



6583 - Probing Early Dust Formation in the Universe via Stripped-Envelope Supernovae

Cycle: 3, Proposal Category: GO

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JWST Proposal 6583 (Created: Friday, June 13, 2025, 10:00:10AM Eastern Standard Time) - Overview

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Phase 4				
	7	NIRSPEC	NIRSpec Fixed Slit Spectroscopy	(2) 2024ahv
	8	MIRI/LRS	MIRI Low Resolution Spectroscopy	(2) 2024ahv

ABSTRACT

Details of dust formation in the early Universe are unknown. While AGB stars are considered to be primary dust producers, the first dust in the local Universe may have formed before AGB stars had time to make it. Core-collapse supernovae (CCSNe) are expected to play an important role in dust production since their current formation rate predominates all other types of supernovae. To date, the community has been fixated on dust formation in CCSNe with intact hydrogen-rich envelopes. However, stripped-envelope supernovae (SESNe) come from the death of massive, shorter-lived stars, and are therefore one of the earliest possible sources of early Universe cosmic dust. We request 16.58 hr of non-disruptive ToO time to obtain an NIR+MIR spectral time-series of one SESN at four key epochs between ~70-300 days past-maximum luminosity to investigate: 1) the formation

of CO at ~70 days past-maximum, 2) the formation of SiO precipitated by CO cooling (or rapid adiabatic cooling) at ~100 days, 3) the condensation of SiO to dust at ~200 days, 4) the growth of dust and obtaining its temperature at ~300 days, and 5) constraining the ejecta mass. The third and fourth epochs will allow us to determine the location of the dust and understand its origin, whether in-situ, in the circumstellar medium (CSM), or pre-existing in a molecular cloud. Following a SESN all the way from the formation of dust precursors CO and SiO through the dust formation phases will provide unprecedented insight into the deaths of a range of massive stars and how they might contribute to the total dust budget of the ISM.

OBSERVING DESCRIPTION

We request a non-disruptive ToO trigger, to obtain a spectroscopic sequence of one stripped-envelope supernova from ~70-300 d past maximum light. Data will be taken at four epochs 70, 100, 200, and 300 d. At each epoch, we will use the low resolution spectral mode on MIRI, and the CLEAR/PRISM mode with the S400A1 slit on NIRSpec.

Proposal 6583 - Targets - Probing Early Dust Formation in the Universe via Stripped-Envelope Supernovae

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(2)	2024ahv	RA: 16 18 46.3100 (244.6929583d) Dec: +07 24 44.84 (7.41246d) Equinox: J2000	Epoch of Position: 2000	
Comments: Category=Star Description=[Supernovae] Extended=NO					

Proposal 6583 - Observation 7 - Probing Early Dust Formation in the Universe via Stripped-Envelope Supernovae

Observation	Proposal 6583, Observation 7: NIRSPEC											Fri Jun 13 15:00:10 GMT 2025
	Diagnostic Status: Warning											
	Observing Template: NIRSpec Fixed Slit Spectroscopy											
Diagnostics	(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous		
	(2)	2024ahv	RA: 16 18 46.3100 (244.6929583d) Dec: +07 24 44.84 (7.41246d) Equinox: J2000				Epoch of Position: 2000					
	Comments: 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	SAME	WATA	FULL	F110W	NRSRAPIDD6	3	1	1	171.788	143926.2	
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	PRISM/CLEAR	S400A1	NRSRAPID	70	1	1	NONE	3	3	331.915	143926.4

Proposal 6583 - Observation 7 - Probing Early Dust Formation in the Universe via Stripped-Envelope Supernovae

Special Requirements	Between Dates 29-JUN-2025:00:00:00 and 30-AUG-2025:00:00:00 Group Observations 7, 8 within 1 Days
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Proposal 6583 - Observation 8 - Probing Early Dust Formation in the Universe via Stripped-Envelope Supernovae

Observation	Proposal 6583, Observation 8: MIRI/LRS									
	Diagnostic Status: Warning									
Diagnostics	Observing Template: MIRI Low Resolution Spectroscopy									
	(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Miscellaneous			
	(2)	2024ahv	RA: 16 18 46.3100 (244.6929583d)		Epoch of Position: 2000					
			Dec: +07 24 44.84 (7.41246d)							
			Equinox: J2000							
	Comments:									
	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	F560W	FASTGRPAVG16	4	1	1	177.603	143926.1	
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	10	5	5	1	1	149.852		F560W

Proposal 6583 - Observation 8 - Probing Early Dust Formation in the Universe via Stripped-Envelope Supernovae

Spectral Elements	#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	FASTR1	100	25	50	1	2	14008.402	143926.3
Special Requirements	Between Dates 29-JUN-2025:00:00:00 and 30-AUG-2025:00:00:00								
	Group Observations 7, 8 within 1 Days								