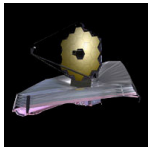

1742 - Planetary nebula NGC 6302 - a testbed for dust formation and processing in a dense torus irradiated by harsh UV radiation

Cycle: 1, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NGC6302-MIRI				
	1		MIRI Medium Resolution Spectroscopy	(4) NGC-6302-BACKGROUND2
	2		MIRI Medium Resolution Spectroscopy	(3) NGC-6302-CENTER

ABSTRACT

Dust is a key ingredient in galaxies, because it provides opacity, plays a key role in interstellar chemistry, and is essential for the formation of stars and (rocky) planets. Evolved Asymptotic Giant Branch (AGB) stars are an important source of stardust in galaxies. The processing of this dust in the interstellar medium (ISM) can be traced by comparing the composition of stardust to that of interstellar dust. For instance, the fraction of crystalline silicate dust in starburst galaxies is used to measure the input of fresh stardust by O-rich evolved stars in the ISM. It is unclear however in what form stardust from AGB stars enters the ISM. This is because: (1) evidence is accumulating that their winds have complex, non-spherical structures, such as disks/tori, often associated with (sub-)stellar companions; and (2) it is unclear how freshly made stardust is affected by the harsh environment that prevails in planetary nebulae (PNe), whose central stars have fast winds and extreme radiation fields. The PN NGC6302 offers a unique laboratory to study the physical and chemical processing of a dense dusty molecular torus ejected by an AGB star, which is exposed to the radiation field and stellar wind of the hottest star known in the Galaxy. Spatially unresolved observations by ISO have revealed a complex chemistry, showing emission from C-rich Polycyclic Aromatic Hydrocarbons (PAHs) in an O-rich chemistry, as well as a very profuse circumstellar dust mineralogy. Spatially resolved JWST observations will allow us to witness how the AGB ejecta are processed in the nebular environment, and to establish in what form the solids in its ejecta are delivered to the ISM.

OBSERVING DESCRIPTION

We will observe the bipolar planetary nebula (PN) NGC 6302 with a dusty torus with JWST MIRI integral field spectrometer (IFU). The IFU will enable us to map the spatial distribution of crystalline silicates, which have been proposed to be associated with the dusty torus.

Additionally, IFU data will map PAHs, molecular hydrogen (H2) and atomic lines within this PN. We will investigate how PAH features change within a PN. H2 and atomic lines will give temperature, density and gas-phase elemental abundances.

Our proposed MIRI MRS IFU observations will be composed of 5 tiles x 5 tiles mosaic image, covering approximately 14.9”x18.4” area with Channel 1. All four spectral channels will be used to cover the entire 4.9-28.3 micron spectra. Four-point dither was chosen to obtain good spatial sampling. Additionally, a background observation with two-point dither will be taken, as the entire IFU map will be covered by the emission from the PN. The anticipated S/N ratio is 20 below 12 micron, while S/N will exceed 300 at wavelengths longer than 13.36 micron, and S/N will be about 220 at 11.52-13.49 micron. Because crystalline silicates in PNe have very low contrast (a few % to 15 % at most) against the overall dust continuum, mostly due to amorphous silicates, such a high S/N is required at longer wavelengths.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	NGC-6302-CENTER	RA: 17 13 44.3938 (258.4349742d) Dec: -37 06 12.36 (-37.10343d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coordinates were adjusted from HST image, which has position calibrated against GAIA *Category=ISM* *Description=[Planetary nebulae]* *Extended=YES*				
(4)	NGC-6302-BACKGROUND2	RA: 17 13 30.6600 (258.3777500d) Dec: -37 04 23.40 (-37.07317d) Equinox: J2000		
Comments: *Category=Unidentified* *Description=[Blank field]*				
(5)	TA1	RA: 17 13 44.3888 (258.4349533d) Dec: -37 05 44.61 (-37.09573d) Equinox: J2000	Proper Motion RA: -5.9833 mas/yr Proper Motion Dec: -6.36558 mas/yr Epoch of Position: 2016	
Comments: Gaia coordinates: 59738056218659 *Category=Star* *Description=[K dwarfs]*				

Observation

Proposal 1742, Observation 1

Tue Aug 22 05:01:23 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [Observation 2]

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
(4)	NGC-6302-BACKGROUND2	RA: 17 13 30.6600 (258.3777500d) Dec: -37 04 23.40 (-37.07317d) Equinox: J2000		

Comments:
Category=Unidentified
Description=[Blank field]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	ALL	YES	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	2-Point	POINT SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F1130W	FASTR1	16	1	1	Dither 1	2	2	88.801	
1	SHORT(A)	MRSLONG		FASTR1	16	1	1	Dither 1	2	2	88.801	
1	SHORT(A)	MRSSHORT		FASTR1	16	1	1	Dither 1	2	2	88.801	
2		IMAGER	F770W	FASTR1	10	1	1	Dither 1	2	2	55.501	
2	LONG(C)	MRSLONG		FASTR1	10	1	1	Dither 1	2	2	55.501	
2	LONG(C)	MRSSHORT		FASTR1	10	1	1	Dither 1	2	2	55.501	
3		IMAGER	F1000W	FASTR1	23	1	1	Dither 1	2	2	127.652	
3	MEDIUM(B)	MRSLONG		FASTR1	23	1	1	Dither 1	2	2	127.652	
3	MEDIUM(B)	MRSSHORT		FASTR1	23	1	1	Dither 1	2	2	127.652	

Special Requirements	Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 1742, Observation 2

Tue Aug 22 05:01:23 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[Observation 1]

Diagnostics

(Observation 2) Warning (Form): Filter mismatch between science and background observations may result in incorrect background subtraction.

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	NGC-6302-CENTER	RA: 17 13 44.3938 (258.4349742d) Dec: -37 06 12.36 (-37.10343d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coordinates were adjusted from HST image, which has position calibrated against GAIA
Category=ISM
Description=[Planetary nebulae]
Extended=YES

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	5 TA1	F560W	FAST	10	1	1	27.75	118710

Template

Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
ALL	YES	FULL	NEUTRAL

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
5	5	10.0	10.0	0.0	0.0	DEFAULT

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F770W	FASTR1	10	1	1	Dither 1	4	4	111.002	54795
1	SHORT(A)	MRSLONG		FASTR1	10	1	1	Dither 1	4	4	111.002	54795
1	SHORT(A)	MRSSHORT		FASTR1	10	1	1	Dither 1	4	4	111.002	54795
2		IMAGER	F1000W	FASTR1	23	1	1	Dither 1	4	4	255.304	54795
2	LONG(C)	MRSLONG		FASTR1	23	1	1	Dither 1	4	4	255.304	54795
2	LONG(C)	MRSSHORT		FASTR1	23	1	1	Dither 1	4	4	255.304	54795
3		IMAGER	F1130W	FASTR1	16	1	1	Dither 1	4	4	177.603	54795
3	MEDIUM(B)	MRSLONG		FASTR1	16	1	1	Dither 1	4	4	177.603	54795
3	MEDIUM(B)	MRSSHORT		FASTR1	16	1	1	Dither 1	4	4	177.603	54795

Special Requirements	
	No Parallel Attachments Sequence Observations 1, 2, Non-interruptible