



1239 - Investigating Dusty Disks in Evolved Stars

Cycle: 1, Proposal Category: GTO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Michael E. Ressler (PI)	Jet Propulsion Laboratory
Dr. Raghvendra Sahai (CoI)	Jet Propulsion Laboratory
Dr. Stacey N Bright (CoI)	Space Telescope Science Institute
Dr. Ryan M Lau (CoI)	NOIRLab - (AZ)

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Spectroscopy				
	1	NGC-7293	MIRI Medium Resolution Spectroscopy	(1) NGC-7293
	11	NGC-7293 - Repeat of observation 1	MIRI Medium Resolution Spectroscopy	(1) NGC-7293
	2	NGC-6804	MIRI Medium Resolution Spectroscopy	(2) NGC-6804
	3	ZZ-PSC	MIRI Medium Resolution Spectroscopy	(3) V-ZZ-PSC
	4	J4629	MIRI Medium Resolution Spectroscopy	(4) J004629.29-731552.3
	5	J4616	MIRI Medium Resolution Spectroscopy	(5) J004614.67-723519.0
	6	J0439	MIRI Medium Resolution Spectroscopy	(6) J043919.30-685733.4

ABSTRACT

We propose to investigate the mysterious mid-infrared dust excesses that have been found around post-AGB stars that are the end products of low and intermediate mass stars (1–8 Msun). These dust excesses are believed to be produced by a dusty disk around the star. The presence of such dusty disks during these late evolutionary stages is not expected, and so to understand the mechanisms that can produce such disks, we wish to characterize the disk structure, mass, temperature, and composition for a small but representative selection of such sources.

We will obtain MIRI MRS spectroscopy for 6 such sources. For each source, we will obtain 2-point dithered exposures, whose lengths have been chosen to obtain a SNR > 10 at all wavelengths (5 to 25 μm) where possible. (Short wavelengths, $< 10 \mu\text{m}$, for NGC 7293 and J043919.30-685733.4 will violate this rule.) There are no special requirements placed on any of these observations.

OBSERVING DESCRIPTION

We propose to investigate the mysterious mid-infrared dust excesses that have been found around post-AGB stars that are the end products of low and intermediate mass stars (1–8 M_{sun}). These dust excesses are believed to be produced by a dusty disk around the star. The presence of such dusty disks during these late evolutionary stages is unexpected. To understand the mechanisms that can produce such disks, it is important to characterize the disk structure, mass, temperature, and composition.

1. Disks around White Dwarfs: The search for planets or planetary systems around stars other than our Sun is one of the most exciting quests in recent times. Two types of dust disks have been discovered around white dwarfs (WDs): the first are large dust disks around the hot WDs at the centers of planetary nebulae (PNe), that extend to radial distances of 10–100 AU. A comprehensive study of such disks was attempted using Spitzer images of 72 PNe with IRAC and MIPS by Bilíková et al. (2012), who identified a list of 8 objects where the IR excess is likely to be due to an extended dust cloud, e.g., a disk. The second type are small disks of material that orbit “naked” or cool WDs and exhibit 10 μm silicate emission features (Jura et al., 2009; those authors propose that micron-size glassy “olivine” grains can account for the feature’s broad wings, and that these particles likely result from tidal disruption of asteroids. However, the limited angular resolution of Spitzer makes removal of nebular contamination uncertain in the case of the hot WDs (and no spectra are available), and in the cool WD case, the spectra are of low S/N. JWST will allow us to address both issues, even for a small sample of sources.
2. Young Disks resulting from common-envelope ejection in Red Giants: The evolution of very luminous ($L \sim 6000 L_{\text{sun}}$) AGB stars is controlled by heavy mass-loss via dusty winds, thus mid-IR excesses are to be expected. However, a class of lower luminosity, post-RGB stars ($L < \sim 1000 L_{\text{sun}}$) that also exhibit dust excesses have recently been identified in the LMC and SMC using Spitzer photometry (Kamath et al., 2016). For these stars, strong interactions with a compact binary companion during the RGB phase is believed to remove most of the primary’s stellar envelope, but with a significant fraction of the ejecta still residing in a disk. We propose to use JWST/MIRI to obtain high S/N spectra of a small sample of post-RGB stars in the LMC and SMC that will enable us to characterize the properties of the disks and their dust compositions.

