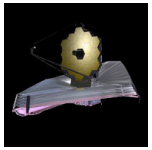

4434 - The late time spectrum of a kilonova in the exceptionally bright GRB 230307A

Cycle: 1, Proposal Category: DD

INVESTIGATORS

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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 propose a modest NIRSPEC and NIRCAM campaign of observations to obtain the spectrum of an apparent kilonova recently associated with the second brightest GRB of all time, GRB 230307A. The source becomes visible to JWST in early April (~25 days post burst), offering the first opportunity to obtain a kilonova spectrum in the mid-IR (and only the second time a KN spectrum has been possible at all after the GW detected AT2017gfo). If the KN hypothesis is correct, then based on its likely host galaxy, the merger lies at ~290 Mpc, comparable to the distances of GW

sources that may soon be identified, providing similar quality data. Our prism observations will be combined with NIRCAM imaging at the blue and red ends of the prism sensitivity curve to give a high signal-to-noise spectral energy distribution from 0.5-5 microns. These observations will characterise the bulk shape of the emission and search for discrete spectral features which can diagnose the properties of the heavy element ejecta. They will also hone our expectations for future gravitational wave - EM detections. These observations will also conclusively rule out (or identify) any more distant GRB scenarios since they will be sensitive to GRB-SNe out to z>2. Together, they can unambiguously solve the mystery of this exceptionally bright burst.

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 likely too faint for direct acquistion.

Once acquired we will undertake approximately 3600s of science observations, consisting of 5 groups per integration, 4 integrations per exposures and 4 dither positions. This will obtain S/N>5 across the ~1-3 micron range of the prism for a blackbody source with a 3000K temperature. In practice, if the emission is nebular it may be concentrated in lines and not a thermal continummn.

To supplement this data we will obtain NIRCAM imaging observations. These will serve multiple roles. Firstly, they will complement our NIRSPEC spectroscopy by focussing on the blue and red ends (e.g. <~ 1 micron and >3.5 microns) where the prism sensitivity is not as good. This will ensure good signal to noise across the spectral range. Secondly, they will provide a robust means of measuring the immediate environment of the burst, providing a very deep search for any directly underlying host galaxy.

We will obtain observations in F070W, F115W, F356W, 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. For a source with K=26(AB) and a 3000K blackbody spectrum we will obtain S/N ratios of >4, 30, 41 and 16 across the filters.

Proposal 4434 - Targets - The late time spectrum of a kilonova in the exceptionally bright GRB 230307A

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	GRB230307A	RA: 04 03 26.0109 (60.8583787d) Dec: -75 22 42.78 (-75.37855d) 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 4434, Observation 2: NIRSpec Fixed Slit Mon Mar 27 13:00:54 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 26.0109 (60.8583787d) Dec: -75 22 42.78 (-75.37855d) 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 09-APR-2023:23:59:59 Group Observations 2, 3 within 24 Hours

Observation

Proposal 4434, Observation 3

Mon Mar 27 13:00:54 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 26.0109 (60.8583787d) Dec: -75 22 42.78 (-75.37855d) 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	INTRASCA	3	STANDARD	8" (SMALL)	2

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	6	1	6	6	1868.198	
2	F150W	F356W	SHALLOW4	5	1	6	6	1546.095	
3	F070W	F444W	SHALLOW4	6	1	6	6	1868.198	

Special Requirements

Before Date 09-APR-2023:23:59:00
Offset 45.0 arcsec, -30.0 arcsec

Group Observations 2, 3 within 24 Hours