



5761 - Ionized Gas Kinematics of a $z > 4$ Main Sequence Disk Galaxy

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
NIRSPEC/IFU for J0817+1351				
	1		NIRSpec IFU Spectroscopy	(1) ALMA-J081740.86+135138.2

ABSTRACT

Fundamental to any theory of galaxy formation is a description of the spin-up of galactic disks across cosmic time. Current conventional wisdom asserts that the process is driven by mergers and gas accretion, both to fuel star formation and to impart angular momentum. However, the onset of disk formation is set by hard-to-model physical processes. ALMA [CII] observations have revealed the first disk galaxies at $z > 4$, suggestive that disks are already commonplace at these high redshifts. Using JWST, we now have the exciting opportunity to explore the ionized gas kinematics and morphology of these galaxies. In this proposal we aim to do exactly this for the archetypal early disk galaxy, the Wolfe disk, which is the best studied main sequence [CII]-emitting disk galaxy at $z > 4$. Using NIRSpec IFU H α observations, we will constrain the kinematics of the ionized gas, and compare it to the kinematics of the cold ISM as traced by [CII] and CO in order to test the prediction that ionized gas is dynamically hotter than the cold ISM. We will also constrain the morphology of the ionized gas to explore the distribution of star formation within the disk and compare this to the distribution of the cold ISM. The proposed NIRSPEC/IFU observations will extend the kinematic analysis of main-sequence disk galaxies at $z \sim$

2 to one of the earliest known main-sequence disk galaxies. This will enable a fair comparison between these two populations without the intrinsic uncertainty of using different tracers to characterize their kinematics and open up a new window for exploring main sequence disk galaxies in the early universe.

OBSERVING DESCRIPTION

The target for our observations is the Wolfe disk, an unlensed, rotating disk galaxy at $z=4.26$. Using the NIRSpec IFU with the G395H/F290LP grating, we will observe the H α nebular emission line in order to trace the kinematics and morphology of the ionized gas. We will compare this with the [CII] emission image, at similar angular resolution, already obtained with ALMA. The IFU observations will also detect the underlying stellar continuum of the disk galaxy. In order to detect the H α emission away from the center at high S/N ratio to determine the kinematics, we require 11,788s on-source time (20 groups per integration, with 2 integrations per exposure using a 4-nod pattern with the NRSIRS2 readout pattern). The size of the Wolfe disk (radius $< 0.4''$) is sufficiently compact to allow for this nodding pattern. We will perform a WATA on a nearby QSO (6" away).

Proposal 5761 - Targets - Ionized Gas Kinematics of a $z > 4$ Main Sequence Disk Galaxy

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ALMA-J081740.86+135138.2	RA: 08 17 40.8630 (124.4202625d) Dec: +13 51 38.23 (13.86062d) Equinox: J2000	Epoch of Position: 2000	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> <i>Category=Galaxy</i> <i>Description=[Disk galaxies, High-redshift galaxies, Quasar-galaxy pairs]</i> <i>Extended=YES</i></p>				
(2)	QSO-J0817+1351	RA: 08 17 40.5277 (124.4188654d) Dec: +13 51 34.56 (13.85960d) Equinox: J2000	Epoch of Position: 2000	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> <i>Category=Galaxy</i> <i>Description=[Quasars]</i> <i>Extended=NO</i></p>				

Fixed Targets

Proposal 5761 - Observation 1 - Ionized Gas Kinematics of a $z > 4$ Main Sequence Disk Galaxy

Tue Jan 21 22:00:17 GMT 2025

Observation	Proposal 5761, Observation 1 Diagnostic Status: Warning Observing Template: NIRSpec IFU Spectroscopy																																		
	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.																																		
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th colspan="4">Targ. Coord. Corrections</th> <th colspan="4">Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>ALMA-J081740.86+135138.2</td> <td>RA: 08 17 40.8630 (124.4202625d) Dec: +13 51 38.23 (13.86062d) Equinox: J2000</td> <td colspan="4">Epoch of Position: 2000</td> <td colspan="4"></td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Galaxy Description=[Disk galaxies, High-redshift galaxies, Quasar-galaxy pairs] Extended=YES</p>											#	Name	Target Coordinates	Targ. Coord. Corrections				Miscellaneous				(1)	ALMA-J081740.86+135138.2	RA: 08 17 40.8630 (124.4202625d) Dec: +13 51 38.23 (13.86062d) Equinox: J2000	Epoch of Position: 2000									
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