References:

- Bilíková, J., Chu, Y.-H., Gruendl, R. A., et al. 2012, ApJS, 200, 3
Jura, M., Farihi, J., & Zuckerman, B. 2009, AJ, 137, 3191

Kamath, D., Wood, P. R., Van Winckel, H., & Nie, J. D. 2016, A&A, 586, L5

Proposal 1239 - Targets - Investigating Dusty Disks in Evolved Stars

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC-7293	RA: 22 29 38.5883 (337.4107846d) Dec: -20 50 13.80 (-20.83717d) Equinox: J2000	Proper Motion RA: 0.002772608782925656 sec of time/yr Proper Motion Dec: -0.0034189999951195205 arcsec/yr Epoch of Position: 2000.0	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Planetary nebulae nuclei]</i></p>				
(2)	NGC-6804	RA: 19 31 35.1349 (292.8963954d) Dec: +09 13 31.15 (9.22532d) Equinox: J2000	Proper Motion RA: -6.464954198750015E-4 sec of time/yr Proper Motion Dec: -0.009407999959876179 arcsec/yr Epoch of Position: 2000.0	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Planetary nebulae nuclei]</i></p>				
(3)	V-ZZ-PSC	RA: 23 28 47.2233 (352.1967637d) Dec: +05 14 50.10 (5.24725d) Equinox: J2000	Proper Motion RA: -0.026658182634620435 sec of time/yr Proper Motion Dec: -0.2667379999820696 arcsec/yr Epoch of Position: 2000.0	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[White dwarfs]</i></p>				
(4)	J004629.29-731552.3	RA: 00 46 29.2901 (11.6220421d) Dec: -73 15 52.30 (-73.26453d) Equinox: J2000		
<p><i>Comments:</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Post-asymptotic giant branch]</i></p>				
(5)	J004614.67-723519.0	RA: 00 46 14.6700 (11.5611250d) Dec: -72 35 19.00 (-72.58861d) Equinox: J2000		
<p><i>Comments:</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Post-asymptotic giant branch]</i></p>				
(6)	J043919.30-685733.4	RA: 04 39 19.3000 (69.8304167d) Dec: -68 57 33.40 (-68.95928d) Equinox: J2000		
<p><i>Comments: Post-RGB (not Post-AGB), but no option in the Description selector.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Post-asymptotic giant branch]</i></p>				

Fixed Targets

Proposal 1239 - Observation 1 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 1: NGC-7293 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(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)	NGC-7293	RA: 22 29 38.5883 (337.4107846d) Dec: -20 50 13.80 (-20.83717d) Equinox: J2000				Proper Motion RA: 0.002772608782925656 sec of time/yr Proper Motion Dec: -0.0034189999951195205 arcsec/yr Epoch of Position: 2000.0						
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[Planetary nebulae nuclei]													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel				Simultaneous Imaging			Imager Subarray		Grating Wheel Direction		
	F1000W	ALL				NO			FULL		NEUTRAL		
Dithers	#	Dither Type				Optimized For				Direction			
	1	2-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	LONG(C)	MRSLONG		FASTR1	90	1	1	Dither 1	2	2	499.507	
	1	LONG(C)	MRSSHORT		FASTR1	90	1	1	Dither 1	2	2	499.507	
	2	MEDIUM(B)	MRSLONG		FASTR1	90	1	1	Dither 1	2	2	499.507	
	2	MEDIUM(B)	MRSSHORT		FASTR1	90	1	1	Dither 1	2	2	499.507	
	3	SHORT(A)	MRSLONG		FASTR1	90	1	1	Dither 1	2	2	499.507	90547
	3	SHORT(A)	MRSSHORT		FASTR1	90	1	1	Dither 1	2	2	499.507	

Proposal 1239 - Observation 11 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 11: NGC-7293 - Repeat of observation 1 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(Visit 11:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections				Miscellaneous		
	(1)	NGC-7293	RA: 22 29 38.5883 (337.4107846d) Dec: -20 50 13.80 (-20.83717d) Equinox: J2000				Proper Motion RA: 0.002772608782925656 sec of time/yr Proper Motion Dec: -0.0034189999951195205 arcsec/yr Epoch of Position: 2000.0						
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[Planetary nebulae nuclei]</i>													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel				Simultaneous Imaging			Imager Subarray		Grating Wheel Direction		
	F1000W	ALL				NO			FULL		NEUTRAL		
Dithers	#	Dither Type				Optimized For				Direction			
	1	2-Point				EXTENDED SOURCE				NEGATIVE			
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	LONG(C)	MRSLONG		FASTR1	90	1	1	Dither 1	2	2	499.507	
	1	LONG(C)	MRSSHORT		FASTR1	90	1	1	Dither 1	2	2	499.507	
	2	MEDIUM(B)	MRSLONG		FASTR1	90	1	1	Dither 1	2	2	499.507	
	2	MEDIUM(B)	MRSSHORT		FASTR1	90	1	1	Dither 1	2	2	499.507	
	3	SHORT(A)	MRSLONG		FASTR1	90	1	1	Dither 1	2	2	499.507	90547
	3	SHORT(A)	MRSSHORT		FASTR1	90	1	1	Dither 1	2	2	499.507	

