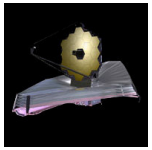

6803 - NIR+MIR Spectroscopy of the Nearby Broad Line Type Ic SN 2024abup: r-process, Dust and Explosion Physics

Cycle: 3, Proposal Category: DD

INVESTIGATORS

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Dr. Carl Edward Fields (CoI)	University of Arizona

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
MIRI LRS +NIRSPEC Prism SNIcBL				
	1	LRS-Slit	MIRI Low Resolution Spectroscopy	(1) SN2024abup
	2	NIR	NIRSpec Fixed Slit Spectroscopy	(1) SN2024abup

ABSTRACT

We request NIRSpec+MIRI/LRS (~1-14 microns; 1.9 hours total) spectroscopic observations of SN 2024abup (D=23 Mpc), a very nearby broad-line type Ic supernova (Ic-BL) in order to search for signatures of heavy element, r-process nucleosynthesis and to obtain the first MIR spectrum of a type Ic-BL supernova with JWST. Binary neutron star mergers are a major source of the heavy elements. However, stellar abundance measurements and models indicate that massive star explosions (e.g. collapsars/type Ic-BL) may also contribute. Recent observations of two long gamma-ray bursts (GRBs), which often also have accompanying SN Ic-BL, have shown infrared emission consistent with the r-process, but whether these are an extension of the binary neutron star merger population or not is unclear. The discovery of SN 2024abup at 23 Mpc offers an opportunity to obtain NIR+MIR spectroscopy of a broad-lined SN Ic without an accompanying GRB for the first time with JWST. This observation allows for a search for r-process elements at ~50d after explosion, when models predict such a signature. Additionally, these observations will also be sensitive to molecular line formation (indicative of dust formation) as well as the geometry and ionization state of the ejecta. All of these are critical for informing explosion models and have never been probed for a SN Ic-BL before.

OBSERVING DESCRIPTION

While neutron star mergers are thought to be the primary producers of r-process elements, the rarity of such events suggest the need for additional r-process formation pathways, the most promising of which is SN Ic-BL. The proposed JWST observations will directly test this hypothesis for the first time.

We request 2.9 hours of DDT for an observation of a nearby broadline Ic SN 2024abup (D=23 Mpc). We will observe it ~50 days, after the discovery when the r-process elment has the biggest impact, with NIRSecp + MIRI for a spectra spanning from 1-14 microns. We will using MIRI LRS with resolution of (R=100) which is sufficient for supernova with broad features. This setup will provide us a wavelength coverage of ~5 to 14 microns. For the NIRSpec observation, we will use G140M+G235M+G395M to get the coverage from ~1 to 5 microns at medium resolution (R~1000). The combination of NIRSpec and MIRI will produce the first ever complete infrared spectral coverage of a SN Ic-BL and will give unprecedented coverage of r-process element signatures. This is a non-disruptive target-of-opportunity request.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN2024abup	RA: 01 49 11.3100 (27.2971250d) Dec: -10 25 27.40 (-10.42428d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Observation

Proposal 6803, Observation 1: LRS-Slit Thu Dec 19 17:00:46 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low 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)	SN2024abup	RA: 01 49 11.3100 (27.2971250d) Dec: -10 25 27.40 (-10.42428d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F1000W	FAST	4	1	1	11.1	233600

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	20	1	1	1	1	55.501		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	100	2	4	1	2	1115.566	2233600

Special Requirements

Before Date 17-JAN-2025:00:00:00

Group Observations 1, 2, Non-interruptible

Observation

Proposal 6803, Observation 2: NIR Thu Dec 19 17:00:46 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit 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)	SN2024abup	RA: 01 49 11.3100 (27.2971250d) Dec: -10 25 27.40 (-10.42428d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	FULL	F110W	NRSRAPID	3	1	1	42.947	226316

Template

HFF Readout Mode	Slit	Subarray
false	S200A1	FULL

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/F100LP	S200A1	NRSIRS2RAPID	15	1	1	NONE	3	3	700.267	233600
2	G235M/F170LP	S200A1	NRSIRS2RAPID	15	1	2	NONE	3	3	700.267	233600
3	G395M/F290LP	S200A1	NRSIRS2RAPID	15	1	3	NONE	3	3	700.267	233600

Special Requirements	
	Before Date 17-JAN-2025:00:00:00 Group Observations 1, 2, Non-interruptible