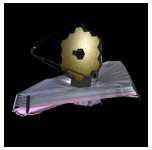

8139 - Local Analogs of JWST's high-z AGN: Uncovering a deeply embedded IMBH in a compact metal poor dwarf

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
J1201+0211				
	1		MIRI Medium Resolution Spectroscopy	(1) J1201+0211-MIRI
	2		MIRI Medium Resolution Spectroscopy	(2) J1201+0211-MIRI-BG

ABSTRACT

Observing the earliest galaxies and their black holes during the epoch of reionization is one of the major goals of JWST. While JWST has delivered spectacular rest-frame optical and UV observations of galaxies at high redshift, these observations lack the spatial resolution, sensitivity, and access to longer wavelengths necessary to constrain the ionizing radiation field, and map the state and structure of the ISM of these galaxies. Thus, despite the tremendous progress in uncovering faint AGNs in the early universe, our understanding of the earliest black holes and their impact on their host galaxies remains incomplete. While it is not possible to uncover faint AGNs in metal poor dwarfs and study the detailed physics of their interaction with their host galaxies at high-z, objects like the faint AGNs discovered by JWST at high-z do exist in the local universe. We propose a MIRI/MRS investigation of J1201+0211, a compact metal poor dwarf recently found by JWST NIRSpec to display a striking unresolved nuclear source with steeply rising continuum suggestive of an accreting IMBH and inconsistent with even the most extreme stellar population known, yet no high ionization lines are detected in the NIR. Our observations are designed to confirm or refute the presence of an accreting IMBH, constrain the radiation field and stellar population, and map the ISM on scales down to parsec scales in local primordial galaxy analogs, paving the way for a new understanding of the high-z AGNs now being discovered by JWST. These observations can uncover an IMBH with mass two orders of magnitude lower than any known, or identify crucial unknown physics in metal poor stars and the ISM.

OBSERVING DESCRIPTION

The goal of this proposal is to obtain mid-infrared spectra of J1201+0211, a low metallicity dwarf galaxy three orders of magnitude less massive than the LMC to search for an accreting IMBH hidden in the near-IR, constrain the stellar population, characterize the state and structure of the ISM, determine the source of dust heating, and study the dust properties and distribution. These goals are impossible to achieve from any other ground or space facility. We request the full MIRI/MRS wavelength range (4 channels, 3 spectral settings) to detect all major mid-IR lines and constrain the vast range of ionization potential, sample both the ionized and molecular gas, and provide crucial constraints to the SED modeling needed to understand the source of dust heating.

No target acquisition is needed, since we do not require a pointing accuracy better than 0.14".

We carefully determined S/N requirements on the various emission lines based on the latest ETC. The S/N requirements would require more than 180 groups/integration with the FASTR1 readout pattern, so following the advice on JDox), we select SLOWR1. We select 1 integration with 28 groups to maximize the signal-to-noise ratio (based on ETC calculation), while obtaining a reliable ramp slope (the integration time is less than < 700s, so we don't need to our exposure into multiple integrations.

A 4-point dithering, optimized for all wavelengths, is used to mitigate
contamination by bad pixels, by sampling the target with redundant detector locations.
The dither pattern used ensures that the source is always within the field-of-view, i.e., minimizing uncertainties
on the source extent and/or due to the pointing accuracy.

No saturation issues are expected based on ETC estimates.

Dedicated offset background observations are requested for the target, in order to remove the zodiacal emission and telescope thermal emission. The background exposures also have 2 dither pointings, as recommended by JDox and are chosen to be half an arcminute off the target.

MIRI/MRS simultaneous imaging in F770W filter will be used to improve the astrometric solution.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	J1201+0211-MIRI	RA: 12 01 22.3128 (180.3429700d) Dec: +02 11 8.35 (2.18565d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[Compact dwarf galaxy, Dwarf irregular galaxies, Emission line galaxies]* *Extended=YES*				
(2)	J1201+0211-MIRI-BG	RA: 12 01 24.0834 (180.3503475d) Dec: +02 11 36.46 (2.19346d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[Compact dwarf galaxy, Dwarf galaxies, Dwarf irregular galaxies, Emission line galaxies]* *Extended=YES*				

Observation

Proposal 8139, Observation 1 Tue Mar 11 22:03:21 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[Observation 2]

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)	J1201+0211-MIRI	RA: 12 01 22.3128 (180.3429700d) Dec: +02 11 8.35 (2.18565d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Compact dwarf galaxy, Dwarf irregular galaxies, Emission line galaxies]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	All MRS	YES	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

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	F770W	SLOWR1	28	1	1	Dither 1	4	4	2675.671	
1	SHORT(A)	MRSLONG		SLOWR1	28	1	1	Dither 1	4	4	2675.671	
1	SHORT(A)	MRSSHORT		SLOWR1	28	1	1	Dither 1	4	4	2675.671	
2		IMAGER	F770W	SLOWR1	28	1	1	Dither 1	4	4	2675.671	
2	MEDIUM(B)	MRSLONG		SLOWR1	28	1	1	Dither 1	4	4	2675.671	
2	MEDIUM(B)	MRSSHORT		SLOWR1	28	1	1	Dither 1	4	4	2675.671	
3		IMAGER	F770W	SLOWR1	28	1	1	Dither 1	4	4	2675.671	
3	LONG(C)	MRSLONG		SLOWR1	28	1	1	Dither 1	4	4	2675.671	
3	LONG(C)	MRSSHORT		SLOWR1	28	1	1	Dither 1	4	4	2675.671	

Special Requirements	Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 8139, Observation 2 Tue Mar 11 22:03:21 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [Observation 1]

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
(2)	J1201+0211-MIRI-BG	RA: 12 01 24.0834 (180.3503475d) Dec: +02 11 36.46 (2.19346d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Compact dwarf galaxy, Dwarf galaxies, Dwarf irregular galaxies, Emission line galaxies]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	All MRS	YES	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	2-Point	EXTENDED SOURCE	NEGATIVE

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	F770W	SLOWR1	28	1	1	Dither 1	2	2	1337.836	
1	SHORT(A)	MRSLONG		SLOWR1	28	1	1	Dither 1	2	2	1337.836	
1	SHORT(A)	MRSSHORT		SLOWR1	28	1	1	Dither 1	2	2	1337.836	
2		IMAGER	F770W	SLOWR1	28	1	1	Dither 1	2	2	1337.836	
2	MEDIUM(B)	MRSLONG		SLOWR1	28	1	1	Dither 1	2	2	1337.836	
2	MEDIUM(B)	MRSSHORT		SLOWR1	28	1	1	Dither 1	2	2	1337.836	
3		IMAGER	F770W	SLOWR1	28	1	1	Dither 1	2	2	1337.836	
3	LONG(C)	MRSLONG		SLOWR1	28	1	1	Dither 1	2	2	1337.836	
3	LONG(C)	MRSSHORT		SLOWR1	28	1	1	Dither 1	2	2	1337.836	

Special Requirements	Sequence Observations 1, 2, Non-interruptible