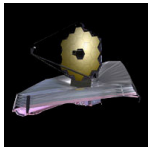

9251 - Probing Pre-Existing Dust in SN 2024xuo with JWST: Insights into Massive Star Evolution

Cycle: 3, Proposal Category: DD

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
SN2024xuo				
	1	SN2024xuo MRS	MIRI Medium Resolution Spectroscopy	(1) SN2024xuo
	2	SN2024xuo Imaging	MIRI Imaging	(1) SN2024xuo

ABSTRACT

Core-collapse supernovae (CCSNe), particularly Type IIn, play a crucial role in the production of cosmic dust. These SNe, particularly Type IIn, are known for their significant dust formation due to their interaction with circumstellar material (CSM). However, there has been a significant discrepancy between the dust masses predicted by theoretical models and those observed in SN ejecta, with observed amounts being two orders of magnitude lower. Recent observations using the James Webb Space Telescope (JWST) have highlighted the significance of mid-infrared (MIR) studies in understanding dust properties in these SNe, addressing this discrepancy by the presence of large amounts of dust at longer MIR

wavelengths in very late epochs in the evolution of Type IIn SNe. This proposal aims to leverage the unique capabilities of JWST to conduct early-time MIR spectroscopic and photometric observations of the newly-discovered Type IIn supernova SN 2024xuo, located at approximately 23.5Mpc. SN 2024xuo, the closest SN IIn discovered in the last decade, presents a rare opportunity to study the properties of pre-existing dust in the circumstellar material (CSM) of such SNe. By obtaining high-resolution MIR data, we aim to trace the composition, temperature, and mass of the dust, providing critical insights into the late stages of mass loss in massive stars. These observations will not only enhance our understanding of dust production in the early universe but also serve as a legacy dataset for future studies of similar systems.

OBSERVING DESCRIPTION

We will observe the SN 2024xuo, a newly-discovered Type IIn SN, that ispresenting insights of pre-existing dust according to our preliminary analyses. Our goal is to contrain the luminosity and the properties of the dusty surrounding material at early-epoch in its evolution. To do this, we require to obtain the following observations:

MIRI:
-- MRS:
---- TA same as target, F560W, FAST, 4groups/int
---- 4-point dither pattern
---- 100 groups/integrations in all chanels
---- All are set to FASTR1 readout mode
-- Imaging:
---- FULL subarray
---- 4-point dither pattern (point-source, positive)
---- Starting in the 5th postion and only 1 set
---- Images in four bands: F1500W, F1800W, F2100W, F2550W (in that order to avoid high background)
---- All bands requiere 10 groups / integration, 1 integration / exp, 1 exposure /dith

Proposal 9251 - Targets - Probing Pre-Existing Dust in SN 2024xuo with JWST: Insights into Massive Star Evolution

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN2024xuo	RA: 10 08 49.8350 (152.2076458d) Dec: -67 02 51.04 (-67.04751d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Circumstellar dust, Dust shell, Supernovae, Type II supernovae]
Extended=NO

Observation

Proposal 9251, Observation 1: SN2024xuo MRS

Wed Apr 02 17:00:34 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(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)	SN2024xuo	RA: 10 08 49.8350 (152.2076458d) Dec: -67 02 51.04 (-67.04751d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Circumstellar dust, Dust shell, Supernovae, Type II supernovae]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F560W	FAST	4	1	1	11.1	242576.13

Template

Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
All MRS	NO	FULL	Allow Auto Reorder

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	SHORT(A)	MRSLONG		FASTR1	100	1	1	Dither 1	4	4	1110.016	242576.4
1	SHORT(A)	MRSSHORT		FASTR1	100	1	1	Dither 1	4	4	1110.016	242576.2
2	MEDIUM(B)	MRSLONG		FASTR1	100	1	1	Dither 1	4	4	1110.016	242576.7
2	MEDIUM(B)	MRSSHORT		FASTR1	100	1	1	Dither 1	4	4	1110.016	242576.6
3	LONG(C)	MRSLONG		FASTR1	100	1	1	Dither 1	4	4	1110.016	242576.11
3	LONG(C)	MRSSHORT		FASTR1	100	1	1	Dither 1	4	4	1110.016	242576.10

Special Requirements	
	Before Date 01-AUG-2025:00:00:00 Group Observations 1, 2 within 21 Days

Observation

Proposal 9251, Observation 2: SN2024xuo Imaging

Wed Apr 02 17:00:34 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

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
(1)	SN2024xuo	RA: 10 08 49.8350 (152.2076458d) Dec: -67 02 51.04 (-67.04751d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Circumstellar dust, Dust shell, Supernovae, Type II supernovae]
Extended=NO

Template

Subarray
FULL

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	4-Point-Sets				5	1	POINT SOURCE	POSITIVE	DEFAULT

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F1500W	FASTR1	10	1	1	Dither 1	4	4	111.002	242576.17
2	F1800W	FASTR1	10	1	1	Dither 1	4	4	111.002	242576.16
3	F2100W	FASTR1	10	1	1	Dither 1	4	4	111.002	242576.15
4	F2550W	FASTR1	10	1	1	Dither 1	4	4	111.002	242576.14

Special Requirements

Before Date 01-AUG-2025:00:00:00

Group Observations 1, 2 within 21 Days