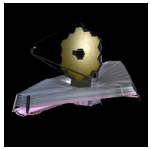

9231 - SN 2024vjm, Probing Evolution, Molecule, and Dust Formation in the nearest Type Iax Supernova

Cycle: 3, Proposal Category: DD

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Epoch 200 days				
	1	NIRSpec	NIRSpec Fixed Slit Spectroscopy	(1) 24vjm
	2	MIRI/LRS	MIRI Low Resolution Spectroscopy	(1) 24vjm
	3	MIRI/Imaging	MIRI Imaging	(1) 24vjm
	4	MIRI/Imaging	MIRI Imaging	(1) 24vjm

ABSTRACT

SN 2024vjm is the closest (7.2 Mpc) Type Iax supernova (SN Iax) yet discovered. Type Iax supernovae are a class of subluminous thermonuclear supernovae with two branches, Faint and Luminous,
likely originating from a non-homogeneous class of progenitor systems. There exist a number of proposed explosion channels, including: (1) a C+O+Ne white dwarf (WD) in a binary system where
the primary WD undergoes a failed deflagration; (2) the merger of a O+Ne WD with a C+O WD; and (3) a pulsating delayed-detonation of a near-Chandrasekhar mass WD. Scenarios (1) and (2) lead to a compact, bound remnant; while scenario (3) will produce copious amounts of carbon monoxide and eventually dust. The proximity of SN 2024vjm offers an unparalleled opportunity to determine the nature of Faint SN Iax. SN 2024vjm was observed near maximum light by JWST with NIRSpec and MIRI/MRS, but a follow-up near 220 days is necessary to reveal possible CO and dust formation. We propose obtaining NIRSpec and MIRI/LRS spectra from 1-14 microns, and photometry at 15, 18 and 21 microns to determine the shape of the SED. These observations will elucidate: the symmetry of ejecta; the ionization state and density; whether CO and dust are formed. This observation will vastly improve our understanding of SN Iax. Forgoing the proposed observations will hamper any future science (JWST or ground-based), and the community will be unable to accurately trace the evolution of dust growth in these enigmatic objects. Since the SNe Iax rate is only 15% of the SNe Ia rate, 2024vjm is our best chance to observe a very nearby SN Iax with JWST.

OBSERVING DESCRIPTION

We propose to observe SN 2024vjm with NIRSpec medium resolution, MIRI/LRS, and MIRI imaging at approximately 220 days after maximum light.
These observations will divulge: the symmetry of ejecta; the ejecta ionization state and density; whether CO and dust are formed.

Proposal 9231 - Targets - SN 2024vjm, Probing Evolution, Molecule, and Dust Formation in the nearest Type Iax Supernova

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	24vjm	RA: 19 09 25.7800 (287.3574167d) Dec: -63 50 1.75 (-63.83382d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Observation

Proposal 9231, Observation 1: NIRSpec

Fri Mar 14 22:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit 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)	24vjm	RA: 19 09 25.7800 (287.3574167d) Dec: -63 50 1.75 (-63.83382d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB2048	CLEAR	NRSRAPID	3	1	1	3.628	243904.6

Template

HFF Readout Mode	Slit	Subarray
false	S400A1	SUBS400A1

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	3	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F070LP	S400A1	NRSRAPID	50	1	1	NONE	3	3	238.435	243904.8
2	G140M/F100LP	S400A1	NRSRAPID	60	1	2	NONE	3	3	285.175	243904.11
3	G235M/F170LP	S400A1	NRSRAPID	70	1	3	NONE	3	3	331.915	243904.1
4	G395M/F290LP	S400A1	NRSRAPID	80	1	4	NONE	3	3	378.655	243904.7

Special Requirements	Sequence Observations 1, 2, 3, 4, Non-interruptible

Observation

Proposal 9231, Observation 2: MIRI/LRS

Fri Mar 14 22:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

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)	24vjm	RA: 19 09 25.7800 (287.3574167d) Dec: -63 50 1.75 (-63.83382d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F560W	FASTGRPAVG16	6	1	1	266.404	243904.9

Template

Subarray	Obtain Verification Image?
FULL	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	5	2	2	1	1	30.525		F770W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	100	20	40	1	2	11205.612	243904.4

Special Requirements

Sequence Observations 1, 2, 3, 4, Non-interruptible

Observation

Proposal 9231, Observation 3: MIRI/Imaging

Fri Mar 14 22:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

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
(1)	24vjm	RA: 19 09 25.7800 (287.3574167d) Dec: -63 50 1.75 (-63.83382d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Type Ia 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	CYCLING	1	4		1	1			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	100	1	1	Dither 1	4	4	1110.016	243903.7

Special Requirements

Sequence Observations 1, 2, 3, 4, Non-interruptible

Observation

Proposal 9231, Observation 4: MIRI/Imaging

Fri Mar 14 22:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 4:1) 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)	24vjm	RA: 19 09 25.7800 (287.3574167d) Dec: -63 50 1.75 (-63.83382d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Subarray
BRIGHTSKY

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	CYCLING	1	4		1	1			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	F1800W	FASTR1	100	5	1	Dither 1	4	20	1744.404	243903.9
2	F2100W	FASTR1	100	12	1	Dither 1	4	48	4191.416	243903.10

Special Requirements

Between Dates 01-APR-2025:00:00:00 and 15-MAY-2025:00:00:00

Sequence Observations 1, 2, 3, 4, Non-interruptible