



5057 - Late Time Spectroscopy of Type Ia Supernovae: Determining the Explosion Mechanism and Elemental Production

Cycle: 3, Proposal Category: GO

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Dr. Kyle Medler (CoI)	University of Hawaii at Manoa

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
100-200d				
	2	100-200d SNe Ia	MIRI Medium Resolution Spectroscopy	(2) SN2024epr
250-350d				
	4	250-350d SNe Ia	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 5057 - 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		
<i>Comments:</i> <i>Category=Star</i> <i>Description=[Supernovae]</i>					
Generic Targets	#	Name	Criteria	Description	
	(1)	Supernova1	A type Ia supernova which exploded within 20Mpc		

Proposal 5057 - Observation 2 - Late Time Spectroscopy of Type Ia Supernovae: Determining the Explosion Mechanism and Element...

Tue Oct 29 20:00:11 GMT 2024

Observation	Proposal 5057, Observation 2: 100-200d SNe Ia Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy																																																																																																							
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Special Requirements

Before Date 31-AUG-2024:00:00:00

Proposal 5057 - Observation 4 - Late Time Spectroscopy of Type Ia Supernovae: Determining the Explosion Mechanism and Element...

Tue Oct 29 20:00:11 GMT 2024

Observation	Proposal 5057, Observation 4: 250-350d SNe Ia Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
Diagnostics	(Visit 4:1) Warning (Form): Data Excess over lower threshold (Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
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	1	LONG(C)	MRSSHORT		FASTR1	154	2	1	Dither 1	4	8	3429.949	86820
	2	MEDIUM(B)	MRSLONG		FASTR1	154	2	1	Dither 1	4	8	3429.949	86820
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	3	SHORT(A)	MRSLONG		FASTR1	154	2	1	Dither 1	4	8	3429.949	86820
	3	SHORT(A)	MRSSHORT		FASTR1	154	2	1	Dither 1	4	8	3429.949	86820

Special Requirements

Between Dates 05-JAN-2025:00:00:00 and 05-FEB-2025:00:00:00