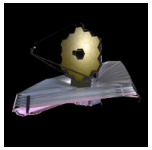

2784 - Late Time Observations of GRB 221009A: The First Search for r-Process Nucleosynthesis in a Collapsar

Cycle: 1, Proposal Category: DD

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	1	Spectroscopy	NIRSpec Fixed Slit Spectroscopy	(1) GRB221009A-OT
	2	Imaging Epoch 1	NIRCam Imaging	(1) GRB221009A-OT
	3	Imaging Epoch 2	NIRCam Imaging	(1) GRB221009A-OT

ABSTRACT

Recent theoretical simulations of accreting black holes formed from the core collapse of massive stars, so-called collapsars and the likely progenitors of long gamma-ray bursts, suggest they may be significant sites of r-process nucleosynthesis. The recent GRB 221009A, discovered on October 9, 2022, is an unprecedentedly bright long-duration GRB that is sufficiently nearby (z=0.151) for detailed follow up to search for r-process signatures. Late time (nebular phase) observations of this event would provide the first ever constraints on r-process nucleosynthesis in collapsar events, a goal that we can only accomplish with JWST. Here, we propose to observe the event at late times (>150 days after explosion) with NIRSpec in fixed-slit mode, and NIRCam to obtain late-time color information and monitor the light curve decline. Given the powerful jet launched in this GRB, we expect a substantial accretion disk in the system, which should produce high quantities of r-process elements; our JWST spectra/photometry will provided the tightest constraints on r-process nucleosynthesis in core-collapse supernovae. Even in the absence of r-process enhanced material, nebular phase spectra probe the innermost ejecta of supernovae; our observations will provide a definitive look at the unique progenitor which launched the brightest jet ever observed. DDT observations are essential for this unique object as it exploded and will fade during Cycle 1.

OBSERVING DESCRIPTION

Here we will obtain late-time observations (>150 days) of GRB221009A to search for r-process signatures produced by the collapsar power source. We will obtain one epoch of NIRSpec fixed-slit spectroscopy with the S200A1 slit using the G140M/F100LP and G235M/F170LP grating/filter combinations to obtain wavelength coverage from 1-3 microns. This is the region where strong signatures of r-process are expected. We use WATA target acquisition with an offset star. For both setups we use a 5-point primary dither pattern, FULL frame readout, and the NRSIRS2 readout pattern. We use 30 groups per intergration and 1 integration per exposure, yielding a total exposure time of 3 hours for each grating/filter setup.

We will also obtain two epochs of photometry using NIRCam with the F115W, F200W, F277W, and F444W filters to monitor color evolution and the light curve decline rate. Depending on total exposure time for the two epochs, we use either the BRIGHT1 or SHALLOW4 readout patterns with 7 groups per integration and 1 integration per exposure. We use 4 STANDARD sub-pixel dithers.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	GRB221009A-OT	RA: 19 13 3.5020 (288.2645917d) Dec: +19 46 24.26 (19.77341d) Equinox: J2000		
Comments: *Category=Star* *Description=[Gamma Ray transients, Supernovae]* *Extended=NO*				
(2)	Acquisition_target	RA: 19 13 3.1716 (288.2632150d) Dec: +19 46 22.62 (19.77295d) Equinox: J2000	Proper Motion RA: -2.532 mas/yr Proper Motion Dec: -6.641 mas/yr Epoch of Position: 2016.0	
Comments: *Category=Star* *Description=[Population I stars]*				

Observation

Proposal 2784, Observation 1: Spectroscopy Sat Mar 11 20:00:34 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

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)	GRB221009A-OT	RA: 19 13 3.5020 (288.2645917d) Dec: +19 46 24.26 (19.77341d) Equinox: J2000		

Comments:
Category=Star
Description=[Gamma Ray transients, 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	2 Acquisition_target	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	150279.23

Template

Slit	Subarray
S200A1	FULL

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	5	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	G140M/F100LP	S200A1	NRSIRS2	30	1	1	NONE	5	5	11014.612	
2	G235M/F170LP	S200A1	NRSIRS2	30	1	2	NONE	5	5	11014.612	

Observation

Proposal 2784, Observation 2: Imaging Epoch 1 Sat Mar 11 20:00:34 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

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)	GRB221009A-OT	RA: 19 13 3.5020 (288.2645917d) Dec: +19 46 24.26 (19.77341d) Equinox: J2000		

Comments:
Category=Star
Description=[Gamma Ray transients, Supernovae]
Extended=NO

Template

Module	Subarray	Target Placement
B	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F115W	F277W	BRIGHT1	7	1	4	4	558.312	
2	F200W	F444W	BRIGHT1	7	1	4	4	558.312	

Special Requirements

Offset 38.83 arcsec, 38.23 arcsec

Observation

Proposal 2784, Observation 3: Imaging Epoch 2 Sat Mar 11 20:00:34 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

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)	GRB221009A-OT	RA: 19 13 3.5020 (288.2645917d) Dec: +19 46 24.26 (19.77341d) Equinox: J2000		

Comments:
Category=Star
Description=[Gamma Ray transients, Supernovae]
Extended=NO

Template

Module	Subarray	Target Placement
B	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F115W	F277W	SHALLOW4	7	1	4	4	1460.201	
2	F200W	F444W	SHALLOW4	7	1	4	4	1460.201	

Special Requirements

After Date 01-AUG-2023:00:00:00
Offset 38.83 arcsec, 38.23 arcsec