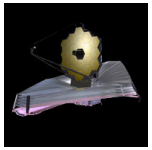

4427 - The impact of smaller accretion bursts on the planet-forming material in the disk of a young eruptive star

Cycle: 1, Proposal Category: DD

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
EX Lup spectroscopy				
	1	EXLup	MIRI Medium Resolution Spectroscopy	(1) HD-325367
	2	EXLup-background	MIRI Medium Resolution Spectroscopy	(2) HD-325367-BACKGROUND

ABSTRACT

One of the first JWST papers about protoplanetary disks (Kospal et al. 2023) presented a MIRI/MRS study of the young eruptive star EX Lup. The authors discovered cold crystalline silicate grains close to the snowline in the disk, and interpreted it as a long-lasting consequence of the powerful outburst of EX Lup in 2008. Here we propose an alternative interpretation of the results, raising the possibility that the detected crystalline silicates

formed in a very recent smaller burst in 2022 spring. In the present time-critical DD time request, we propose an experiment to discriminate between the two scenarios by taking a new MIRI/MRS 5-27 um spectrum. Comparing the strength of the crystalline silicate features at 16.3, 19.0, 20.0, and 23.5 um with the published JWST observation, we will learn if the features have changed during the 7 months between the two JWST epochs and estimate the timescale of their evolution. Based on models, the constancy (or slow evolution) of the crystalline features points to the 2008 large outburst, while a significant drop implies the 2022 smaller burst as the origin of the crystals. The DD request is justified by the expected rapid evolution of the features in the latter scenario. Waiting for cycle 3 means observations in 2024 Aug, 2.5 years after the small burst, which would not contrain the timescales sufficiently. Proving that the spectral features detected in EX Lup by JWST indeed originate from the 2022 burst would be a paradigm-shifting discovery, implying that not only the rare large outbursts but also the more common smaller bursts can enrich planet-forming disks in crystalline material.

OBSERVING DESCRIPTION

We request MIRI MRS spectroscopy of the young outbursting star EX Lup. We will use all 4 channels, covering the whole available wavelength range between 5 and 28 micrometer. This is a variability proposal: our aim is to compare the requested MIRI spectrum with a previous MIRI spectrum obtained on 2022-Aug-23. The object is expected to have comparable continuum brightness now as in late 2022, therefore, the same observing setup as previously used is requested here. For this, we copied the setup of the program 2209 to here. The executed program 2209 observations of EX Lup resulted in a spectrum with signal-to-noise ratios of 120 at 9.0 um, 100 at 15.5 um, and 60 at 25.0 um on the continuum (Kospal et al. 2023). We expect to reach similar signal-to-noise ratios for the proposed project. The only difference compared to the previous observations is that we will take acquisition for the science target. For the spectroscopy, will use 15 groups and 2 integrations per exposure in each Channel/Wavelength range. A 4-point dither pattern will be adopted. We include simultaneous imaging to help the astrometric calibration. We will also observe a separate background field with no dithering, 15 groups, and 1 integration per exposure.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HD-325367	RA: 16 03 5.4777 (240.7728237d) Dec: -40 18 25.78 (-40.30716d) Equinox: J2000	Proper Motion RA: -8.879418238926603E-4 sec of time/yr Proper Motion Dec: -0.022530999990522105 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Circumstellar disks, Pre-main sequence stars, Protoplanetary disks]* *Extended=NO*				
(2)	HD-325367-BACKGROUND	RA: 16 03 12.6281 (240.8026171d) Dec: -40 15 30.42 (-40.25845d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: *Category=Calibration* *Description=[Telescope/sky background]* *Extended=NO*				

Observation

Proposal 4427, Observation 1: EXLup Thu Mar 30 20:03:43 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[EXLup-background (Obs 2)]

Diagnostics

(EXLup (Obs 1)) Warning (Form): The science and background exposures are not consistent and may result in non-optimal science output.

(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)	HD-325367	RA: 16 03 5.4777 (240.7728237d) Dec: -40 18 25.78 (-40.30716d) Equinox: J2000	Proper Motion RA: -8.879418238926603E-4 sec of time/yr Proper Motion Dec: -0.022530999990522105 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar disks, Pre-main sequence stars, Protoplanetary disks]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	FND	FAST	4	1	1	11.1	145539

Template

Primary Channel	Simultaneous Imaging	Imager Subarray
ALL	YES	FULL

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	F1130W	FASTR1	15	2	1	Dither 1	4	8	344.105	
1	LONG(C)	MRSLONG		FASTR1	15	2	1	Dither 1	4	8	344.105	
1	LONG(C)	MRSSHORT		FASTR1	15	2	1	Dither 1	4	8	344.105	
2		IMAGER	F1130W	FASTR1	15	2	1	Dither 1	4	8	344.105	
2	MEDIUM(B)	MRSLONG		FASTR1	15	2	1	Dither 1	4	8	344.105	
2	MEDIUM(B)	MRSSHORT		FASTR1	15	2	1	Dither 1	4	8	344.105	
3		IMAGER	F1130W	FASTR1	15	2	1	Dither 1	4	8	344.105	
3	SHORT(A)	MRSLONG		FASTR1	15	2	1	Dither 1	4	8	344.105	
3	SHORT(A)	MRSSHORT		FASTR1	15	2	1	Dither 1	4	8	344.105	

Special Requirements	Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 4427, Observation 2: EXLup-background Thu Mar 30 20:03:43 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [EXLup (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
(2)	HD-325367-BACKGROUND	RA: 16 03 12.6281 (240.8026171d) Dec: -40 15 30.42 (-40.25845d) Equinox: J2000	Epoch of Position: 2015.5	

Comments:
Category=Calibration
Description=[Telescope/sky background]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
F1500W	ALL	NO	FULL

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	15	1	1	None	1	1	41.626	
1	LONG(C)	MRSSHORT		FASTR1	15	1	1	None	1	1	41.626	
2	MEDIUM(B)	MRSLONG		FASTR1	15	1	1	None	1	1	41.626	
2	MEDIUM(B)	MRSSHORT		FASTR1	15	1	1	None	1	1	41.626	
3	SHORT(A)	MRSLONG		FASTR1	15	1	1	None	1	1	41.626	
3	SHORT(A)	MRSSHORT		FASTR1	15	1	1	None	1	1	41.626	

Special Requirements

Sequence Observations 1, 2, Non-interruptible