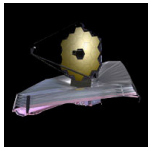

3477 - EPISODE: EC 53, the only known Periodically variable Infant Star to chase the Outburst in the next Dynamical Event

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
EC53_burst_phase				
	1	NIRSPEC_burst_phase	NIRSpec IFU Spectroscopy	(7) EC53-nobkg-epoch2
	2	MIRI_burst_phase	MIRI Medium Resolution Spectroscopy	(6) EC53-epoch2
	6	MIRI_burst_phase_bkg	MIRI Medium Resolution Spectroscopy	(8) EC53-background-epoch2
EC53_quiescent_phase				

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	3	NIRSPEC_quiescent_phase	NIRSpec IFU Spectroscopy	(5) EC53-nobkg
	4	MIRI_quiescent_phase	MIRI Medium Resolution Spectroscopy	(1) EC53
	8	MIRI_quiescent_phase_bkg	MIRI Medium Resolution Spectroscopy	(3) EC53-background

ABSTRACT

Despite the importance of episodic accretion in the star formation process and its significant role in changing physical and chemical structures of the protostellar system, coherent observational studies tracing a full cycle of accretion burst from a single protostar have never been performed. Protostellar outbursts are rare and usually unpredictable, making such observations challenging, but one embedded Class I protostar, EC 53, shows cyclical bursts. Using this unique laboratory, we propose NIRSPEC and MIRI IFU observations to trace variations of chemical compositions in response to burst accretion. Spatially resolved NIR and MIR spectra will reveal the distributions of ice and gas species, including complex organic molecules, in the disk and envelope. Time-constrained observations designed to catch the quiescent and burst phases will allow us to directly compare the chemical differences following the changes in the locations of sublimation fronts of the most abundant species (CO, CO2, and H2O) and the changes in the strength of hot molecular emission.

OBSERVING DESCRIPTION

We propose to observe EC 53, a Class I protostellar system located in Serpens Main cloud, which shows quasi-periodic accretion bursts. Using the predictable burst event of the source, this proposal aims to investigate the ice and gas compositions of the disk and inner envelope and their variations. NIRSPEC and MIRI IFU observations will provide spatially resolved distributions of various species. The NIR spectra of NIRSPEC include chemically important ice features, such as H2O at 3.0 micron, CO2 at 4.27 micron, and CO at 4.67 micron, as well as warm gaseous emission from the disk surface scattered out along the outflow cavity walls. The MIR spectra of MIRI over ~5-28 micron will observe absorption features by a bulk of icy complex organic molecules and thermal emissions from the disk surface and hot inner envelope. To trace the chemical compositions of the disk and envelope of a protostellar system and understand their variations caused by an accretion burst, we propose time constrained observations toward EC 53. Using the constructed light curves, the next cycles of quiescent and burst phases are determined.

We will use a 4-point dither pattern with target acquisition for each epoch and instrument, with a dedicated background observation of nearby regions of the Serpens cloud. This will maximize the chance of our source landing in the same pixel in each epoch, which will be crucial for cross-epoch comparison of this variable object.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	EC53	RA: 18 29 51.1329 (277.4630538d) Dec: +01 16 41.29 (1.27814d) Equinox: J2000	Epoch of Position: 2023.3	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]* *Extended=YES*				
(3)	EC53-background	RA: 18 29 55.0217 (277.4792571d) Dec: +01 16 20.33 (1.27231d) Equinox: J2000	Epoch of Position: 2023.3	
Comments: Relatively clear region of Serpens molecular cloud within 1' of science target, away from stellar diffraction spikes. *Category=Unidentified* *Description=[Blank field]*				
(4)	2MASS-J18295360+0117017	RA: 18 29 53.6100 (277.4733750d) Dec: +01 17 1.73 (1.28381d) Equinox: J2000	Proper Motion RA: 2.1263 mas/yr Proper Motion Dec: -9.1275 mas/yr Parallax: 0.0019896" Epoch of Position: 2016	
Comments: *Category=Star* *Description=[Young stellar objects]* *Extended=NO*				
(5)	EC53-nobkg	RA: 18 29 51.1329 (277.4630538d) Dec: +01 16 41.29 (1.27814d) Equinox: J2000	Epoch of Position: 2023.3	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]* *Extended=YES*				
(6)	EC53-epoch2	RA: 18 29 51.2081 (277.4633671d) Dec: +01 16 39.92 (1.27776d) Equinox: J2000	Epoch of Position: 2023.3	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]* *Extended=YES*				
(7)	EC53-nobkg-epoch2	RA: 18 29 51.2081 (277.4633671d) Dec: +01 16 39.92 (1.27776d) Equinox: J2000	Epoch of Position: 2023.3	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]* *Extended=YES*				
(8)	EC53-background-epoch2	RA: 18 29 57.5217 (277.4896738d) Dec: +01 16 20.33 (1.27231d) Equinox: J2000	Epoch of Position: 2023.3	
Comments: Relatively clear region of Serpens molecular cloud within 1.5' of science target, away from stellar diffraction spikes. There are more Gaia targets in this second epoch background, as it shifted 0.5 arcmin to the east. *Category=Unidentified* *Description=[Blank field]* *Extended=YES*				

