



9433 - Black hole primacy - do supermassive black holes really predate galaxies?

Cycle: 4, Proposal Category: DD

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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) TheCliff

ABSTRACT

Explaining the formation and rapid growth of supermassive black holes in the early universe is one of the most profound open questions in astrophysics. A faint AGN at $z=7$ recently observed with NIRSpec/IFS shows extremely low metallicity but large black-hole mass. This cannot be explained by any existing model of black hole growth, and may require the existence of massive, primordial black holes that were already in place before galaxies formed.

This finding would have far-reaching implications, from cosmology to fundamental physics, but it currently rests on a single, faint source. We propose to test the hypothesis of primordial supermassive black holes by measuring the gas metallicity of 'The Cliff', a recently discovered AGN at $z=3.55$ with nearly identical spectral shape and line ratios to the $z=7$ source, but 10x brighter. Using just 3 hours of high-resolution NIRSpec/IFS spectroscopy,

we will accurately measure its metallicity, emission-line profiles, and spatial extent, enabling a definitive test of the primordial black hole scenario. This observation provides a unique, time-sensitive opportunity to independently confirm one of JWST's most surprising results, and potentially rewrite the story of how SMBHs formed.

OBSERVING DESCRIPTION

The observations aim to detect broad and narrow-line emission of Hbeta, [OIII]5007, and Halpha. The high-resolution grating improves the ability to identify and disentangle Balmer-line absorption superimposed to the broad lines.

The compact nature of the target means no acquisition is required.

10 dithered exposures improve the PSF sampling.

Proposal 9433 - Targets - Black hole primacy - do supermassive black holes really predate galaxies?

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	TheCliff	RA: 02 17 38.5797 (34.4107487d) Dec: -05 07 46.79 (-5.12966d) Equinox: J2000		
Comments: Category=Galaxy Description=[Active galactic nuclei, Active galaxies] Extended=YES					

Proposal 9433 - Observation 1 - Black hole primacy - do supermassive black holes really predate galaxies?

Wed Jun 25 01:00:12 GMT 2025

Observation	<p>Proposal 9433, Observation 1</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec IFU Spectroscopy</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)	TheCliff	RA: 02 17 38.5797 (34.4107487d) Dec: -05 07 46.79 (-5.12966d) Equinox: J2000									
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Active galactic nuclei, Active galaxies]</i> <i>Extended=YES</i></p>											
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	ETC Wkbk.Calc ID
	1	G235H/F170LP	NRSIRS2	18	1	false	true	NONE	10	10	13275.89	
Special Requirements	Aperture PA Range 162.97164917 to 84.97164917 Degrees (V3 24.0 to 306.0)											