



12486 - DDT: Catching an FU Ori Outburst Near Inception

Cycle: 4, Proposal Category: DD

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Lynne A. Hillenbrand (PI)	California Institute of Technology
Adolfo Carvalho (CoI)	Center for Astrophysics Harvard & Smithsonian

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
ZTF 20				
	2	MIRI First Visit	MIRI Medium Resolution Spectroscopy	(1) ZTF20
	1	MIRI First Visit Background	MIRI Medium Resolution Spectroscopy	(4) ZTF20-background
	5	MIRI Second Visit	MIRI Medium Resolution Spectroscopy	(1) ZTF20
	4	MIRI Second Visit Background	MIRI Medium Resolution Spectroscopy	(4) 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 measured in the mid-infrared only photometrically, with NEOWISE.

JWST Proposal 12486 (Created: Monday, December 1, 2025, 5:01:25PM Eastern Standard Time) - Overview

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 initial 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 μm 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 μm , 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 (H α) 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 12486 - Targets - DDT: Catching an FU Ori Outburst Near Inception

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	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	
Fixed Targets	(4)	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] Extended=YES				

Proposal 12486 - Observation 2 - DDT: Catching an FU Ori Outburst Near Inception

Mon Dec 01 22:01:26 GMT 2025

Observation	Proposal 12486, Observation 2: MIRI First Visit Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observations:[MIRI First Visit Background (Obs 1)]												
	(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)	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													
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/E xp	Exposures/Dit h	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	

Proposal 12486 - Observation 2 - DDT: Catching an FU Ori Outburst Near Inception

Special Requirements

Between Dates 13-DEC-2025 and 20-DEC-2025

Sequence Observations 1, 2, Non-interruptible

Proposal 12486 - Observation 1 - DDT: Catching an FU Ori Outburst Near Inception

Mon Dec 01 22:01:26 GMT 2025

Observation	Proposal 12486, Observation 1: MIRI First Visit Background Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observation For: [MIRI First Visit (Obs 2)]												
	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Diagnosics													
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(4)	ZTF20-background	RA: 02 58 2.4090 (44.5100375d) Dec: +61 13 13.08 (61.22030d) Equinox: J2000				Epoch of Position: 2000						
<i>Comments: Category=Star Description=[FU Orionis stars]</i>													
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/E xp	Exposures/Dit h	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	

Proposal 12486 - Observation 1 - DDT: Catching an FU Ori Outburst Near Inception

Special Requirements

Between Dates 13-DEC-2025 and 20-DEC-2025

Sequence Observations 1, 2, Non-interruptible

Proposal 12486 - Observation 5 - DDT: Catching an FU Ori Outburst Near Inception

Mon Dec 01 22:01:26 GMT 2025

Observation	Proposal 12486, Observation 5: MIRI Second Visit Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observations:[MIRI Second Visit Background (Obs 4)]																					
	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.																					
Diagnosics																						
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>ZTF20</td> <td>RA: 02 58 7.8300 (44.5326250d) Dec: +61 12 57.10 (61.21586d) Equinox: J2000</td> <td>Proper Motion RA: 0.104 mas/yr Proper Motion Dec: -3.347 mas/yr Epoch of Position: 2000</td> <td></td> </tr> </tbody> </table>	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(1)	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												
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(1)	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																			
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	1		IMAGER	F560W	FASTR1	20	1	1	Dither 1	4	4	222.003										
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	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										

Proposal 12486 - Observation 5 - DDT: Catching an FU Ori Outburst Near Inception

Special Requirements

Between Dates 20-FEB-2026 and 28-FEB-2026

Sequence Observations 4, 5, Non-interruptible

Proposal 12486 - Observation 4 - DDT: Catching an FU Ori Outburst Near Inception

Mon Dec 01 22:01:26 GMT 2025

Observation	Proposal 12486, Observation 4: MIRI Second Visit Background Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observation For: [MIRI Second Visit (Obs 5)]												
	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous				
	(4)	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											
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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					
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Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
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	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	

Proposal 12486 - Observation 4 - DDT: Catching an FU Ori Outburst Near Inception

Special Requirements

Between Dates 20-FEB-2026 and 28-FEB-2026

Sequence Observations 4, 5, Non-interruptible