Observation

Proposal 3477, Observation 1: NIRSPEC_burst_phase Wed Mar 20 16:00:32 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.

(Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(7)	EC53-nobkg-epoch2	RA: 18 29 51.2081 (277.4633671d) Dec: +01 16 39.92 (1.27776d) Equinox: J2000	Epoch of Position: 2023.3	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]
Extended=YES

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 2MASS-J18295360+0117017	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	193790

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	LARGE	1	6	

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	G235H/F170LP	NRSIRS2RAPID	7	4	false	true	NONE	6	24	2801.067	193790
2	G395H/F290LP	NRSIRS2RAPID	6	3	false	true	NONE	6	18	1838.2	193790

Special Requirements

Between Dates 10-APR-2024:00:00:00 and 19-MAY-2024:00:00:00

Group Observations 1, 2 within 1 Days

Observation

Proposal 3477, Observation 2: MIRI_burst_phase Wed Mar 20 16:00:32 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI_burst_phase_bkg (Obs 6)]

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 2:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	EC53-epoch2	RA: 18 29 51.2081 (277.4633671d) Dec: +01 16 39.92 (1.27776d) Equinox: J2000	Epoch of Position: 2023.3	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]
Extended=YES

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 2MASS-J18295360+0117017	FND	FAST	4	1	1	11.1	193790

Template

Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
All MRS	YES	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	POINT SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F560W	FASTR1	5	10	1	Dither 1	4	40	654.909	
1	SHORT(A)	MRSLONG		FASTR1	18	5	1	Dither 1	4	20	1043.415	193790
1	SHORT(A)	MRSSHORT		FASTR1	18	5	1	Dither 1	4	20	1043.415	193790
2		IMAGER	F770W	FASTR1	5	10	1	Dither 1	4	40	654.909	
2	MEDIUM(B)	MRSLONG		FASTR1	16	5	1	Dither 1	4	20	932.413	193790
2	MEDIUM(B)	MRSSHORT		FASTR1	16	5	1	Dither 1	4	20	932.413	193790
3		IMAGER	F1000W	FASTR1	5	10	1	Dither 1	4	40	654.909	
3	LONG(C)	MRSLONG		FASTR1	16	5	1	Dither 1	4	20	932.413	193790
3	LONG(C)	MRSSHORT		FASTR1	16	5	1	Dither 1	4	20	932.413	193790

Special Requirements	
	Between Dates 10-APR-2024:00:00:00 and 19-MAY-2024:00:00:00 Group Observations 1, 2 within 1 Days Sequence Observations 2, 6, Non-interruptible

Observation

Proposal 3477, Observation 6: MIRI_burst_phase_bkg Wed Mar 20 16:00:32 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MIRI_burst_phase (Obs 2)]

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 6:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(8)	EC53-background-epoch2	RA: 18 29 57.5217 (277.4896738d) Dec: +01 16 20.33 (1.27231d) Equinox: J2000	Epoch of Position: 2023.3	

