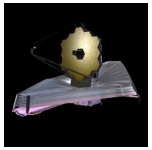

6036 - JWST+ALMA reveals the earliest-known thin disk galaxy

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRCam WFSS				
	1	WFSS GRISMC (along major axis)	NIRCam Wide Field Slitless Spectroscopy	(1) REBELS-25

ABSTRACT

According to prevailing galaxy evolution models, galaxies at high redshifts should be increasingly dominated by chaotic and turbulent motion. Remarkably, a highly rotation dominated disk galaxy has recently been discovered at z=7.3, with exquisitely resolved (700pc) high-fidelity ALMA [CII] observations revealing a v/sigma = 10 — an order of magnitude higher than predicted. Here we propose NIRCam WFSS+imaging observations of this extraordinary target. We will utilize a novel method to measure the ionized gas dynamics directly from NIRCam grism data via the bright [OIII] 5007A nebular emission line (which falls in the NIRSpec chip gap between z=6.95-7.4). These observations are critical for constraining the ionized gas kinematics, testing whether the discrepancy with theory is due to the gas tracer used. Importantly, this proposal will also reveal the underlying stellar populations on the same (sub-)kpc scales as the high-fidelity ALMA [CII]+dust imaging, crucial for unveiling the highly dust-obscured stellar morphology, deriving an accurate stellar mass to test early disk formation models/decompose the rotation curve, and constraining early dust production mechanisms. As an added bonus, we will use NIRCam's large field of view to detect ~20 neighbor galaxies via [OIII] emission, piloting this method for larger samples. Combined with the unrivaled ALMA imaging of an exceptionally bright target, the proposed program is a rare opportunity for a joint ALMA+JWST study of the formation of the Universe's first disk galaxies.

OBSERVING DESCRIPTION

This proposal intends to obtain (sub-)kpc scale spectroscopy and multi-band imaging of the z=7.306 thin disk galaxy REBELS-25 and its large-scale environment with NIRCam Wide Field Slitless Spectroscopy (WFSS)+imaging. The goals of the observations are to measure the ionized gas kinematics directly from the grism data using the bright [OIII] 5007A nebular emission line, and to reveal the currently dust-obscured stellar morphology. As an added bonus, we will use NIRCam's large field of view to detect ~20 neighbor z=7.3 galaxies via their [OIII] emission. Use of Module A is sufficient to reduce the excess data rate while still probing the large-scale environment (~5 cMpc).

We will use the F410M grism filter for maximum sensitivity to [OIII]5007 at redshift z=7.3. We request both GRISMR and GRISMC dispersion directions to mitigate any confusion from spectral overlap. We input a position angle restriction in order to orient one of the dispersion directions (GRISMC) approximately along the major axis of REBELS-25 as measured from the ALMA [CII] data, where we include +/-10deg in order to maintain scheduling flexibility.

Simultaneously with the F410M grism observations, we obtain F150W and F200W imaging observations (one filter for each grism exposure). For the accompanying direct imaging, we obtain F410M+F090W. The F090W filter is included specifically for the study of neighboring galaxies, where it is necessary to identify and exclude low-redshift interlopers emitting in, e.g., Halpha. The remaining filters (which can be accurately corrected for emission line contamination using the grism data) will provide (sub-)kpc imaging of the UV-optical stellar populations of REBELS-25 and

neighboring galaxies. Based on the sensitivity of the F410M filter to the background configuration in the ETC, we request background limited observations with a background no more than 50th percentile above minimum. This is sufficient to limit the effect to <10% while maintaining scheduling flexibility.

Proposal 6036 - Targets - JWST+ALMA reveals the earliest-known thin disk galaxy

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	REBELS-25	RA: 10 00 32.3220 (150.1346750d) Dec: +01 44 31.26 (1.74202d) Equinox: J2000	Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Disk galaxies, High-redshift galaxies, Ultraluminous infrared galaxies]
Extended=NO

Observation

Proposal 6036, Observation 1: WFSS GRISMC (along major axis)

Fri Mar 01 05:03:58 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Wide Field Slitless 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)	REBELS-25	RA: 10 00 32.3220 (150.1346750d) Dec: +01 44 31.26 (1.74202d) Equinox: J2000	Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Disk galaxies, High-redshift galaxies, Ultraluminous infrared galaxies]
Extended=NO

Template

Module	Subarray	Grism (Long Wavelength)
A	FULL	BOTH

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Positions
1	INTRAMODULEX	2	2-Point

Direct Image

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
1	F090W	F410M	SHALLOW4	7	2	2	740.837		GRISMR	Direct Image	1
2	F090W	F410M	SHALLOW4	7	2	2	740.837		GRISMR	Direct Image	1
3	F090W	F410M	SHALLOW4	7	2	2	740.837		GRISMC	Direct Image	1
4	F090W	F410M	SHALLOW4	7	2	2	740.837		GRISMC	Direct Image	1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
1	F200W	F410M	SHALLOW4	7	2	8	2963.349		GRISMR	Grism (Long Wavelength)	4
2	F150W	F410M	SHALLOW4	7	2	8	2963.349		GRISMR	Grism (Long Wavelength)	4
3	F090W	F410M	SHALLOW4	7	2	4	1481.674			Out of Field	2
4	F200W	F410M	SHALLOW4	7	2	8	2963.349		GRISMC	Grism (Long Wavelength)	4
5	F150W	F410M	SHALLOW4	7	2	8	2963.349		GRISMC	Grism (Long Wavelength)	4
6	F090W	F410M	SHALLOW4	7	2	4	1481.674			Out of Field	2

Special Requirements	
	Aperture PA Range 112 to 132 Degrees (V3 112.0 to 132.0) Background Limited. Background no more than 50th percentile above minimum