



2763 - SN 1987A: The Formation and Evolution of Dust in a Supernova Explosion

Cycle: 2, Proposal Category: GTO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dir. Margaret Meixner (PI)	Jet Propulsion Laboratory
Dr. Olivia Jones (CoI) (ESA Member)	United Kingdom Astronomy Technology Centre
Prof. Michael J. Barlow (CoI) (ESA Member)	University College London
Dr. Patrice Bouchet (CoI) (ESA Member)	CEA/DSM/Irfu/Service d'Astrophysique - Laboratoire AIM
Dr. Patrick Kavanagh (CoI) (ESA Member)	Dublin Institute For Advanced Studies
Prof. Claes Fransson (CoI) (ESA Member)	Stockholm University
Dr. Joris A.D.L. Blommaert (CoI) (ESA Member)	Vrije Universiteit Brussel
Prof. Alistair Glasse (CoI) (ESA Member)	UK Astronomy Technology Centre
Prof. Jens Hjorth (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute
Dr. Tea Temim (CoI)	Princeton University
Dr. Ryan M Lau (CoI)	NOIRLab - (AZ)
Dr. Ori Dosovitz Fox (CoI)	Space Telescope Science Institute
Dr. Benjamin Sargent (CoI)	Space Telescope Science Institute
Dr. Tuomo Tikkanen (CoI) (ESA Member)	University of Leicester
Dr. Omnarayani Nayak (CoI)	The Johns Hopkins University
Dr. Alec S. Hirschauer (CoI)	Space Telescope Science Institute
Dr. Armin Rest (CoI)	Space Telescope Science Institute
Dr. Oliver Krause (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Rene Gastaud (CoI) (ESA Member)	Commissariat a l'Energie Atomique (CEA)
Gillian Wright (CoI) (ESA Member)	United Kingdom Astronomy Technology Centre
Dr. Josefin Larsson (CoI) (ESA Member)	Royal Institute of Technology
Dr. Laura Lenkic (CoI)	Universities Space Research Association
Nolan Habel (CoI)	Jet Propulsion Laboratory

<i>Name</i>	<i>Institution</i>
Dr. Roger Wesson (CoI) (ESA Member)	Cardiff University

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
MIRI				
	2	MRS - ALL	MIRI Medium Resolution Spectroscopy	(1) SN-1987A
	3	MRS - ALL	MIRI Medium Resolution Spectroscopy	(2) SN1987A-BKG-SE

ABSTRACT

From Supernova to Supernova Remnant, SN 1987A has given us a unique opportunity to study the mechanics of a supernova explosion and now to witness the birth of a supernova remnant. We want to understand how massive stars age and explode, how their ejecta form dust and molecules and how the blast wave from their violent explosion affects their surroundings.

The central stellar ejecta of SN 1987A are surrounded by a ring of progenitor gas and dust that has been shocked by the blast wave of the explosion, which is now leaving it and moving farther into the Interstellar Medium (ISM), which can thus be explored for the first time at high spatial and spectral resolution. Further, the ejecta are now hit by the reverse shock whose effects and evolution with time will be observed with MRS IFU spectroscopy. The inner ejecta of SN 1987A and its Equatorial Ring are known to be strongly evolving over timescales of a year, resulting in significant changes in both its flux and morphology. To monitor the rapid evolution of the ring – ejecta collision, and follow the expansion of the reverse shock into the surrounding CSM we duplicate the MRS observational setup of the JWST Cycle 1 program #1232.

In summary the Cycle 2 MRS IFU spectroscopy will measure key shocked line diagnostics that will constrain the shock physics as well as the elemental abundances in both the ring and the stellar ejecta, will provide key information about potential neutron star formation.

OBSERVING DESCRIPTION

Using the MRS we are resolving the SN1987a ring and ejecta. A background field is observed for the MRS callibration.

