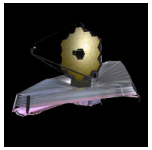

1586 - Black Hole Jet Launching Physics with MIRI

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	***Institution***
Prof. Poshak Gandhi (PI) (ESA Member)	**University of Southampton**
Prof. Thomas J. Maccarone (CoI) (CoPI) (US Admin CoI) (Contact)	Texas Tech University
Dr. Aarran Shaw (CoI) (CoPI) (Contact)	Butler University
Federico Vincentelli (CoI) (ESA Member)	UNIVERSITA DEGLI STUDI DELL'INSUBRIA
Dr. Piergiorgio Casella (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Roma
Prof. Robert I. Hynes (CoI)	Louisiana State University and A & M College
Prof. Sera Markoff (CoI) (ESA Member)	Universiteit van Amsterdam
Dr. Julien Malzac (CoI) (ESA Member)	Observatoire Midi-Pyrenees
Prof. Tomaso M Belloni (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Brera, Merate
Prof. Christian Knigge (CoI) (ESA Member)	University of Southampton
Dr. Alexandra Jean Tetarenko (CoI) (CSA Member)	University of Lethbridge
Dr. Christopher Britt (CoI)	Space Telescope Science Institute
Dr. Craig Heinke (CoI) (CSA Member)	University of Alberta
Dr. David M. Russell (CoI)	New York University Abu Dhabi
Dr. David Buckley (CoI)	South African Astronomical Observatory
Dr. Gregory R. Sivakoff (CoI) (CSA Member)	University of Alberta
Dr. James Miller-Jones (CoI)	Curtin University
Dr. Jesus M Corral-Santana (CoI) (ESA Member)	European Southern Observatory - Chile
Mr. John Paice (CoI) (ESA Member)	University of Southampton
Dr. John A. Tomsick (CoI)	University of California - Berkeley
Dr. Kieran O'Brien (CoI) (ESA Member)	University of Oxford
Dr. Tariq Shahbaz (CoI) (ESA Member)	Instituto de Astrofisica de Canarias
Joe Bright (CoI)	University of California - Berkeley

Name	*Institution*
Prof. Rob Fender (CoI) (ESA Member)	University of Oxford
Prof. Philip A. Charles (CoI) (ESA Member)	University of Southampton
Dr. Richard M. Plotkin (CoI)	University of Nevada - Reno
Dr. Abigail L Stevens (CoI)	Michigan State University

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		MIRI Low Resolution Spectroscopy	(1) V-V821-ARA
	4		MIRI Low Resolution Spectroscopy	(1) V-V821-ARA
	5		MIRI Low Resolution Spectroscopy	(1) V-V821-ARA
	2		MIRI Low Resolution Spectroscopy	(3) GRANAT-1915+105

ABSTRACT

Despite ~50 years of compact object studies in the Galaxy, the physics of relativistic jet launching remains an active and open field of research. There has been important recent progress in development of state-of-the-art MHD simulations, but how these determine the emission properties is now a major focus. A deeper understanding requires us to probe rapidly changing conditions in the outflowing plasma close to the jet base, for which only piecemeal studies have been possible to-date. A key observational feature, the spectral break above which the jet becomes optically thin, provides a crucial link between light and plasma properties. It is a variable feature that needs to be tracked and linked to other jet properties, and is known to pass through the mid-infrared band.

We propose to detect this jet spectral break, and monitor rapid flux and spectral shape variations in outbursting Galactic black hole binaries using the MIRI LRS mode, to provide estimates of the variable magnetic (B) field strength and physical dimensions of the jet base. There is evidence that these properties are subject to violent variations on timescales <~1 seconds, which can have important consequences for our understanding of the inner jet B field dynamics and particle acceleration mechanisms. We will measure the B field strength and radiative energy of the jet, while any variability in flux and frequency will provide unprecedented constraints on the speed and magnitude of B field changes. The break is predicted to lie in the infrared regime during typical jetted outbursts of transient black hole X-ray binaries, so this science is ideally suited for MIRI LRS observations.

OBSERVING DESCRIPTION

Aim

===

Subarray rapid MIRI LRS of Galactic X-ray binaries. Scientific aim is to probe the variable physical conditions at the locations in the plasma flow associated with jet base emission, something that JWST can uniquely probe.

Strategy

=====

This is a Target of Opportunity (ToO) proposal, with a non-disruptive (14d+) trigger. Programme will be triggered based on multiwavelength monitoring (both publicly available and proprietary).

