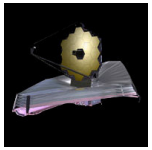

3149 - A possible runaway supermassive black hole at the tip of a 62 kpc long linear feature

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	IFU observation	NIRSpec IFU Spectroscopy	(3) Group WAKE

ABSTRACT

It has long been predicted that supermassive black holes (SMBHs) can be ejected from their host galaxies, through gravitational recoil or a three-body interaction after multiple galaxy mergers. So far no runaway SMBHs have been securely identified. A new candidate was recently serendipitously found in HST/ACS data. F606W and F814W images, combined with Keck spectra, show a striking linear feature at z=0.964 with a length of 62 kpc. Strong and complex emission lines are detected all along the feature, including a bright knot of [OIII] emission at the tip. The linear

feature has been interpreted as the wake behind a runaway SMBH, with the observed continuum and line emission produced by shocks and star formation in the circumgalactic medium. Here we propose to obtain spatially-resolved spectroscopy of the region near the tip, using the NIRSpec IFU. The spectra cover the important diagnostic lines [OIII], Halpha, [NII], and [SII]. The primary goal is to search for the expected highly red- or blue-shifted broad emission lines that are associated with the SMBH itself, either from bound gas that escaped with it or from accretion onto the black hole. A detection would be definitive evidence for the existence of runaway supermassive black holes, fifty years after they were predicted. A secondary goal is to map the morphology of the ionized circumgalactic medium.

OBSERVING DESCRIPTION

The primary goal of the program is to search for broad emission lines associated with a runaway supermassive black hole. The location of the black hole is assumed to be inside the 0.4 arcsec tip of a striking linear feature.

The observations are divided over two target positions, WAKEPOS1 and WAKEPOS2. These are symmetrically placed on each side of the linear feature, 0.5 arcsec downstream from the tip. The tip will be inside the IFU FOV for all roll angles, and observed on different parts of the detector for WAKEPOS1 and WAKEPOS2.

At each of the two target positions a 4 point dither pattern will be used to improve sampling.

The NIRSpec IFU will be used with the G140M/F100LP grating/filter combination. Each of the 8 integrations consists of 50 groups. The NRSIRS2 readout pattern provides the lowest possible noise.

No target acquisition is required, but a verification image is taken at the end of the visit so that the precise pointing can be reconstructed.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	WAKEPOS1	RA: 02 41 45.7224 (40.4405100d) Dec: -08 21 1.30 (-8.35036d) Equinox: J2000		
Comments: There are two target positions, on each side of the wake. They are effectively nod positions to enable better sky subtraction. They have to be defined in RA, DEC as they have to be perpendicular to the linear feature irrespective of the roll angle. *Category=Unidentified* *Description=[Visible sources]* *Extended=YES*				
(2)	WAKEPOS2	RA: 02 41 45.6628 (40.4402617d) Dec: -08 21 1.89 (-8.35053d) Equinox: J2000		
Comments: There are two target positions, on each side of the wake. They are effectively nod positions to enable better sky subtraction. They have to be defined in RA, DEC as they have to be perpendicular to the linear feature irrespective of the roll angle. *Category=Unidentified* *Description=[Visible sources]* *Extended=YES*				
(3)	Group WAKE			
Comments: Two nods of the wake *Target Selection=[1 WAKEPOS1, 2 WAKEPOS2]*				

Observation

Proposal 3149, Observation 1: IFU observation

Mon May 06 13:00:18 GMT 2024

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
(3)	Group WAKE			

Comments: Two nods of the wake
Target Selection=[1 WAKEPOS1, 2 WAKEPOS2]

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

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	G140M/F100LP	NRSIRS2	16	3	false	true	NONE	4	12	14180.401	136525.1
2	G140M/F100LP	NRSIRS2	2	1	true	true	NONE	4	4	641.911	136525.1