Proposal 2763 - Targets - SN 1987A: The Formation and Evolution of Dust in a Supernova Explosion

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	SN-1987A	RA: 05 35 27.9680 (83.8665333d) Dec: -69 16 11.09 (-69.26975d) 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>		
(2)	SN1987A-BKG-SE	RA: 05 35 28.5915 (83.8691312d) Dec: -69 16 20.99 (-69.27250d) Equinox: J2000 <i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i>			

Proposal 2763 - Observation 2 - SN 1987A: The Formation and Evolution of Dust in a Supernova Explosion

Mon Jun 26 14:02:22 GMT 2023

Observation	Proposal 2763, Observation 2: MRS - ALL Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observations:[MRS - ALL (Obs 3)]																																																																																																																																													
	(Visit 2:1) Warning (Form): Data Excess over lower threshold (Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.																																																																																																																																													
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>SN-1987A</td> <td>RA: 05 35 27.9680 (83.8665333d) Dec: -69 16 11.09 (-69.26975d) Equinox: J2000</td> <td></td> <td></td> </tr> </tbody> </table> Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[Supernovae] Extended=YES												#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(1)	SN-1987A	RA: 05 35 27.9680 (83.8665333d) Dec: -69 16 11.09 (-69.26975d) Equinox: J2000																																																																																																																										
	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous																																																																																																																																									
(1)	SN-1987A	RA: 05 35 27.9680 (83.8665333d) Dec: -69 16 11.09 (-69.26975d) Equinox: J2000																																																																																																																																												
<table border="1"> <thead> <tr> <th>#</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>NONE</td> </tr> </tbody> </table>												#	Target	1	NONE																																																																																																																															
#	Target																																																																																																																																													
1	NONE																																																																																																																																													
Template	<table border="1"> <thead> <tr> <th>AcqFilter</th> <th>Primary Channel</th> <th>Simultaneous Imaging</th> <th>Imager Subarray</th> <th>Grating Wheel Direction</th> </tr> </thead> <tbody> <tr> <td>F560W</td> <td>ALL</td> <td>YES</td> <td>FULL</td> <td>NEUTRAL</td> </tr> </tbody> </table>												AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction	F560W	ALL	YES	FULL	NEUTRAL																																																																																																																								
	AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction																																																																																																																																									
F560W	ALL	YES	FULL	NEUTRAL																																																																																																																																										
Dithers	<table border="1"> <thead> <tr> <th>#</th> <th>Dither Type</th> <th>Optimized For</th> <th>Direction</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4-Point</td> <td>EXTENDED SOURCE</td> <td>NEGATIVE</td> </tr> </tbody> </table>												#	Dither Type	Optimized For	Direction	1	4-Point	EXTENDED SOURCE	NEGATIVE																																																																																																																										
	#	Dither Type	Optimized For	Direction																																																																																																																																										
1	4-Point	EXTENDED SOURCE	NEGATIVE																																																																																																																																											
Spectral Elements	<table border="1"> <thead> <tr> <th>#</th> <th>Wavelength Range</th> <th>Detector</th> <th>Filter</th> <th>Readout Pattern</th> <th>Groups/Int</th> <th>Integrations/Exp</th> <th>Exposures/Dith</th> <th>Dither</th> <th>Total Dithers</th> <th>Total Integrations</th> <th>Total Exposure Time</th> <th>ETC Wkbk.Calc ID</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td>IMAGER</td> <td>F1000W</td> <td>SLOWR1</td> <td>10</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3057.91</td> <td></td> </tr> <tr> <td>1</td> <td>LONG(C)</td> <td>MRSLONG</td> <td></td> <td>FASTR1</td> <td>94</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3152.445</td> <td></td> </tr> <tr> <td>1</td> <td>LONG(C)</td> <td>MRSSHORT</td> <td></td> <td>FASTR1</td> <td>94</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3152.445</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>IMAGER</td> <td>F770W</td> <td>SLOWR1</td> <td>10</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3057.91</td> <td></td> </tr> <tr> <td>2</td> <td>MEDIUM(B)</td> <td>MRSLONG</td> <td></td> <td>FASTR1</td> <td>94</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3152.445</td> <td></td> </tr> <tr> <td>2</td> <td>MEDIUM(B)</td> <td>MRSSHORT</td> <td></td> <td>FASTR1</td> <td>94</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3152.445</td> <td></td> </tr> <tr> <td>3</td> <td></td> <td>IMAGER</td> <td>F560W</td> <td>SLOWR1</td> <td>10</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3057.91</td> <td></td> </tr> <tr> <td>3</td> <td>SHORT(A)</td> <td>MRSLONG</td> <td></td> <td>FASTR1</td> <td>94</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3152.445</td> <td></td> </tr> <tr> <td>3</td> <td>SHORT(A)</td> <td>MRSSHORT</td> <td></td> <td>FASTR1</td> <td>94</td> <td>3</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>12</td> <td>3152.445</td> <td></td> </tr> </tbody> </table>												#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	1		IMAGER	F1000W	SLOWR1	10	3	1	Dither 1	4	12	3057.91		1	LONG(C)	MRSLONG		FASTR1	94	3	1	Dither 1	4	12	3152.445		1	LONG(C)	MRSSHORT		FASTR1	94	3	1	Dither 1	4	12	3152.445		2		IMAGER	F770W	SLOWR1	10	3	1	Dither 1	4	12	3057.91		2	MEDIUM(B)	MRSLONG		FASTR1	94	3	1	Dither 1	4	12	3152.445		2	MEDIUM(B)	MRSSHORT		FASTR1	94	3	1	Dither 1	4	12	3152.445		3		IMAGER	F560W	SLOWR1	10	3	1	Dither 1	4	12	3057.91		3	SHORT(A)	MRSLONG		FASTR1	94	3	1	Dither 1	4	12	3152.445		3	SHORT(A)	MRSSHORT		FASTR1	94	3	1	Dither 1	4	12	3152.445	
	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID																																																																																																																																	
	1		IMAGER	F1000W	SLOWR1	10	3	1	Dither 1	4	12	3057.91																																																																																																																																		
	1	LONG(C)	MRSLONG		FASTR1	94	3	1	Dither 1	4	12	3152.445																																																																																																																																		
	1	LONG(C)	MRSSHORT		FASTR1	94	3	1	Dither 1	4	12	3152.445																																																																																																																																		
	2		IMAGER	F770W	SLOWR1	10	3	1	Dither 1	4	12	3057.91																																																																																																																																		
	2	MEDIUM(B)	MRSLONG		FASTR1	94	3	1	Dither 1	4	12	3152.445																																																																																																																																		
	2	MEDIUM(B)	MRSSHORT		FASTR1	94	3	1	Dither 1	4	12	3152.445																																																																																																																																		
	3		IMAGER	F560W	SLOWR1	10	3	1	Dither 1	4	12	3057.91																																																																																																																																		
	3	SHORT(A)	MRSLONG		FASTR1	94	3	1	Dither 1	4	12	3152.445																																																																																																																																		
3	SHORT(A)	MRSSHORT		FASTR1	94	3	1	Dither 1	4	12	3152.445																																																																																																																																			

