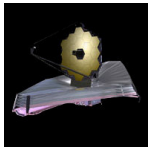

12580 - DDT: Catching an FU Ori Outburst Near Inception

Cycle: 5, Proposal Category: DD

INVESTIGATORS

Name	*Institution*
Dr. Lynne A. Hillenbrand (PI)	**California Institute of Technology**
Adolfo Carvalho (CoI)	Center for Astrophysics | Harvard & Smithsonian

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
ZTF 20				
	2	MIRI First Visit	MIRI Medium Resolution Spectroscopy	(2) ZTF20
	1	MIRI First Visit Background	MIRI Medium Resolution Spectroscopy	(1) ZTF20-background

ABSTRACT

Episodic accretion is a defining but poorly understood process in the early evolution of stars and planetary systems. FU Ori outbursts are rare, decades-long events that feature rapid accretion onto the central star, and consequent heating of the circumstellar disk. The dramatic luminosity increase alters the irradiation environment, and likely reshapes the physical structure and chemical inventory of protoplanetary disks.

We have recently become aware of a new FU Ori outburst -- currently within the first few months of its eruption, and in the early stages of disk heating. The source has just reached its lightcurve peak, and is a unique opportunity to capture such an event spectroscopically in the mid-infrared. Prior new FU Ori outbursts have been measureed in the mid-infrared only photometrically, with NEOWISE.

We propose JWST/MIRI spectroscopy of this new outburst source, to measure the mid-infrared spectrum and thus:
(1) with the continuum spectral energy distribution, trace the transition between the rapidly accreting inner disk that is just heating up, and the passively heated (by the inner disk) outer disk;

(2) study the disk ice and gas features, looking for chemical processing induced by the rapid onset of heating from viscous accretion;
(3) quantify over time, via repeated observations, how the thermal front propagates outward in the disk.

Our observations will directly address how transient accretion re-sets the intial conditions for planet formation. This represents an unprecedented opportunity for JWST over the next few months and year.

OBSERVING DESCRIPTION

We are requesting MIRI observations covering the complete spectral range from ~5-28 um for a newly discovered FU Ori outburst that first came to our attention on 30 October 2025. We require high signal-to-noise spectra in order to observe both emission and absorption features in our source. The continuum will be readily detected, and our time request is dominated by desire to obtain signal-to-noise ratio > 80 at the longest wavelengths, 25-28 um, which is necessary for accurate deblending of potential H2O and OH emission lines. We will also detect absorption or emission from a mix of gas/ice species that we expect to be prevalent. Silicate dust, and potentially weak forsterite and/or PAH may also be present.

The program consists of two visits in Cycle 4, and clocks in at 2.3 hours for science, which including overheads sums to a total of 5.3 hours charged. We are also asking for a third visit that falls in Cycle 5, at 1.4 hours for science and 2.5 hours charged.

We are also requesting WFC3/UVIS on HST to obtain imaging in the F656N (Halpha) filter along with the F625W and F775W filters, so as to map the anticipated nebular structure associated with the outburst. This would be 1 orbit per visit including overheads, or two (2) orbits total.

Proposal 12580 - Targets - DDT: Catching an FU Ori Outburst Near Inception

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ZTF20-background	RA: 02 58 2.4090 (44.5100375d) Dec: +61 13 13.08 (61.22030d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Star* *Description=[FU Orionis stars]*				
(2)	ZTF20	RA: 02 58 7.8300 (44.5326250d) Dec: +61 12 57.10 (61.21586d) Equinox: J2000	Proper Motion RA: 0.104 mas/yr Proper Motion Dec: -3.347 mas/yr Epoch of Position: 2000	
Comments: *Category=Star* *Description=[FU Orionis stars]* *Extended=YES*				

Observation

Proposal 12580, Observation 2: MIRI First Visit Thu Apr 16 21:00:15 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI First Visit Background (Obs 1)]

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
(2)	ZTF20	RA: 02 58 7.8300 (44.5326250d)	Proper Motion RA: 0.104 mas/yr	
		Dec: +61 12 57.10 (61.21586d)	Proper Motion Dec: -3.347 mas/yr	
		Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[FU Orionis stars]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
F560W	All MRS	YES	FULL	Allow Auto Reorder

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	Optional ETC ID
1		IMAGER	F560W	FASTR1	20	1	1	Dither 1	4	4	222.003	
1	SHORT(A)	MRSLONG		FASTR1	20	2	1	Dither 1	4	8	455.107	
1	SHORT(A)	MRSSHORT		FASTR1	20	2	1	Dither 1	4	8	455.107	
2		IMAGER	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
2	MEDIUM(B)	MRSLONG		FASTR1	20	3	1	Dither 1	4	12	688.21	
2	MEDIUM(B)	MRSSHORT		FASTR1	20	3	1	Dither 1	4	12	688.21	
3		IMAGER	F1000W	FASTR1	20	1	1	Dither 1	4	4	222.003	
3	LONG(C)	MRSLONG		FASTR1	20	3	1	Dither 1	4	12	688.21	
3	LONG(C)	MRSSHORT		FASTR1	20	3	1	Dither 1	4	12	688.21	

Special Requirements	
	Between Dates 20-SEP-2026 and 10-OCT-2026 Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 12580, Observation 1: MIRI First Visit Background Thu Apr 16 21:00:15 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MIRI First Visit (Obs 2)]

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
(1)	ZTF20-background	RA: 02 58 2.4090 (44.5100375d) Dec: +61 13 13.08 (61.22030d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[FU Orionis stars]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
F560W	All MRS	YES	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	2-Point	BACKGROUND	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1		IMAGER	F560W	FASTR1	20	1	1	Dither 1	2	2	111.002	
1	SHORT(A)	MRSLONG		FASTR1	20	2	1	Dither 1	2	4	227.553	
1	SHORT(A)	MRSSHORT		FASTR1	20	2	1	Dither 1	2	4	227.553	
2		IMAGER	F770W	FASTR1	20	1	1	Dither 1	2	2	111.002	
2	MEDIUM(B)	MRSLONG		FASTR1	20	3	1	Dither 1	2	6	344.105	
2	MEDIUM(B)	MRSSHORT		FASTR1	20	3	1	Dither 1	2	6	344.105	
3		IMAGER	F1000W	FASTR1	20	1	1	Dither 1	2	2	111.002	
3	LONG(C)	MRSLONG		FASTR1	20	3	1	Dither 1	2	6	344.105	
3	LONG(C)	MRSSHORT		FASTR1	20	3	1	Dither 1	2	6	344.105	

Special Requirements	
	Between Dates 20-SEP-2026 and 10-OCT-2026 Sequence Observations 1, 2, Non-interruptible