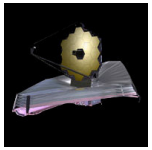

3726 - Examining the Heart of Type Ia Supernova 2021aefx with Ultra-Late Time Spectra

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
MIRI				
	1	SN2021aefx_MIR_Visit1	MIRI Low Resolution Spectroscopy	(1) SN2021AEFX
NIRSPEC				
	4	SN2021aefx_NIR_Visit1	NIRSpec Fixed Slit Spectroscopy	(1) SN2021AEFX

ABSTRACT

Type Ia supernovae (SNe Ia) are the explosive, thermonuclear deaths of white dwarf stars in multi-star systems. Despite decades of intensive study, the true nature of their progenitors and the physical mechanism by which they explode are still unknown. SNe Ia provide crucial insights into other areas of astronomy, including: understanding sources of systematic errors in the use of SNe Ia as cosmological probes, the final phases of stellar evolution, and the origin and distribution of elements formed in nuclear statistical equilibrium. NIR and MIR ultra-late time spectra with NIRSpec and MIRI are a new probe, enabled by the sensitivity of JWST to address these longstanding questions. We request 19.8 hrs of JWST time to obtain 3 NIR+MIR spectra of SN 2021aefx between 750-1150 days after B-band max light. These observations will be the first ever ultra-late time SNe Ia spectra in the NIR and MIR. These data will: (1) reveal the ions responsible for flux redistribution to the IR in late-time SNe Ia, enabling full use of accurate bolometric light curves; (2) measure the location, composition, and mass of radioactive electron capture elements like 57Co and 55Fe; (3) determine the origin, strength, and evolution of the magnetic field in the SN; (4) probe macroscopic mixing between the electron capture and nuclear

statistical equilibrium regions; and (5) and monitor for potential late-onset H/He interaction signatures. This data will be truly groundbreaking and push SN physics and observations into previously unexplored areas. Significant progress will be made in our understanding of the heavy elements in the Universe and SNe Ia as distance indicators.

OBSERVING DESCRIPTION

We propose obtaining three ultra-late time NIR+MIR spectra of SN 2021aefx with NIRSpec and MIRI/LRS near +750, +1000, and +1150 days after B-band maximum light, totaling 19.76 hours of charged time spread over Cycles 2 and 3. NIRSpec observations will be obtained in fixed-slit configuration with the PRISM/CLEAR filter, with target acquisition images taken in the F140X filter. MIRI observations with the Low Resolution Spectrograph will use P750L grating, and use the F1000W filter for target acquisition. Observations fall near the edges of the JWST visibility windows for SN 2021aefx but can be classically scheduled within +/- 15 days of the requested epoch to allow for scheduling flexibility.

Proposal 3726 - Targets - Examining the Heart of Type Ia Supernova 2021aefx with Ultra-Late Time Spectra

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000		

Comments: SN 2021aefx is a Type Ia supernova in NGC 1566
Category=Star
Description=[Supernovae]
Extended=NO

Observation

Proposal 3726, Observation 1: SN2021aefx_MIR_Visit1 Tue Nov 07 17:00:38 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

(SN2021aefx_MIR_Visit1 (Obs 1)) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(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)	SN2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000		

Comments: SN 2021aefx is a Type Ia supernova in NGC 1566
Category=Star
Description=[Supernovae]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F1000W	FASTGRPAVG	4	1	1	44.401	141791.4

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	4	1	1	1	1	11.1		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	134	2	4	1	2	1492.972	141791.3

Special Requirements

Between Dates 04-DEC-2023:00:00:00 and 03-JAN-2024:23:59:59

Group Observations 1, 4, Non-interruptible

Observation

Proposal 3726, Observation 4: SN2021aefx_NIR_Visit1 Tue Nov 07 17:00:38 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000		

Comments: SN 2021aefx is a Type Ia supernova in NGC 1566
Category=Star
Description=[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	1 SN2021AEFX	WATA	FULL	CLEAR	NRSRAPID	3	1	1	42.947	141791.2

Template

Slit	Subarray
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	PRISM/CLEAR	S200A1	NRSIRS2RAPID	11	1	1	NONE	3	3	525.2	141791.1

Special Requirements	
	Between Dates 04-DEC-2023:00:00:00 and 03-JAN-2024:23:59:59 Group Observations 1, 4, Non-interruptible