



11192 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Cycle: 5, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Thomas Leslie Killestein (PI) (ESA Member)	University of Warwick
Dr. Miika Pursiainen (CoI) (ESA Member)	University of Warwick
Dr. Rubina Kotak (CoI) (ESA Member)	University of Turku
Dr. Joseph Lyman (CoI) (ESA Member)	University of Warwick
Dr. Conor Byrne (CoI) (ESA Member)	University of Warwick

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Epoch 1				
	1	NIRSPEC-epoch1	NIRSpec Fixed Slit Spectroscopy	(1) SN2024cld
	2	MIRI-epoch1	MIRI Medium Resolution Spectroscopy	(1) SN2024cld
Epoch 2				
	3	NIRSPEC-epoch2	NIRSpec Fixed Slit Spectroscopy	(1) SN2024cld
	4	MIRI-epoch2	MIRI Medium Resolution Spectroscopy	(1) SN2024cld

ABSTRACT

The impacts of cosmic dust are pervasive throughout the Universe, with supernovae (SNe) being known to be significant dust factories since SN 1987A. The origins of dust, particularly in the distant Universe, remain hotly debated however. SNe interacting with a disk of CSM may drive enhanced dust yields, as evidenced by SN 1998S, among the dustiest SNe known. This has strong implications for the low-metallicity early Universe, where wind-driven mass loss is suppressed, and so binary shedding events may deposit even greater masses of material into the CSM.

JWST Proposal 11192 (Created: Tuesday, June 2, 2026, 3:00:40PM Eastern Standard Time) - Overview

SN 2024cld, the latest object in the rare 98S-like class, shows a strong NIR excess in photometry, but without MIR spectroscopy, determining the dust properties is impossible. NIRSpec and MIRI spectroscopy (totalling 7.4h) obtained of SN2024cld at two epochs, 850d and 1150d, will yield an exquisite dataset spanning 2-25 micron, sampling the epochs of maximum dust formation. Two epochs provides a crucial lever arm by which to break degeneracies and disentangle multiple dust components. This approach will uniquely enable us to measure the dust mass (and rate of dust synthesis), constrain the dust location and composition, and quantify how much of it is newly-formed versus pre-existing. MIRI will also enable us to constrain colder dust components, whether arising from massive star dust shells, or ISM warmed by the supernova itself. For the first time in over a decade, we have the opportunity to conduct a detailed census of dust formation in a SN II interacting with a disk-like CSM, a geometrically complex environment - and thus quantify whether such events are able to partially resolve the tension in the cosmic dust budget.

OBSERVING DESCRIPTION

The program aims to obtain NIR and MIR spectroscopy of a peculiar dust-forming supernova, fuelled by interaction with a dense CSM disk. The observations with NIRSPEC FS and MIRI MRS modes will cover a broad spectral range of 2-25 micron, with observing time split between two epochs spaced roughly 200d apart to characterise the time evolution of the IR SED, and measure the dust cooling rate.

Proposal 11192 - Targets - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	SN2024cld	RA: 15 50 21.5501 (237.5897921d) Dec: +18 56 20.22 (18.93895d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	
Comments: Category=Star Description=[Dust shell, Supernovae] Extended=NO					

Proposal 11192 - Observation 1 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Observation	Proposal 11192, Observation 1: NIRSPEC-epoch1 Diagnostic Status: Warning Observing Template: NIRSpec Fixed Slit Spectroscopy											Tue Jun 02 20:00:40 GMT 2026
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)	SN2024cld	RA: 15 50 21.5501 (237.5897921d) Dec: +18 56 20.22 (18.93895d) Equinox: J2000				Parallax: 0" Epoch of Position: 2000					
	Comments: Category=Star Description=[Dust shell, Supernovae] Extended=NO											
Acquisition	#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	
	1	1 SN2024cld	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	271545	
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	Optional ETC ID
	1	G235M/F170LP	S200A1	NRSIRS2RAPID	7	1	1	NONE	3	3	350.133	273417
	2	G395M/F290LP	S200A1	NRSIRS2RAPID	4	1	2	NONE	3	3	218.833	273417

Proposal 11192 - Observation 1 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Special Requirements	Before Date 01-SEP-2026:00:00:00
	3 After 1 by 200 Days to <None specified>