Proposal 2763 - Observation 2 - SN 1987A: The Formation and Evolution of Dust in a Supernova Explosion

Special Requirements

Sequence Observations 2, 3, Non-interruptible

Proposal 2763 - Observation 3 - SN 1987A: The Formation and Evolution of Dust in a Supernova Explosion

Mon Jun 26 14:02:22 GMT 2023

Observation	Proposal 2763, Observation 3: MRS - ALL Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observation For: [MRS - ALL (Obs 2)]												
	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(2)	SN1987A-BKG-SE	RA: 05 35 28.5915 (83.8691312d) Dec: -69 16 20.99 (-69.27250d) Equinox: J2000 <i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i>										
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray		Grating Wheel Direction			
	F560W	ALL			YES			FULL		NEUTRAL			
Dithers	#	Dither Type				Optimized For				Direction			
	1	4-Point				EXTENDED SOURCE				NEGATIVE			
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1		IMAGER	F1000W	SLOWR1	10	1	1	Dither 1	4	4	955.597	
	1	LONG(C)	MRSLONG		FASTR1	94	1	1	Dither 1	4	4	1043.415	
	1	LONG(C)	MRSSHORT		FASTR1	94	1	1	Dither 1	4	4	1043.415	
	2		IMAGER	F770W	SLOWR1	10	1	1	Dither 1	4	4	955.597	
	2	MEDIUM(B)	MRSLONG		FASTR1	94	1	1	Dither 1	4	4	1043.415	
	2	MEDIUM(B)	MRSSHORT		FASTR1	94	1	1	Dither 1	4	4	1043.415	
	3		IMAGER	F560W	SLOWR1	10	1	1	Dither 1	4	4	955.597	
	3	SHORT(A)	MRSLONG		FASTR1	94	1	1	Dither 1	4	4	1043.415	
	3	SHORT(A)	MRSSHORT		FASTR1	94	1	1	Dither 1	4	4	1043.415	

Proposal 2763 - Observation 3 - SN 1987A: The Formation and Evolution of Dust in a Supernova Explosion

Special Requirements

Sequence Observations 2, 3, Non-interruptible