



2235 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Cycle: 1, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Farhad Yusef-Zadeh (PI)	Northwestern University
Dr. Howard A. Bushouse (CoI) (Contact)	Space Telescope Science Institute
Dr. Richard G. Arendt (CoI)	University of Maryland Baltimore County
Dr. Nadeen B. Sabha (CoI) (ESA Member)	Universitat Innsbruck, Institut fur Astronomie
Dr. Mark Wardle (CoI)	Macquarie University
Mr. Joseph M Michail (CoI)	Northwestern University
Prof. Daryl Haggard (CoI) (CSA Member)	McGill University
Dr. Kazuhiro Hada (CoI)	National Astronomical Observatory of Japan (NAOJ)
Prof. Sera Markoff (CoI) (ESA Member)	Universiteit van Amsterdam
Dr. Geoffrey Bower (CoI)	Academia Sinica, Institute of Astronomy and Astrophysics

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Sgr A* imaging				
	1	NIRCam imaging	NIRCam Imaging	(1) SGRA
	2	NIRCam imaging	NIRCam Imaging	(1) SGRA
	3	NIRCam imaging	NIRCam Imaging	(1) SGRA
	4	NIRCam imaging - Repeat of visit 3	NIRCam Imaging	(1) SGRA
	5	NIRCam imaging - Repeat of visit 4	NIRCam Imaging	(1) SGRA
	6	NIRCam imaging - Repeat of visit 5	NIRCam Time Series	(1) SGRA

ABSTRACT

We propose to monitor the near-IR flare emission of Sgr A* at two wavelengths using NIRCam imaging. The observations will consist of 3 8-hour episodes to be carried out simultaneously with observations by ALMA and the Event Horizon Telescope (EHT). Simultaneous measurements at 2.1 and 4.8 microns provide the spectral evolution of IR flare emission. This yields information about the particle acceleration process and subsequent synchrotron cooling of the highest-energy particles. Using an adiabatic expansion model, the IR light curve can then be used to determine the spectrum and the variability of submm emission across the multiple flares that are likely during the course of the EHT observations. The predicted submm variability is a necessary component in being able to construct an image of the black hole shadow from the EHT observations. The proposed simultaneous IR and submm observations of the variability of Sgr A* will be key to the EHT's success.

OBSERVING DESCRIPTION

We will use the NIRCam in imaging mode to obtain observations centered on the SMBH Sgr A* at the Galactic Center (GC). Simultaneous imaging will be obtained in the short- and long-wavelength channels, using Module B only, and the SUB640 subarray readout. Subarray readouts are used to reduce data volume and decrease the exposure time per group, because of the bright sources located near Sgr A*. The F210M and F480M filters will be used to obtain photometry of Sgr A* at two different wavelengths simultaneously, thus allowing for measurements of the spectral index of Sgr A* as well. Using the RAPID readout mode, with the SUB640 subarray, we will obtain 10 groups per integration and 20 integrations per exposure, in conjunction with a 4-point dither pattern. Each block of 4 dithered exposures will cover ~1 hour of observing. We will obtain 6 such exposure blocks in a back-to-back fashion, which will provide ~8 hours of coverage on the target. Three such 8-hour visits will be obtained, which will be coordinated with dates and times at which other telescopes in the EHT campaign (such as ALMA) are observing Sgr A*.

Proposal 2235 - Targets - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000	Epoch of Position: 2000	
<i>Comments:</i> Category=Stellar Cluster Description=[Young star clusters] Extended=NO					

Proposal 2235 - Observation 1 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Tue Mar 12 20:00:11 GMT 2024

