



## 1726 - Shocks and expanding ejecta in Supernova 1987A

Cycle: 1, Proposal Category: GO

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JWST Proposal 1726 (Created: Tuesday, July 6, 2021 at 1:01:25 PM 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>
Observation Folder				
	1	First PA	NIRCam Imaging	(1) SN-1987A

**ABSTRACT**

Supernovae (SNe) play crucial roles in the chemical and dynamical evolution of galaxies; they are sources of kinetic energy and elements, and provide and destroy dust. With JWST, these fundamental questions for SNe will be tackled: How do core collapse SNe explode? How do the SN blast waves impact the ambient gas and destroy dust?

We propose to obtain high-sensitivity and high angular-resolution NIRCam images of SN 1987A, which at a distance of 50 kpc is the nearest SN

explosion detected in the last 400 years. Since the explosion, the fastest part of the blast wave has overtaken the circumstellar ring, which consists of material expelled from the progenitor star when it was in a red-supergiant phase about 20,000 years ago. Deep NIRCam images, including with the [Fe II] 1.64 $\mu$ m filter, can identify for the first time the location of the current shocked region beyond SN 1987A's ring.

The blast wave and reverse shocks shatter and sputter dust grains into smaller fragments and collisionally heat them to high temperatures. NIRCam will be able to spatially resolve hot dust and pinpoint the hot dust locations with respect to [Fe II]-traced shocks. Shock models including dust destruction will be used to evaluate the efficiency of the real time dust destruction by the SN blast wave.

H<sub>2</sub> images obtained with NIRCam can resolve both the distribution and excitation of molecular hydrogen in the inner ejecta. They can trace the posited mixing of the hydrogen envelope deep into the ejecta at the time of SN explosion, thereby constraining the SN explosion model, which predicts mixing efficiencies that depend on the explosion energy.

### **OBSERVING DESCRIPTION**

We will observe SN 1987A, the nearest SN explosion detected in 400 years, with NIRCam.

The observing program will obtain a deep [Fe II] image to detect current on-going shocks within SN 1987A, and high-resolution and high-sensitivity continuum images to identify the emission from hot dust that is undergoing collisional heating and destruction. We will also map ejecta in H<sub>2</sub> in order to investigate the mixing of gas that happened soon after the SN explosion.

The other filters used for the program are Br alpha and continuum for [Fe II] and H<sub>2</sub>. Br alpha will be used to compare the location with shocked [Fe II]

The SUB 400 subarray will be used to cover the entire SN 1987A system, including the outer rings. The current ongoing shocks are located between the equatorial ring and the outer rings, so that covering the entire region is important.

Proposal 1726 - Targets - Shocks and expanding ejecta in Supernova 1987A

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	SN-1987A	RA: 05 35 28.0200 (83.8667500d)	Dec: -69 16 11.07 (-69.26974d)	Equinox: J2000
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>					
<i>Category=Star</i>					
<i>Description=[Supernovae]</i>					
<i>Extended=YES</i>					

Proposal 1726 - Observation 1 - Shocks and expanding ejecta in Supernova 1987A

Tue Jul 06 18:01:25 GMT 2021

<b>Observation</b>	<p><b>Proposal 1726, Observation 1: First PA</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCcam Imaging</p> <p><i>Comments: PA range set to nominal ERS visibility window</i></p>									
<b>Diagnostics</b>	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>		<b>Miscellaneous</b>		
	(1)	SN-1987A	RA: 05 35 28.0200 (83.8667500d) Dec: -69 16 11.07 (-69.26974d) Equinox: J2000							
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Supernovae]</i></p> <p><i>Extended=YES</i></p>									
<b>Template</b>	<b>Module</b>					<b>Subarray</b>				
	B					SUB320				
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>		<b>Subpixel Positions</b>
	1	NONE				STANDARD				9
<b>Spectral Elements</b>	<b>#</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	F164N+F150W2	F405N+F444W	MEDIUM8	10	40	360	9	38107.958	54250
	2	F212N	F323N+F322W2	MEDIUM8	10	30	270	9	28580.969	54250
	3	F150W	F356W	RAPID	10	14	126	9	1484.27	54250
	4	F200W	F444W	RAPID	10	12	108	9	1272.231	54250
<b>Special Requirements</b>	Offset 6.1 arcsec, 5.6 arcsec									