



4691 - Investigating an Extreme [OIII] Outflow Discovered in a Reionization-era Luminous Quasar

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1		NIRSpec IFU Spectroscopy	(1) J0224-4711
	2		NIRSpec IFU Spectroscopy	(2) SKY

ABSTRACT

Observations of $z > 6$ quasars have revealed the existence of billion solar-mass supermassive black holes (SMBHs) and massive host galaxies with intense star formation in the early Universe. A key open question is whether and how the energy output by these first SMBHs regulates the star formation in their host galaxies through quasar feedback. The [OIII] 4959,5007 doublet is regarded as a primary tracer of galactic-scale outflows, but related studies have been largely limited to $z < 3.5$ until the advent of JWST due to limitations in wavelength coverage, resolution, and sensitivity. Quasar J0224-4711 at $z = 6.5$ was observed with JWST NIRCам/WFSS in Cycle 1, and shows signatures of an extreme [OIII] outflow. It is the only case known in high-redshift quasars so far, and one of the most extreme quasar [OIII] outflows known over cosmic time. This system is clearly showcasing one of the most powerful quasar feedback events ever observed. Existing data are limited to shallow slitless spectroscopy. Thus, we propose deep NIRSpec/IFU observations to investigate this strong outflow and the quasar-host galaxy system. The proposed observations will resolve the [OIII] outflow spatially and spectroscopically to map its spatial extent, measure its kinematic properties, and probe the wind-driving mechanism. We will also be able to characterize the host galaxy properties by constraining its spectral energy distribution and mapping narrow emission lines. The observations will reveal the nature of the most powerful AGN feedback known in distant quasars and will be a milestone in our understanding of SMBH-host galaxy interaction, particularly during the early, fast-growing stage of the SMBH.

OBSERVING DESCRIPTION

We proposed NIRSpec/IFU observations of a quasar at $z=6.5$ which is found to have extreme [OIII] outflow signatures. The proposed IFU observations will resolve the [OIII] outflow and characterise the outflow and the quasar host galaxy.

We choose G395H/F290LP to cover the main emission lines from H-beta to H-alpha (~ 3.66 to 4.94 micron). G395H is selected for higher resolution ($R \sim 2700$, 110 km/s), which is needed for kinematic modeling. Given our science goals, the on-source exposure time estimated using the JWST ETC is 10.5 hours. Including background observation, MSA leakage calibration, and overhead, the total charged time is 16.2 hours.

We will use the NRSIRS2 readout pattern with 9-point dither (CYCLING-SMALL), 19 groups per integration, and 3 integrations per exposure (~ 1400 s per integrations).

Proposal 4691 - Targets - Investigating an Extreme [OIII] Outflow Discovered in a Reionization-era Luminous Quasar

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	J0224-4711	RA: 02 24 26.5480 (36.1106167d) Dec: -47 11 29.41 (-47.19150d) Equinox: J2000 <i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Active galactic nuclei, Emission line galaxies, Quasars]</i> <i>Extended=YES</i>		
(2)	SKY	RA: 02 24 25.6704 (36.1069600d) Dec: -47 11 26.81 (-47.19078d) Equinox: J2000 <i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i> <i>Extended=NO</i>			

Proposal 4691 - Observation 1 - Investigating an Extreme [OIII] Outflow Discovered in a Reionization-era Luminous Quasar

Thu Jul 11 16:00:22 GMT 2024

Observation	<p>Proposal 4691, Observation 1</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSspec IFU Spectroscopy</p> <p>Background Observations:[Observation 2]</p>											
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)	J0224-4711	RA: 02 24 26.5480 (36.1106167d) Dec: -47 11 29.41 (-47.19150d) Equinox: J2000									
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Active galactic nuclei, Emission line galaxies, Quasars]</i> <i>Extended=YES</i></p>											
Template	TA Method											
	NONE											
Dithers	#	Dither Type		Size	Starting Point			Number of Points	Points			
	1	CYCLING		SMALL	1			9				
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Ex p	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	G395H/F290LP	NRSIRS2	19	3	false	true	NONE	9	27	37814.403	
	2	G395H/F290LP	NRSIRS2	19	3	true	false	NONE	1	3	4201.6	
Special Requirements	<p>Aperture PA Range 81.97164917 to 98.97164917 Degrees (V3 303.0 to 320.0)</p> <p>Sequence Observations 1, 2, Non-interruptible</p>											

Proposal 4691 - Observation 2 - Investigating an Extreme [OIII] Outflow Discovered in a Reionization-era Luminous Quasar

Thu Jul 11 16:00:22 GMT 2024

Observation	<p>Proposal 4691, Observation 2</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec IFU Spectroscopy</p> <p>Background Observation For: [Observation 1]</p>												
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)	SKY	RA: 02 24 25.6704 (36.1069600d) Dec: -47 11 26.81 (-47.19078d) Equinox: J2000										
	<p><i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i> <i>Extended=NO</i></p>												
Template	TA Method												
	NONE												
Dithers	#	Dither Type		Size	Starting Point			Number of Points	Points				
	1	NONE											
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	
	1	G395H/F290LP	NRSIRS2	19	3	false	false	NONE	1	3	4201.6		
Special Requirements	<p>Aperture PA Range 89.97164917 to 105.97164917 Degrees (V3 311.0 to 327.0)</p> <p>Sequence Observations 1, 2, Non-interruptible</p>												