Comments: Relatively clear region of Serpens molecular cloud within 1.5' of science target, away from stellar diffraction spikes. There are more Gaia targets in this second epoch background, as it shifted 0.5 arcmin to the east.
Category=Unidentified
Description=[Blank field]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
FND	All MRS	YES	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	POINT SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F560W	FASTR1	5	10	1	Dither 1	4	40	654.909	
1	SHORT(A)	MRSLONG		FASTR1	18	5	1	Dither 1	4	20	1043.415	193790
1	SHORT(A)	MRSSHORT		FASTR1	18	5	1	Dither 1	4	20	1043.415	193790
2		IMAGER	F770W	FASTR1	5	10	1	Dither 1	4	40	654.909	
2	MEDIUM(B)	MRSLONG		FASTR1	16	5	1	Dither 1	4	20	932.413	193790
2	MEDIUM(B)	MRSSHORT		FASTR1	16	5	1	Dither 1	4	20	932.413	193790
3		IMAGER	F1000W	FASTR1	5	10	1	Dither 1	4	40	654.909	
3	LONG(C)	MRSLONG		FASTR1	16	5	1	Dither 1	4	20	932.413	193790
3	LONG(C)	MRSSHORT		FASTR1	16	5	1	Dither 1	4	20	932.413	193790

Special Requirements	Between Dates 10-APR-2024:00:00:00 and 19-MAY-2024:00:00:00 Sequence Observations 2, 6, Non-interruptible

Observation

Proposal 3477, Observation 3: NIRSPEC_quiescent_phase Wed Mar 20 16:00:32 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

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
(5)	EC53-nobkg	RA: 18 29 51.1329 (277.4630538d) Dec: +01 16 41.29 (1.27814d) Equinox: J2000	Epoch of Position: 2023.3	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]
Extended=YES

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 2MASS-J18295360+0117017	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	161678

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	G235H/F170LP	NRSIRS2RAPID	7	2	false	true	NONE	4	8	933.689	141240
2	G395H/F290LP	NRSIRS2RAPID	6	2	false	true	NONE	4	8	816.978	141240

Special Requirements

Between Dates 18-SEP-2023:00:00:00 and 07-OCT-2023:00:00:00

Group Observations 3, 4 within 1 Days

Observation

Proposal 3477, Observation 4: MIRI_quiescent_phase Wed Mar 20 16:00:32 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI_quiescent_phase_bkg (Obs 8)]

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)	EC53	RA: 18 29 51.1329 (277.4630538d) Dec: +01 16 41.29 (1.27814d) Equinox: J2000	Epoch of Position: 2023.3	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar matter, Eruptive variables, Periodic variable stars, Protoplanetary disks, Young stellar objects]
Extended=YES

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 2MASS-J18295360+0117017	FND	FAST	4	1	1	11.1	161678

Template

Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
All MRS	NO	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	LONG(C)	MRSLONG		FASTR1	40	2	1	Dither 1	4	8	899.113	141240
1	LONG(C)	MRSSHORT		FASTR1	40	2	1	Dither 1	4	8	899.113	141240
2	MEDIUM(B)	MRSLONG		FASTR1	45	2	1	Dither 1	4	8	1010.115	141240
2	MEDIUM(B)	MRSSHORT		FASTR1	45	2	1	Dither 1	4	8	1010.115	141240
3	SHORT(A)	MRSLONG		FASTR1	35	2	1	Dither 1	4	8	788.111	141240
3	SHORT(A)	MRSSHORT		FASTR1	35	2	1	Dither 1	4	8	788.111	141240

Special Requirements	
	Between Dates 18-SEP-2023:00:00:00 and 07-OCT-2023:00:00:00 Group Observations 3, 4 within 1 Days Sequence Observations 4, 8, Non-interruptible

Observation

Proposal 3477, Observation 8: MIRI_quiescent_phase_bkg Wed Mar 20 16:00:32 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MIRI_quiescent_phase (Obs 4)]

Diagnostics

(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	EC53-background	RA: 18 29 55.0217 (277.4792571d) Dec: +01 16 20.33 (1.27231d) Equinox: J2000	Epoch of Position: 2023.3	

Comments: Relatively clear region of Serpens molecular cloud within 1' of science target, away from stellar diffraction spikes.
Category=Unidentified
Description=[Blank field]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
FND	All MRS	NO	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	LONG(C)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	141240
1	LONG(C)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	141240
2	MEDIUM(B)	MRSLONG		FASTR1	45	1	1	Dither 1	4	4	499.507	141240
2	MEDIUM(B)	MRSSHORT		FASTR1	45	1	1	Dither 1	4	4	499.507	141240
3	SHORT(A)	MRSLONG		FASTR1	35	1	1	Dither 1	4	4	388.506	141240
3	SHORT(A)	MRSSHORT		FASTR1	35	1	1	Dither 1	4	4	388.506	141240

Special Requirements	
	Between Dates 18-SEP-2023:00:00:00 and 07-OCT-2023:00:00:00 Sequence Observations 4, 8, Non-interruptible