Proposal 11192 - Observation 2 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Observation	Proposal 11192, Observation 2: MIRI-epoch1												Tue Jun 02 20:00:40 GMT 2026	
	Diagnostic Status: Warning													
	Observing Template: MIRI Medium Resolution 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)	SN2024cld	RA: 15 50 21.5501 (237.5897921d) Dec: +18 56 20.22 (18.93895d) Equinox: J2000				Parallax: 0" Epoch of Position: 2000							
	Comments: Category=Star Description=[Dust shell, Supernovae] Extended=NO													
Acquisition	#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID					
	1	1 SN2024cld	F560W	FAST	6	1	1	16.65	273417					
Template	Primary Channel		Simultaneous Imaging				Imager Subarray				Grating Wheel Direction			
	All MRS		YES				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		IMAGER	F560W	FASTR1	50	1	1	Dither 1	4	4	555.008	273417	
	1	SHORT(A)	MRSLONG		FASTR1	150	1	1	Dither 1	4	4	1665.024	273417	
	1	SHORT(A)	MRSSHORT		FASTR1	150	1	1	Dither 1	4	4	1665.024	273417	
	2		IMAGER	F770W	FASTR1	50	1	1	Dither 1	4	4	555.008	273417	
	2	MEDIUM(B)	MRSLONG		FASTR1	150	1	1	Dither 1	4	4	1665.024	273417	
	2	MEDIUM(B)	MRSSHORT		FASTR1	150	1	1	Dither 1	4	4	1665.024	273417	
	3		IMAGER	F1000W	FASTR1	50	1	1	Dither 1	4	4	555.008	273417	
	3	LONG(C)	MRSLONG		FASTR1	150	1	1	Dither 1	4	4	1665.024	273417	
	3	LONG(C)	MRSSHORT		FASTR1	150	1	1	Dither 1	4	4	1665.024	273417	

Proposal 11192 - Observation 2 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Special Requirements	Before Date 01-SEP-2026:00:00:00 4 After 2 by 200 Days to <None specified>
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Proposal 11192 - Observation 3 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Observation	Proposal 11192, Observation 3: NIRSPEC-epoch2											Tue Jun 02 20:00:40 GMT 2026
	Diagnostic Status: Warning											
	Observing Template: NIRSpec Fixed Slit Spectroscopy											
Diagnostics	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous			
	(1)	SN2024cld	RA: 15 50 21.5501 (237.5897921d) Dec: +18 56 20.22 (18.93895d) Equinox: J2000			Parallax: 0" Epoch of Position: 2000						
	Comments: Category=Star Description=[Dust shell, Supernovae] Extended=NO											
Acquisition	#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	
	1	1 SN2024cld	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	271545	
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	Optional ETC ID
	1	G235M/F170LP	S200A1	NRSIRS2RAPID	8	1	1	NONE	3	3	393.9	273427
	2	G395M/F290LP	S200A1	NRSIRS2RAPID	4	1	2	NONE	3	3	218.833	273427

Proposal 11192 - Observation 3 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Special Requirements	3 After 1 by 200 Days to <None specified>
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Proposal 11192 - Observation 4 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Observation	Proposal 11192, Observation 4: MIRI-epoch2												Tue Jun 02 20:00:40 GMT 2026
	Diagnostic Status: Warning												
	Observing Template: MIRI Medium Resolution 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)	SN2024cld	RA: 15 50 21.5501 (237.5897921d) Dec: +18 56 20.22 (18.93895d) Equinox: J2000				Parallax: 0" Epoch of Position: 2000						
	Comments: Category=Star Description=[Dust shell, Supernovae] Extended=NO												
Acquisition	#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID				
	1	1 SN2024cld	F560W	FAST	6	1	1	16.65	273427				
Template	Primary Channel		Simultaneous Imaging			Imager Subarray			Grating Wheel Direction				
	All MRS		YES			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		IMAGER	F560W	FASTR1	60	1	1	Dither 1	4	4	666.01	273427
	1	SHORT(A)	MRSLONG		FASTR1	120	1	1	Dither 1	4	4	1332.019	273427
	1	SHORT(A)	MRSSHORT		FASTR1	120	1	1	Dither 1	4	4	1332.019	273427
	2		IMAGER	F770W	FASTR1	60	1	1	Dither 1	4	4	666.01	273427
	2	MEDIUM(B)	MRSLONG		FASTR1	120	1	1	Dither 1	4	4	1332.019	273427
	2	MEDIUM(B)	MRSSHORT		FASTR1	120	1	1	Dither 1	4	4	1332.019	273427
	3		IMAGER	F1000W	FASTR1	60	1	1	Dither 1	4	4	666.01	273427
	3	LONG(C)	MRSLONG		FASTR1	120	1	1	Dither 1	4	4	1332.019	273427
	3	LONG(C)	MRSSHORT		FASTR1	120	1	1	Dither 1	4	4	1332.019	273427

Proposal 11192 - Observation 4 - From disk to dust: can supernovae interacting with disk-like CSM explain dust in the early Universe?

Special Requirements	4 After 2 by 200 Days to <None specified>
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