Observation	<p>Proposal 2235, Observation 1: NIRCam imaging</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p> <p><i>Comments: Will need to be scheduled in coordination with the Event Horizon Telescope observing campaign planned for April-May 2022.</i></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)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000			Epoch of Position: 2000				
	<p><i>Comments:</i> <i>Category=Stellar Cluster</i> <i>Description=[Young star clusters]</i> <i>Extended=NO</i></p>									
Template	Module		Subarray			Target Placement				
	B		SUB640			Module Gap				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	SUBARRAY_DITHER		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F210M	F480M	RAPID	10	19	76	4	3500.919	63569
	2	F210M	F480M	RAPID	10	19	76	4	3500.919	
	3	F210M	F480M	RAPID	10	19	76	4	3500.919	
	4	F210M	F480M	RAPID	10	19	76	4	3500.919	
	5	F210M	F480M	RAPID	10	19	76	4	3500.919	
	6	F210M	F480M	RAPID	10	19	76	4	3500.919	
Special Requirements	<p>Between Dates 13-APR-2023:06:00:00 and 13-APR-2023:08:00:00</p> <p>Offset 10.0 arcsec, 10.0 arcsec</p>									

Proposal 2235 - Observation 2 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Tue Mar 12 20:00:11 GMT 2024

Observation	<p>Proposal 2235, Observation 2: NIRCam imaging</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p> <p><i>Comments: Will need to be scheduled in coordination with the Event Horizon Telescope observing campaign planned for April-May 2022.</i></p>									
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	
	(1)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000			Epoch of Position: 2000				
	<p><i>Comments:</i></p> <p><i>Category=Stellar Cluster</i></p> <p><i>Description=[Young star clusters]</i></p> <p><i>Extended=NO</i></p>									
Template	Module		Subarray			Target Placement				
	B		SUB640			Module Gap				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	SUBARRAY_DITHER		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F210M	F480M	RAPID	10	19	76	4	3500.919	63569
	2	F210M	F480M	RAPID	10	19	76	4	3500.919	
	3	F210M	F480M	RAPID	10	19	76	4	3500.919	
	4	F210M	F480M	RAPID	10	19	76	4	3500.919	
	5	F210M	F480M	RAPID	10	19	76	4	3500.919	
	6	F210M	F480M	RAPID	10	19	76	4	3500.919	
Special Requirements	<p>Between Dates 16-APR-2023:06:00:00 and 16-APR-2023:08:00:00</p> <p>Offset 10.0 arcsec, 10.0 arcsec</p>									

Proposal 2235 - Observation 3 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Tue Mar 12 20:00:11 GMT 2024

Observation	<p>Proposal 2235, Observation 3: NIRCam imaging</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p> <p><i>Comments: Will need to be scheduled in coordination with the Event Horizon Telescope observing campaign planned for April-May 2022.</i></p>									
Diagnostics	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous	
	(1)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000			Epoch of Position: 2000				
	<p><i>Comments:</i></p> <p><i>Category=Stellar Cluster</i></p> <p><i>Description=[Young star clusters]</i></p> <p><i>Extended=NO</i></p>									
Template	Module		Subarray			Target Placement				
	B		SUB640			Module Gap				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	SUBARRAY_DITHER		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F210M	F480M	RAPID	10	18	72	4	3316.66	63569
	2	F210M	F480M	RAPID	10	18	72	4	3316.66	
	3	F210M	F480M	RAPID	10	18	72	4	3316.66	
	4	F210M	F480M	RAPID	10	18	72	4	3316.66	
	5	F210M	F480M	RAPID	10	18	72	4	3316.66	
	6	F210M	F480M	RAPID	10	18	72	4	3316.66	
Special Requirements	<p>Between Dates 18-APR-2023:06:30:00 and 18-APR-2023:08:00:00</p> <p>Offset 10.0 arcsec, 10.0 arcsec</p>									

Proposal 2235 - Observation 4 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Tue Mar 12 20:00:11 GMT 2024

