



9261 - Late Time Spectroscopy of Type Ia Supernovae: Determining the Explosion Mechanism and Elemental Production

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
400d+				
	5	400-500d medium	MIRI Medium Resolution Spectroscopy	(2) SN2024epr

ABSTRACT

Type Ia Supernovae (SNe Ia) are the thermonuclear explosions of white dwarf stars, which originate from binary star systems and synthesize roughly half of the iron-group elements in the universe. The nature of the progenitors and the explosion mechanism is an open question. Understanding SNe Ia is foundational for: the late stages of stellar evolution, the origins of the elements, and controlling systematic errors related to the use of SNe Ia as cosmological rulers. Observational estimates of the nuclear burning products in SNe Ia probe the progenitor and explosion. JWST provides an entirely new window of opportunity as there are spectral lines with unique information in the MIR. We request 20.8 hours of time to obtain 3 Medium resolution MIRI spectra 100-500d past maximum light for the nearest SN Ia discovered in Cycle 3. The progenitor and explosion mechanism will be constrained using spectra acquired in three physical regimes: 1) 100-200d which measures radioactive Co and the intermediate mass elements, 2) 250-350d where hard gamma-rays, non-local effects, and the appearance of forbidden lines of neutron rich elements probe the progenitor density, 3) 400-500d where positrons deposit energy locally revealing the radioactive cobalt distribution. One of goals of JWST is to reveal the origin of heavy elements and how they feedback into the universe. The sensitivity and resolution of MIRI will produce resolved line profiles, probing the element distribution. MIRI spectra will also show many isolated forbidden lines of isotopes with known wavelengths. The atomic physics learned will provide insight into many transients to come.

OBSERVING DESCRIPTION

We request ~20.8 hours of time to obtain 3 Medium resolution MIRI spectra of SN Ia between 100-500d past maximum light. As our target is not yet known we request non disruptive ToO time. For all phases we will use the medium resolution spectrometer on MIRI, and observe in all sub-bands (A, B & C) and all channels. Due to the long temporal base line of the data, the first and second epochs will be obtained in Cycle3 and the third epoch of observations in Cycle4.

Proposal 9261 - Targets - Late Time Spectroscopy of Type Ia Supernovae: Determining the Explosion Mechanism and Elemental Pro...

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(2)	SN2024epr	RA: 03 06 11.2240 (46.5467667d) Dec: +41 51 0.18 (41.85005d) Equinox: J2000		
Comments: Category=Star Description=[Supernovae] Extended=NO					
Generic Targets	#	Name	Criteria	Description	
	(1)	Supernova1	A type Ia supernova which exploded within 20Mpc		

Proposal 9261 - Observation 5 - Late Time Spectroscopy of Type Ia Supernovae: Determining the Explosion Mechanism and Element...

Observation	Proposal 9261, Observation 5: 400-500d medium												Tue Nov 18 21:00:10 GMT 2025
	Diagnostic Status: Warning												
	Observing Template: MIRI Medium Resolution Spectroscopy												
Diagnostics	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(2)	SN2024epr	RA: 03 06 11.2240 (46.5467667d) Dec: +41 51 0.18 (41.85005d) Equinox: J2000										
	Comments: Category=Star Description=[Supernovae] Extended=NO												
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray			Grating Wheel Direction		
	F1000W	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	Optional ETC ID
	1	SHORT(A)	MRSLONG		SLOWR1	36	3	1	Dither 1	4	12	10511.565	81816
	1	SHORT(A)	MRSSHORT		SLOWR1	36	3	1	Dither 1	4	12	10511.565	81816
	2	MEDIUM(B)	MRSLONG		SLOWR1	36	3	1	Dither 1	4	12	10511.565	81816
	2	MEDIUM(B)	MRSSHORT		SLOWR1	36	3	1	Dither 1	4	12	10511.565	81816
	3	LONG(C)	MRSLONG		SLOWR1	36	3	1	Dither 1	4	12	10511.565	81816
	3	LONG(C)	MRSSHORT		SLOWR1	36	3	1	Dither 1	4	12	10511.565	81816

Special Requirements	Between Dates 28-DEC-2025:00:00:00 and 28-JAN-2026:00:00:00
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