



10075 - A second multiply-imaged Little Red Dot: Abell383-QSO1

Cycle: 5, 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	Abell383-QSO1a	NIRSpec IFU Spectroscopy	(1) Abell383-QSO1a
	2	Abell383-QSO1b	NIRSpec IFU Spectroscopy	(2) Abell383-QSO1b

ABSTRACT

One of the most exciting discoveries from JWST is a new population of compact red objects dubbed Little Red Dots (LRDs). One of the first examples of the LRD prototype was an extremely red and compact object triply imaged by the galaxy cluster Abell 2744, Abell-2744-QSO1 -- the only strongly lensed LRD known to date. Thanks to lensing constraints on its small size and tentative spectroscopic variability between its time-delayed multiple images, this object provided important hints that these sources were likely supermassive black holes. It was recently shown that lensing magnification also allows JWST to marginally resolve the SMBH's sphere of influence, enabling a direct dynamical mass measurement with NIRSpec IFU. Here we report the discovery of a second, multiply imaged $z_{\text{Lya}}=6.027$ LRD, for which we seek NIRSpec IFU observations to obtain its full spectrum, establish a baseline for variability studies, and measure the black hole mass through both the broad line width as well as dynamically, which can only be done for lensed LRDs with JWST. Similar to other LRDs, this source also shows a nearby blue companion (~ 150 pc away), resolvable here thanks to lensing, allowing us perhaps for the first time to spectroscopically explore the blue companion's nature and its relation to the LRD.

OBSERVING DESCRIPTION

We request NIRSpec IFU PRISM ($R\sim 100$) observations of two mirrored images, and 395H/290LP ($R\sim 2700$) and observations of the brightest image, of the second strongly lensed Little Red Dot now found. The PRISM observations for both lensed images, will consist of 2.5 hours (8899 sec) each, while we use a medium cycling pattern with 10-point dithers and 12 groups per integration. This will cover the full wavelength range of rest-frame

UV-to-optical lines from Lyman alpha through CIV, and Hbeta+[OIII], to beyond Halpha.

The PRISM observations will be used to examine the spectrum of the object, check for UV emission lines (that are not always seen in LRDs or their companions) and measure the broad emission lines from which a scaling-relation based BH mass would be derived.

In addition, we will use these to test for variability (both in line flux, continuum, or equivalent width) between the two images, that are time delayed by about 5 years in the observer frame (0.7 years in the rest frame). The combined flux from the two images, assuming no variability, is equivalent to ~300 hours of NIRSpec-IFU PRISM observations on the LRD, were it not lensed.

As for the higher-resolution IFU observations of the brightest image, we again use medium cycling pattern with 10-point dithers and 35 groups/integration for a total exposure time of 7.13 hours (25676 sec).

These high-resolution observations will be used to map the kinematics of the gas and ionization state around the LRD, test for outflows, and by fitting a model to the 2D velocity map, obtain a direct dynamical mass of the BH to compare with that from the scaling relations.

Moreover, the LRD has a prominent blue companion next to it which, thanks to lensing, is expected to be at the same redshift. Hence the 2D IFU velocity field data will also be used to examine the relation and nature of the blue companion.

Our observational setup follows a successful measurement made for the only lensed LRD to date, Abell2744-QSO1, by BlackTHUNDER. A383-QSO1 is brighter by about 1-1.5 mags than A2744-QSO1 thus guaranteeing sufficient SNR.

Proposal 10075 - Targets - A second multiply-imaged Little Red Dot: Abell383-QSO1

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	Abell383-QSO1a	RA: 02 48 3.2845 (42.0136854d) Dec: -03 31 34.93 (-3.52637d) Equinox: J2000	Epoch of Position: 2000.0	
	Comments: Category=Galaxy Description=[Active galactic nuclei, Galaxy nuclei, High-redshift galaxies]				
Fixed Targets	(2)	Abell383-QSO1b	RA: 02 48 4.6180 (42.0192417d) Dec: -03 31 58.55 (-3.53293d) Equinox: J2000	Epoch of Position: 2000.0	
	Comments: Category=Galaxy Description=[Active galactic nuclei, Galaxy nuclei, High-redshift galaxies]				

Proposal 10075 - Observation 1 - A second multiply-imaged Little Red Dot: Abell383-QSO1

Observation	Proposal 10075, Observation 1: Abell383-QSO1a											Tue May 26 14:00:37 GMT 2026
	Diagnostic Status: Warning											
	Observing Template: NIRSpec IFU 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)	Abell383-QSO1a		RA: 02 48 3.2845 (42.0136854d)			Epoch of Position: 2000.0					
				Dec: -03 31 34.93 (-3.52637d)								
				Equinox: J2000								
Template	Comments: Category=Galaxy Description=[Active galactic nuclei, Galaxy nuclei, High-redshift galaxies]											
	TA Method						HFF Readout Mode					
	NONE						false					
Dithers	#	Dither Type			Size		Starting Point		Number of Points		Points	
	1	CYCLING			MEDIUM		1		10			
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
	1	PRISM/CLEAR	NRSIRS2	12	1	false	true	NONE	10	10	8899.223	
	2	G395H/F290LP	NRSIRS2	35	1	false	true	NONE	10	10	25676.446	

Proposal 10075 - Observation 2 - A second multiply-imaged Little Red Dot: Abell383-QSO1

Observation	Proposal 10075, Observation 2: Abell383-QSO1b											Tue May 26 14:00:37 GMT 2026
	Diagnostic Status: Warning											
	Observing Template: NIRSpec IFU 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		
	(2)	Abell383-QSO1b		RA: 02 48 4.6180 (42.0192417d) Dec: -03 31 58.55 (-3.53293d) Equinox: J2000			Epoch of Position: 2000.0					
	Comments: Category=Galaxy Description=[Active galactic nuclei, Galaxy nuclei, High-redshift galaxies]											
Template	TA Method						HFF Readout Mode					
	NONE						false					
Dithers	#	Dither Type			Size		Starting Point		Number of Points		Points	
	1	CYCLING			MEDIUM		1		10			
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
	1	PRISM/CLEAR	NRSIRS2	12	1	false	true	NONE	10	10	8899.223	