Observation	<p>Proposal 2235, Observation 4: NIRCam imaging - Repeat of visit 3</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p> <p><i>Comments: Will need to be scheduled in coordination with the Event Horizon Telescope observing campaign planned for April-May 2022.</i></p>									
Diagnostics	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous	
	(1)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000			Epoch of Position: 2000				
	<p><i>Comments:</i></p> <p><i>Category=Stellar Cluster</i></p> <p><i>Description=[Young star clusters]</i></p> <p><i>Extended=NO</i></p>									
Template	Module		Subarray			Target Placement				
	B		SUB640			Module Gap				
Dithers	#	Primary Dither Type		Primary Dithers	Subpixel Dither Type		Dither Size	Subpixel Positions		
	1	SUBARRAY_DITHER		4	STANDARD			1		
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F210M	F480M	RAPID	5	33	132	4	3317.889	63569
	2	F210M	F480M	RAPID	5	33	132	4	3317.889	
	3	F210M	F480M	RAPID	5	33	132	4	3317.889	
	4	F210M	F480M	RAPID	5	33	132	4	3317.889	
	5	F210M	F480M	RAPID	5	33	132	4	3317.889	
	6	F210M	F480M	RAPID	5	33	132	4	3317.889	
Special Requirements	<p>Between Dates 24-AUG-2023:21:00:00 and 24-AUG-2023:23:00:00</p> <p>Aperture PA Range 87.76509521 to 87.76509521 Degrees (V3 87.75 to 87.75)</p> <p>Offset 10.0 arcsec, 10.0 arcsec</p>									

Proposal 2235 - Observation 5 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Tue Mar 12 20:00:11 GMT 2024

Observation	<p>Proposal 2235, Observation 5: NIRCam imaging - Repeat of visit 4</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Imaging</p> <p><i>Comments: Will need to be scheduled in coordination with the Event Horizon Telescope observing campaign planned for April-May 2022.</i></p>									
Diagnostics	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous	
	(1)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000			Epoch of Position: 2000				
	<p><i>Comments:</i></p> <p><i>Category=Stellar Cluster</i></p> <p><i>Description=[Young star clusters]</i></p> <p><i>Extended=NO</i></p>									
Template	Module		Subarray				Target Placement			
	B		SUB640				Module Gap			
Dithers	#	Primary Dither Type		Primary Dithers		Subpixel Dither Type		Dither Size		Subpixel Positions
	1	SUBARRAY_DITHER		4		STANDARD				1
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F210M	F480M	RAPID	5	33	132	4	3317.889	63569
	2	F210M	F480M	RAPID	5	33	132	4	3317.889	
	3	F210M	F480M	RAPID	5	33	132	4	3317.889	
	4	F210M	F480M	RAPID	5	33	132	4	3317.889	
	5	F210M	F480M	RAPID	5	33	132	4	3317.889	
	6	F210M	F480M	RAPID	5	33	132	4	3317.889	
Special Requirements	<p>Between Dates 22-SEP-2023:00:00:00 and 22-SEP-2023:05:00:00</p> <p>Aperture PA Range 91.01509521 to 91.01509521 Degrees (V3 91.0 to 91.0)</p> <p>Offset 10.0 arcsec, 10.0 arcsec</p>									

Proposal 2235 - Observation 6 - Imaging the Shadow of a Black Hole through Sgr A* Monitoring

Tue Mar 12 20:00:11 GMT 2024

Observation	<p>Proposal 2235, Observation 6: NIRCam imaging - Repeat of visit 5</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Time Series</p> <p><i>Comments: Will need to be scheduled in coordination with the Event Horizon Telescope observing campaign planned for April-May 2022.</i></p>											
Diagnostics	<p>(NIRCam imaging - Repeat of visit 5 (Obs 6)) Warning (Form): Exposure Duration exceeds the limit of 10000.0 seconds. Above this limit it is possible that a High Gain Antenna move may occur during the exposure.</p> <p>(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous			
	(1)	SGRA	RA: 17 45 40.0400 (266.4168333d) Dec: -29 00 28.07 (-29.00780d) Equinox: J2000			Epoch of Position: 2000						
	<p><i>Comments:</i> <i>Category=Stellar Cluster</i> <i>Description=[Young star clusters]</i> <i>Extended=NO</i></p>											
Acquisition	#	Target										
	1	NONE										
Template	Module					Subarray						
	B					SUB400P						
Spectral Elements	#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	CLEAR	F210M	CLEAR	F480M	RAPID	10	1250	1	1250	22798.9	
Special Requirements	<p>Time Series Observation No Parallel Attachments</p>											