



1983 - Uncovering Intermediate Mass Black Holes with JWST: Pushing the Frontier

Cycle: 1, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Prof. Shobita Satyapal (PI)	George Mason University	ssatyapa@gmu.edu
Dr. Nicholas P. Abel (CoI)	University of Cincinnati-Clermont College	npabel2@gmail.com
Dr. Laura Blecha (CoI)	University of Florida	lblecha@ufl.edu
Dr. Torsten Boeker (CoI)	Space Telescope Science Institute - ESA - JWST	boeker@stsci.edu
Mr. Thomas Bohn (CoI)	University of California - Riverside	tbohn002@ucr.edu
Prof. Gabriela Canalizo (CoI)	University of California - Riverside	gabriela.canalizo@ucr.edu
Dr. Jenna M Cann (CoI)	George Mason University	jcann@masonlive.gmu.edu
Dr. Jacqueline Fischer (CoI)	George Mason University	jfische7@gmu.edu
Dr. Stephanie La Massa (CoI)	Space Telescope Science Institute	slamassa@stsci.edu
Dr. Suzanne Madden (CoI) (ESA Member)	CEA/DSM/DAPNIA/Service d'Astrophysique	suzanne.madden@cea.fr
Mr. William G Matzko (CoI)	George Mason University	wmatzko@gmu.edu
Dr. Barry Rothberg (CoI)	George Mason University	dr.barry.rothberg@gmail.com
Dr. Nathan Secrest (CoI)	United States Naval Observatory	nathansecrest@msn.com
Prof. Anil C. Seth (CoI)	University of Utah	aseth@astro.utah.edu

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
NIRSpec IFU				
	1		NIRSpec IFU Spectroscopy	(1) J1601
	2		NIRSpec IFU Spectroscopy	(2) J1201

ABSTRACT

Intermediate mass black holes (IMBHs) in local low metallicity dwarf galaxies, with masses between one hundred and a million solar masses are crucial to our understanding of the origins of supermassive black holes (SMBHs) and will give rise to the prime targets for LISA. Despite their importance, very little is known about their mass distribution and the host galaxies in which they reside. Dynamical studies cannot uncover the lowest masses, and accreting IMBHs have eluded detection by optical spectroscopic, mid-infrared color, X-ray, and radio surveys due either to obscuration of the central engine, or dilution of the accretion activity from star formation in the host galaxy. In fact, there is currently no direct evidence for black holes with masses between $\sim 150 - 10,000$ solar masses, a gap of roughly two orders of magnitude in mass. In this pilot program, we propose to push the frontier in the low mass regime by observing two nearby low mass, low metallicity dwarf galaxies with the most convincing evidence yet for optically elusive AGNs in the lowest mass galaxies. Using the NIRSpec IFU, this pilot program is designed to unveil a ~ 1000 solar mass IMBH, an order of magnitude lower than any other nuclear black hole known in a galaxy thus far and will be the lowest mass galaxy in the Universe known to host an AGN. With a modest investment in observing time, this study can not only make a breakthrough in the IMBH mass frontier, but pave the way to discover more elusive AGNs in the low mass regime. This program can only be carried out using the unique capabilities of JWST.

OBSERVING DESCRIPTION

The goal of this proposal is to obtain near infrared spectroscopy of two dwarf galaxies with compelling evidence for optically elusive active galactic nuclei (AGNs) in order to search for coronal lines (CLs), and to obtain intensity and kinematic maps to confirm their hidden AGNs and constrain their properties. To exploit the maximum sensitivity of JWST and observe the infrared CLs with the highest ionization potentials (IPs) that are sensitive to the ionizing SED, we request NIRSpec IFU medium resolution observations in two gratings (G235M and G395M) for our two targets enabling the detection of key diagnostic CLs necessary to achieve our science goals that are impossible to observe from the ground.

Given carefully determined S/N requirements on the various emission lines, we request ~ 3600 sec and ~ 7100 sec, respectively, for each target with the G235M and G395M grating settings. We will use NSIRS2RAPID readout with 60 groups & 1 integration at four dither positions for the brighter target and 60 groups & 2 integrations at four dither positions for the fainter target. No saturation issues are expected based on ETC estimates.

Since we are using NIRSpec, LeakCals will be necessary, but because our primary goal is to obtain the emission line fluxes, we follow the recommended LeakCal strategy and will obtain a single LeakCal at only one position with the same exposure time as our observation. Based on the expected pointing accuracy of JWST and the fact that our targets have SDSS coordinates, we will not be requiring any target acquisition; our targets are compact and will fit completely in the NIRSpec $3'' \times 3''$ FOV. We will also be able to perform background subtraction within the FOV, increasing the efficiency of our program.

Proposal 1983 - Targets - Uncovering Intermediate Mass Black Holes with JWST: Pushing the Frontier

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	J1601	RA: 16 01 35.9496 (240.3997900d) Dec: +31 13 53.69 (31.23158d) Equinox: J2000 <i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf galaxies, Emission line galaxies, Nucleated dwarf galaxies]</i> <i>Extended=NO</i>		
(2)	J1201	RA: 12 01 22.3128 (180.3429700d) Dec: +02 11 8.35 (2.18565d) Equinox: J2000 <i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf galaxies, Emission line galaxies, Nucleated dwarf galaxies]</i>			

Proposal 1983 - Observation 1 - Uncovering Intermediate Mass Black Holes with JWST: Pushing the Frontier

Tue Sep 28 20:00:41 GMT 2021

Observation	<p>Proposal 1983, 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)	J1601	RA: 16 01 35.9496 (240.3997900d) Dec: +31 13 53.69 (31.23158d) Equinox: J2000									
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf galaxies, Emission line galaxies, Nucleated dwarf galaxies]</i> <i>Extended=NO</i></p>											
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/Ex p	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	G235M/F170LP	NRSIRS2RAPI D	60	1	false	true	NONE	4	4	3559.689	
	2	G235M/F170LP	NRSIRS2RAPI D	60	1	true	false	NONE	1	1	889.922	
	3	G395M/F290LP	NRSIRS2RAPI D	60	1	false	true	NONE	4	4	3559.689	
	4	G395M/F290LP	NRSIRS2RAPI D	60	1	true	false	NONE	1	1	889.922	

Proposal 1983 - Observation 2 - Uncovering Intermediate Mass Black Holes with JWST: Pushing the Frontier

Tue Sep 28 20:00:41 GMT 2021

Observation	Proposal 1983, Observation 2 Diagnostic Status: Warning Observing Template: NIRSpec IFU Spectroscopy											
	(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)	J1201	RA: 12 01 22.3128 (180.3429700d) Dec: +02 11 8.35 (2.18565d) Equinox: J2000									
<i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf galaxies, Emission line galaxies, Nucleated dwarf galaxies]</i>												
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	G235M/F170LP	NRSIRS2	12	2	false	true	NONE	4	8	7119.378	
	2	G235M/F170LP	NRSIRS2	12	2	true	false	NONE	1	2	1779.845	
	3	G395M/F290LP	NRSIRS2	12	2	false	true	NONE	4	8	7119.378	
	4	G395M/F290LP	NRSIRS2	12	2	true	false	NONE	1	2	1779.845	