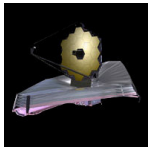

2635 - Infrared emission from the magnetar 4U 0142+61: A dusty fallback disk?

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		MIRI Low Resolution Spectroscopy	(1) PSR-J0146+6145
	2		NIRCam Time Series	(1) PSR-J0146+6145
	3		NIRCam Imaging	(1) PSR-J0146+6145
	4	repeat	NIRCam Time Series	(2) 4U0142+61
	5	repeat of obs 4.	NIRCam Time Series	(2) 4U0142+61
	6	repeat of obs 4.	NIRCam Time Series	(2) 4U0142+61

ABSTRACT

Observations of the magnetar 4U 0142+61 with the Spitzer space telescope have shown a broad infrared excess with a possible silicate spectral feature at 9.7 micron. This result was interpreted as emission from a passive disk surrounding the energetic isolated neutron star. Such disks, predicted by supernova dynamic models, have been long sought after because they can elucidate details of neutron star formation and evolution. Unfortunately, the Spitzer spectrum was of low quality, thus an infrared flux contribution from the neutron star's magnetosphere remains a possibility, leaving the origin of the magnetar's infrared-optical spectrum uncertain. JWST will enable a thorough investigation and clarification of the nature of 4U0142+61's infrared emission. Taking advantage of the NIRCam subarray time-series mode, we also propose to investigate the

pulsations of emission from this slowly spinning neutron star to quantify the contribution of the magnetosphere and separate the magnetospheric emission from the disk emission.

OBSERVING DESCRIPTION

This JWST project has two parts - spectroscopy and time series + imaging observations.

For the spectroscopy, we will employ the MIRI Low Resolution Spectroscopy with the 0.5 arcsec x 4.7 arcsec slit. Two dither positions ('along slit nod' dither type) will be used with FAST readout. The goal is to investigate a suspected silicate feature at 9.7 micron and look for other dust/PAH emission features in the source spectrum.
An acquisition image will be obtained in the F560W filter (FASTGRPAVG readout) which will detect the magnetar in 44 s with S/N=43.

For the time-series observations we will use the NIRCam SUBP64P subarray with SHALLOW4 readout pattern (0.25 sec time resolution) in order to detect pulsations from the magnetar (rotation period 8.7 sec) in the infrared (F410M) and optical (F070W). Obtaining these two bands in one visit is important because magnetars can show long-term flux variations. We also ask for a short acquisition image in the F335M band (DEEP8 readout) as recommended in the JWST documentation.

To cover the wavelength gap between the MIRI/LRS and NIRCam/time-series observations, and obtain a multi-band phometry, we propose a very short NIRCam imaging exposure with F140M and F250M filters (Full arra)y with a standard 3 point dither.

In order to enable contemporaneous coverage (needed because of magnetar variability), we use GROUP OBSERVATION Timing Special Requirement, linking all 3 observations to be carried out within one day.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PSR-J0146+6145	RA: 01 46 22.2100 (26.5925417d) Dec: +61 45 3.80 (61.75106d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Neutron stars]*				
(2)	4U0142+61	RA: 01 46 22.3940 (26.5933083d) Dec: +61 45 3.23 (61.75090d) Equinox: J2000		
Comments: *Category=Star* *Description=[Neutron stars]* *Extended=NO*				

Observation

Proposal 2635, Observation 1

Fri Oct 20 18:00:09 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

(Observation 1) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(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)	PSR-J0146+6145	RA: 01 46 22.2100 (26.5925417d) Dec: +61 45 3.80 (61.75106d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Neutron stars]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F560W	FASTGRPAVG	4	1	1	44.401	63247

Template

Subarray	Obtain Verification Image?
FULL	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	4	1	1	1	1	11.1		F560W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	50	7	14	1	2	1975.828	

Special Requirements

Group Observations 1, 2, 3 within 1 Days

Observation

Proposal 2635, Observation 2

Fri Oct 20 18:00:09 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Time Series

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)	PSR-J0146+6145	RA: 01 46 22.2100 (26.5925417d) Dec: +61 45 3.80 (61.75106d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Neutron stars]

Acquisition

#	Target	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	SUB32TATS	F335M	DEEP8	65	1	1	19.286	63241

Template

Module	Subarray
B	SUB64P

Spectral Elements

#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	CLEAR	F070W	CLEAR	F410M	SHALLOW4	10	800	1	800	2008.448	

Special Requirements

Time Series Observation
No Parallel Attachments

Group Observations 1, 2, 3 within 1 Days

Observation

Proposal 2635, Observation 3

Fri Oct 20 18:00:09 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)	PSR-J0146+6145	RA: 01 46 22.2100 (26.5925417d) Dec: +61 45 3.80 (61.75106d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Neutron stars]

Template

Module	Subarray	Target Placement
B	SUB400P	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	F140M	F250M	RAPID	10	1	7	7	127.674	

Special Requirements

Group Observations 1, 2, 3 within 1 Days

Observation

Proposal 2635, Observation 4: repeat

Fri Oct 20 18:00:09 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Time Series

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	4U0142+61	RA: 01 46 22.3940 (26.5933083d) Dec: +61 45 3.23 (61.75090d) Equinox: J2000		

Comments:
Category=Star
Description=[Neutron stars]
Extended=NO

Acquisition

#	Target	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 4U0142+61	SUB32TATS	F335M	DEEP8	65	1	1	19.286	130489

Template

Module	Subarray
B	SUB64P

Spectral Elements

#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	CLEAR	F070W	CLEAR	F410M	SHALLOW4	10	800	1	800	2008.448	

Special Requirements

Time Series Observation
No Parallel Attachments

Observation

Proposal 2635, Observation 5: repeat of obs 4.

Fri Oct 20 18:00:09 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Time Series

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	4U0142+61	RA: 01 46 22.3940 (26.5933083d) Dec: +61 45 3.23 (61.75090d) Equinox: J2000		

Comments:
Category=Star
Description=[Neutron stars]
Extended=NO

Acquisition

#	Target	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 4U0142+61	SUB32TATS	F335M	DEEP8	65	1	1	19.286	130489

Template

Module	Subarray
B	SUB64P

Spectral Elements

#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	CLEAR	F070W	CLEAR	F410M	SHALLOW4	10	800	1	800	2008.448	

Special Requirements

Time Series Observation
No Parallel Attachments

Observation

Proposal 2635, Observation 6: repeat of obs 4.

Fri Oct 20 18:00:09 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Time Series

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	4U0142+61	RA: 01 46 22.3940 (26.5933083d) Dec: +61 45 3.23 (61.75090d) Equinox: J2000		

Comments:
Category=Star
Description=[Neutron stars]
Extended=NO

Acquisition

#	Target	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 4U0142+61	SUB32TATS	F335M	DEEP8	65	1	1	19.286	130489

Template

Module	Subarray
B	SUB64P

Spectral Elements

#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	CLEAR	F070W	CLEAR	F410M	SHALLOW4	10	800	1	800	2008.448	

Special Requirements

Time Series Observation
No Parallel Attachments