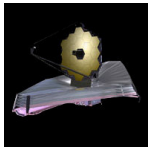

3805 - A NIRSpec Look at the Emission and Gas Kinematics of the SMBH in the Milky Way Dwarf Satellite Leo I

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	Target	NIRSpec IFU Spectroscopy	(1) LEOI
	2	Background	NIRSpec IFU Spectroscopy	(3) LEOI-background

ABSTRACT

A SMBH of ~3 million solar masses at the center of the Milky Way satellite galaxy Leo I was recently discovered via dynamical measurements. Extensive multiwavelength data, from radio to X-rays, support the identification of this SMBH with a source, Leo I*. These observations match existing GRMHD simulations of the expected emission. This SMBH would be strikingly similar to Sgr A* but located in a close-by dwarf galaxy,

which is under-dense and devoid of gas. Hence, Leo I* provides a uniquely unobstructed look into the central parsecs of a galactic nucleus.

We propose to use JWST to probe the emission and kinematic structure of the environment around Leo I*. With high-resolution grating of R ~ 2700 in NIRSpec IFU, we plan to probe regions at >=0.1”, or >=0.12 pc, from the SMBH, characterized by velocities of ~200 km/s. These observations will probe the near-infrared spectral shape of Leo I*: from the region ~0.1 pc around the SMBH accreting in ADAF mode, we expect a line-less spectrum due to gas being fully ionized. We will also probe the kinematics of gas/stars at > 0.2 pc from the source, where we expect partially ionized gas. These data will test the ADAF hypothesis and gain insights into the kinematics around the SMBH.

The presence of such an over-massive SMBH can inform formation models for black holes, especially regarding the seed formation pathway at high-z. Moreover, at a distance of 0.25 Mpc, this SMBH could be a new target for space-based EHT observations. A NIRSpec observation on a location with robust evidence for emission could be a cornerstone for studying black holes, both in the local Universe and, indirectly, in the high-z one.

OBSERVING DESCRIPTION

We propose to observe Leo I* with NIRSpec IFU using the gratings G235H and G395H to probe the continuum emission and the inner velocity structure of sub-pc regions around the SMBH. We are requesting a high-resolution grating of R ~2700 in NIRSpec IFU in order to probe a velocity field of the order ~200 km/s. To reach our science goals, we request a total of 13.70 hrs of NIRSpec IFU time, of which 10.21 hrs is devoted to science.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	LEOI	RA: 10 08 25.8110 (152.1075458d) Dec: +12 18 38.47 (12.31069d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[Dwarf spheroidal galaxies, Galaxy nuclei]* *Extended=YES*				
(3)	LEOI-background	RA: 10 08 25.8110 (152.1075458d) Dec: +12 18 38.47 (12.31069d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[Dwarf spheroidal galaxies, Galaxy nuclei]* *Extended=YES*				

Observation

Proposal 3805, Observation 1: Target

Fri Mar 15 23:00:29 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[Background (Obs 2)]

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)	LEOI	RA: 10 08 25.8110 (152.1075458d) Dec: +12 18 38.47 (12.31069d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Dwarf spheroidal galaxies, Galaxy nuclei]
Extended=YES

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	G395H/F290LP	NRSIRS2	6	1	false	true	NONE	4	4	1809.022	144222.3
2	G235H/F170LP	NRSIRS2	20	4	false	true	NONE	4	16	23575.646	144222.2

Special Requirements

Group Observations 1, 2, Non-interruptible

Observation

Proposal 3805, Observation 2: Background

Fri Mar 15 23:00:29 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [Target (Obs 1)]

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
(3)	LEOI-background	RA: 10 08 25.8110 (152.1075458d) Dec: +12 18 38.47 (12.31069d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Dwarf spheroidal galaxies, Galaxy nuclei]
Extended=YES

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	G395H/F290LP	NRSIRS2	6	1	false	true	NONE	4	4	1809.022	144222.3
2	G235H/F170LP	NRSIRS2	20	1	false	true	NONE	4	4	5893.912	144222.2

Special Requirements

Offset -3.6687310971019222 arcsec, -2.53635036984131 arcsec

Group Observations 1, 2, Non-interruptible