) Equinox: J2000	Proper Motion RA: 12.635420502545465 mas/yr Proper Motion Dec: -17.8446943139618 mas/yr Epoch of Position: 2016	
Comments: *Category=Star* *Description=[M stars]* *Extended=NO*				
(6)	ACQ_JADES_10058975	RA: 03 32 28.7400 (53.1197500d) Dec: -27 46 20.70 (-27.77242d) Equinox: J2000	Epoch of Position: 2000	
Comments: Unfortunately there was no star within the distance required for a successful target acquisition. *We found a round object that according to SIMBAD should be an AGN with J (AB mag) ~20.45* *The only uncertainty I could find on the coordinates are the Merged positional error on ellipse semi-major and semi-minor axis 0.169, 0.159 arcsec, respectively.* *Proper motion should be negligible.* *Let me know if there's any issue with this TA. Thank you!* *Category=Galaxy* *Description=[Active galactic nuclei, Active galaxies]* *Extended=YES*				

Observation

Proposal 6073, Observation 1: OB1-JADES Wed Aug 14 20:00:29 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit 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
(2)	JADES_10058975	RA: 03 32 26.9844 (53.1124350d) Dec: -27 46 28.65 (-27.77463d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[High-redshift galaxies]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	6 ACQ_JADES_10058975	WATA	SUB32	CLEAR	NRSRAPIDD6	3	1	1	0.26	169837

Template

Slit	Subarray
S200A1	SUBS200A1

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	5	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G235M/F170LP	S200A1	NRS	250	6	1	NONE	5	30	46787.354	169837

Observation

Proposal 6073, Observation 2: OB2-RX

Wed Aug 14 20:00:29 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit 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
(3)	RX_11027	RA: 21 29 41.1750 (322.4215625d) Dec: +00 05 30.07 (.09169d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[High-redshift galaxies]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 ACQ_RX_11027	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	169837

Template

Slit	Subarray
S200A1	SUBS200A1

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	5	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G235M/F170LP	S200A1	NRS	200	6	1	NONE	5	30	37439.354	169837