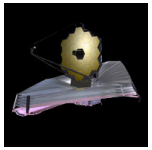

4445 - Revealing the nature of the exceptional GRB 230307A: nearby nucleosynthesis or a primordial explosion?

Cycle: 1, Proposal Category: DD

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observations disruptive ToO epoch2				
	2	NIRSpec Fixed Slit	NIRSpec Fixed Slit Spectroscopy	(1) GRB230307A
	3		NIRCam Imaging	(1) GRB230307A

ABSTRACT

We request JWST observations of the remarkable GRB 230307A, one of the brightest GRBs ever detected, and one where extensive ground-based and JWST observations offer two plausible solutions to the burst's origin. Firstly, the faint afterglow of the blast evolved from blue to red and then faded rapidly. This is consistent with a kilonova in which a compact object binary was ejected from a galaxy ~40 kpc away in projection at a relatively local distance of ~290 Mpc. JWST observations show the source to be very red, notionally in keeping with the local interpretation. However, these JWST observations also show a second solution -- emission lines from a faint, underlying galaxy at z=3.87. Although the probability of chance alignment is small in this case, the inferred energetics are extreme, with isotropic equivalent energy E_iso > 10^56 erg -- an order of magnitude more energetic than any other GRB, comparable to the energies suggested for Population III bursts. Given the rarity, the origin of GRB 230307A remains unclear but can be determined by a new epoch of JWST observations. These will either i) show the source to brighten due to an underlying supernova at z=3.87, ii) show the source to remain constant, indicating the (relatively) bright red source seen in JWST is, in fact, all distant galaxy and not kilonova, and so securing z=3.87 or iii) show the source to fade rapidly, leaving only a much fainter (and so much more likely to arise by chance) galaxy in the background. This scenario would demonstrate a kilonova origin. GRB 230307A is one of the most remarkable GRBs ever detected, and these modest (few hours) JWST observations can conclusively determine its nature.

OBSERVING DESCRIPTION

Our observational strategy is simple. We will obtain observations of GRB 230307A with both NIRSPEC and NIRCAM.

For NIRSPEC we will conduct fixed slit spectroscopy with the prism. We will acquire on a nearby star, and then offset the telescope to the afterglow position as it is too faint for direct acquistion.

Once acquired we will undertake approximately 3600s of science observations with a direct copy of observations taken under GO 4434. In particular we will use the 0.4" slit, NRSRAPID2 reads, 60 reads per integration and for integrations.

To supplement this data we will obtain NIRCAM imaging observations. We will obtain observations in F115W, F150W, F277W, and F444W with the MEDIUM2 reads, 3 groups per integration, 1 integration per exposure and 6 dither positions to enable some sub-pixel dithering and PSF recovery. We will repeat this observation block twice for the F150W and F277W observaitons to obtain the most sensitive constraints on supernovae and once for F115W and F444W for the most senstive KN constraints.

Proposal 4445 - Targets - Revealing the nature of the exceptional GRB 230307A: nearby nucleosynthesis or a primordial explosion?

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	GRB230307A	RA: 04 03 26.0241 (60.8584337d) Dec: -75 22 42.82 (-75.37856d) Equinox: J2000		
Comments: *Category=Star* *Description=[Gamma Ray bursters]*				
(2)	GRB230307A-REFSTAR	RA: 04 03 25.4871 (60.8561962d) Dec: -75 22 44.88 (-75.37913d) Equinox: J2000		
Comments: *Category=Star* *Description=[M stars]*				

Observation

Proposal 4445, Observation 2: NIRSpec Fixed Slit Mon May 01 22:01:35 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit 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)	GRB230307A	RA: 04 03 26.0241 (60.8584337d) Dec: -75 22 42.82 (-75.37856d) Equinox: J2000		

Comments:
Category=Star
Description=[Gamma Ray bursters]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 GRB230307A-REFSTAR	WATA	SUB2048	F140X	NRSRAPID	3	1	1	3.628	146452

Template

Slit	Subarray
S400A1	FULL

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	2	SPATIAL

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	S400A1	NRSIRS2RAPID	60	1	1	NONE	4	4	3559.689	63789

Special Requirements	
	Before Date 20-MAY-2023:23:59:59 Group Observations 2, 3 within 48 Hours

Observation

Proposal 4445, Observation 3

Mon May 01 22:01:35 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)	GRB230307A	RA: 04 03 26.0241 (60.8584337d) Dec: -75 22 42.82 (-75.37856d) Equinox: J2000		

Comments:
Category=Star
Description=[Gamma Ray bursters]

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		7

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	F444W	SHALLOW4	5	1	7	7	1803.777	
2	F150W	F277W	SHALLOW4	4	2	14	7	2931.138	

Special Requirements

Before Date 20-MAY-2023:23:59:00
Aperture PA Range 168 to 172 Degrees (V3 167.94416471 to 171.94416471)
Offset 45.0 arcsec, -30.0 arcsec

Group Observations 2, 3 within 48 Hours