We propose two observations, each ~2 hours long on-target.

Target:

1) GX 339-4 : Black hole X-ray binary that frequently undergoes bright outbursts.

2) Generic : Any Galactic X-ray binary that is discovered to be undergoing a standard bright jet-dominated outburst.

Dithering:

We are mainly interested in rapid contiguous point source time series spectroscopy. We intend to measure the background locally around the source (the field of the known fixed target is not significantly crowded).

Hence we chose MIRI slitless mode, which allows the most rapid time sampling.

This programme will also provide tests of the possibility of time series photometry with long MIRI stares. We are working with the MIRI instrument team to optimise rapid time-series MIRI data.

Multiwavelength coordination:

We will be arranging coordination from several global facilites (from radio to X-rays) in conjunction with JWST to test the absolute time calibration and carry out broad band science. But we are not imposing any constraints on JWST scheduling.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-V821-ARA	RA: 17 02 49.3811 (255.7057546d) Dec: -48 47 23.16 (-48.78977d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Black holes, X-ray binary stars]*				
(3)	GRANAT-1915+105	RA: 19 15 11.5558 (288.7981492d) Dec: +10 56 44.91 (10.94581d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[X-ray binary stars]* *Extended=NO*				
(4)	S8Q6152434	RA: 17 02 49.7213 (255.7071721d) Dec: -48 47 36.33 (-48.79343d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Epoch of Position: 2016	
Comments: Gaia DR3 coordinates *Category=Star* *Description=[Disk stars]*				

Generic Targets

#	Name	Criteria	Description
(2)	GENERIC-JET-TOO-MIRI-LRS	X-ray/radio trigger (standard hard bright jetted accretion state)	

Observation

Proposal 1586, Observation 1

Fri Mar 01 17:00:23 GMT 2024

Diagnostic Status: Error

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

(Observation 1) Error (Form): Permission has not been granted for this program to use Special Requirement 'No Parallel Attachments'.

(Observation 1) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(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)	V-V821-ARA	RA: 17 02 49.3811 (255.7057546d) Dec: -48 47 23.16 (-48.78977d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Black holes, X-ray binary stars]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F1000W	FAST	4	1	1	0.636	87818

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	4	1	1	1	1	0.636		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	10	4150	4150	1	1	7260.017	87818

Special Requirements

Time Series Observation
No Parallel Attachments
No Parallel Attachments
Target Of Opportunity Response Time 14 Days

Observation

Proposal 1586, Observation 4

Fri Mar 01 17:00:23 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Comments: Retrigger approved by TTRB following WOPR 88542.

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)	V-V821-ARA	RA: 17 02 49.3811 (255.7057546d) Dec: -48 47 23.16 (-48.78977d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Black holes, X-ray binary stars]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F1000W	FASTGRPAVG	6	1	1	3.817	87818

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	6	64	64	1	1	71.091		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	30	1470	1470	1	1	7247.294	87818

Special Requirements

Time Series Observation
No Parallel Attachments
Target Of Opportunity Response Time 14 Days

Observation

Proposal 1586, Observation 5

Fri Mar 01 17:00:23 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Comments: Retrigger approved by TTRB following WOPR 88542.

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)	V-V821-ARA	RA: 17 02 49.3811 (255.7057546d) Dec: -48 47 23.16 (-48.78977d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Black holes, X-ray binary stars]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 S8Q6152434	F1000W	FAST	4	1	1	0.636	87818

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	6	10	10	1	1	10.974		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	30	1470	1470	1	1	7247.294	87818

Special Requirements

Time Series Observation
No Parallel Attachments
Target Of Opportunity Response Time 14 Days

Observation

Proposal 1586, Observation 2

Fri Mar 01 17:00:23 GMT 2024

Diagnostic Status: Error

Observing Template: MIRI Low Resolution Spectroscopy

Comments: x

Diagnostics

(Observation 2) Error (Form): Permission has not been granted for this program to use Special Requirement 'No Parallel Attachments'.

(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)	GRANAT-1915+105	RA: 19 15 11.5558 (288.7981492d) Dec: +10 56 44.91 (10.94581d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[X-ray binary stars]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	3 GRANAT-1915+105	FND	FASTGRPAVG16	8	1	1	20.357	156106

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	8	16	16	1	1	22.743		FND

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	10	4150	4150	1	1	7260.017	156106

Special Requirements

Time Series Observation
No Parallel Attachments
No Parallel Attachments
Target Of Opportunity Response Time 14 Days