

7648 - N6946-BH1: Fading following a failed supernova, or post-merger recovery?

Cycle: 4, Proposal Category: GO

INVESTIGATORS

Name	Institution
Dr. Emma Beasor (PI)	University of Arizona
Dr. Nathan Smith (CoI)	University of Arizona
Prof. Griffin Hosseinzadeh (CoI)	University of California - San Diego
Prof. David J. Sand (CoI)	University of Arizona
Dr. Jacob Jencson (CoI)	California Institute of Technology
Jeniveve Pearson (CoI)	University of Arizona
Dr. Ben Davies (CoI) (ESA Member)	Liverpool John Moores University

OBSERVATIONS

Folder	Folder Observation Label		Observing Template	Science Target					
MIRI									
	2	MIRI	MIRI Imaging	(1) NAME-N6946-BH1					
	3 NIRCam NIRC		NIRCam Imaging	(1) NAME-N6946-BH1					
Observation Folder									
	4	MIRI MRS	MIRI Medium Resolution Spectroscopy	(1) NAME-N6946-BH1					

ABSTRACT

Recent JWST imaging revealed a luminous infrared source at the location of failed supernova (SN) candidate N6946-BH1. While significantly fainter than the progenitor (13-25% of the bolometric luminosity), the spectral energy distribution (SED) is consistent with both a failed SN and a stellar merger or outburst event. Curiously, observations taken one month later in matching filters revealed a 50% flux reduction in the shortest MIRI filter (5.6m). The mid-IR fluxes also appear to resemble Case C Polycyclic Aromatic Hydrocarbon (PAH) emission, typically produced when dust is irradiated by a UV field.

JWST Proposal 7648 (Created: Tuesday, March 11, 2025, 4:02:32PM Eastern Standard Time) - Overview

We are requesting a total of 16 hours of JWST time in Cycle 4: 5 hours for continued monitoring of N6946-BH1 to assess variability across the nearand mid-IR, and 11 hours for medium-resolution MIRI spectroscopy to search for PAH features. In addition, we are requesting another 5 hours in Cycle 5 to repeat the photometry observations so that we can determine the rate of change in brightness of the source. If the near-IR flux continues to fade, it will strongly suggest the formation of a black hole. If the source remains constant or brightens in the near-IR while fading in the mid-IR, this will support a merger scenario, with the dust clearing to reveal the surviving star.

These observations will not only constrain the timescales for such events but also help estimate the ejected dust mass from mid-IR emission, ultimately resolving a long-standing debate over the fate of N6946-BH1.

OBSERVING DESCRIPTION

We are proposing to image the remaining infrared source remaining at the position of failed SN candidate N6946-BH1 with NIRCam and MIRI over two epochs. This will enable us to understand how the source changes in brightness across the SED with time, and will allow us to constrain the total dust mass of the system. Ultimately these observations will constrain the fate of BH1: has it formed a black hole, or is there a surviving star following a merger?

We are also requesting 10 hours of JWST time to obtain a MIRI MRS spectrum of the remaining source at the position of failed SN candidate BH1. The MRS spectrum will reveal whether or not there are PAH features present in the SED, and break the degeneracy between the merger and failed SN scenarios.

Proposal 7648 - Targets - N6946-BH1: Fading following a failed supernova, or post-merger recovery?

S	# Name		Target Coordinates	Targ. Coord. Corrections	Miscellaneous				
get	(1) NAME-N6946-BH1 RA: 20 35 27.5600 (308.8648333d)			Epoch of Position: 2000					
a			Dec: +60 08 8.29 (60.13564d)						
			Equinox: J2000						
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[Black holes, Circumstellar dust, M supergiants, Red supergiants]									

Proposal 7648 - Observation 2 - N6946-BH1: Fading following a failed supernova, or post-merger recovery?

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ß	# Name	Target Co	ordinates		Targ. Co	ord. Correc	ctions	Miscellaneous				
g	(1) NAME-N6946-BH1	RA: 20 35	27.5600 (308.86	548333d)	Epoch of	Position: 20	00					
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<u>a</u>	4 F1280W	FASTR1	11	1	1	Dither 1	4	4	122.102			
<u></u>	5 F1800W	FASTR1	11	1	1	Dither 1	4	4	122.102			
be	6 F2100W	FASTR1	11	1	1	Dither 1	4	4	122.102			
ر م	7 F2550W	FASTR1	11	1	1	Dither 1	4	4	122.102			

Proposal 7648 - Observation 3 - N6946-BH1: Fading following a failed supernova, or post-merger recovery?

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Ž	Observing Template: NIRCam Imaging										
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a			Dec: +60 08 8.	29 (60.13564d)							
5			Equinox: J2000)							
×.	Comments: This ob	ject was generated b	y the targetselector an	d retrieved from the SI	MBAD database.						
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Proposal 7648 - Observation 4 - N6946-BH1: Fading following a failed supernova, or post-merger recovery?

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