Proposal 1239 - Observation 2 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 2: NGC-6804 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(2)	NGC-6804	RA: 19 31 35.1349 (292.8963954d) Dec: +09 13 31.15 (9.22532d) Equinox: J2000				Proper Motion RA: -6.464954198750015E-4 sec of time/yr Proper Motion Dec: -0.009407999959876179 arcsec/yr Epoch of Position: 2000.0						
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[Planetary nebulae nuclei]													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray		Grating Wheel Direction			
	F1000W	ALL			NO			FULL		NEUTRAL			
Dithers	#	Dither Type				Optimized For				Direction			
	1	2-Point				EXTENDED SOURCE				NEGATIVE			
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	LONG(C)	MRSLONG		FASTR1	18	1	1	Dither 1	2	2	99.901	
	1	LONG(C)	MRSSHORT		FASTR1	18	1	1	Dither 1	2	2	99.901	
	2	MEDIUM(B)	MRSLONG		FASTR1	18	1	1	Dither 1	2	2	99.901	
	2	MEDIUM(B)	MRSSHORT		FASTR1	18	1	1	Dither 1	2	2	99.901	
	3	SHORT(A)	MRSLONG		FASTR1	18	1	1	Dither 1	2	2	99.901	90548
	3	SHORT(A)	MRSSHORT		FASTR1	18	1	1	Dither 1	2	2	99.901	

Proposal 1239 - Observation 3 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 3: ZZ-PSC Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous				
	(3)	V-ZZ-PSC	RA: 23 28 47.2233 (352.1967637d) Dec: +05 14 50.10 (5.24725d) Equinox: J2000			Proper Motion RA: -0.026658182634620435 sec of time/yr Proper Motion Dec: -0.2667379999820696 arcsec/yr Epoch of Position: 2000.0							
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[White dwarfs]													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging		Imager Subarray		Grating Wheel Direction				
	F1000W	ALL			NO		FULL		NEUTRAL				
Dithers	#	Dither Type			Optimized For			Direction					
	1	2-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	SHORT(A)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	90549
	1	SHORT(A)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	
	2	MEDIUM(B)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	
	2	MEDIUM(B)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	
	3	LONG(C)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	
	3	LONG(C)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	

Proposal 1239 - Observation 4 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 4: J4629 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(4)	J004629.29-731552.3	RA: 00 46 29.2901 (11.6220421d) Dec: -73 15 52.30 (-73.26453d) Equinox: J2000										
<i>Comments:</i> <i>Category=Star</i> <i>Description=[Post-asymptotic giant branch]</i>													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray		Grating Wheel Direction			
	F1000W	ALL			NO			FULL		NEUTRAL			
Dithers	#	Dither Type				Optimized For				Direction			
	1	2-Point				EXTENDED SOURCE				NEGATIVE			
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	LONG(C)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	
	1	LONG(C)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	
	2	MEDIUM(B)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	
	2	MEDIUM(B)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	
	3	SHORT(A)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	90550
	3	SHORT(A)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	

Proposal 1239 - Observation 5 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 5: J4616 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(5)	J004614.67-723519.0	RA: 00 46 14.6700 (11.5611250d) Dec: -72 35 19.00 (-72.58861d) Equinox: J2000										
<i>Comments:</i> Category=Star Description=[Post-asymptotic giant branch]													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray		Grating Wheel Direction			
	F1000W	ALL			NO			FULL		NEUTRAL			
Dithers	#	Dither Type				Optimized For				Direction			
	1	2-Point				EXTENDED SOURCE				NEGATIVE			
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	LONG(C)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	
	1	LONG(C)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	
	2	MEDIUM(B)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	
	2	MEDIUM(B)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	
	3	SHORT(A)	MRSLONG		FASTR1	40	1	1	Dither 1	2	2	222.003	90551
	3	SHORT(A)	MRSSHORT		FASTR1	40	1	1	Dither 1	2	2	222.003	

Proposal 1239 - Observation 6 - Investigating Dusty Disks in Evolved Stars

Wed Jul 05 20:00:25 GMT 2023

Observation	Proposal 1239, Observation 6: J0439 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy												
	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous			
	(6)	J043919.30-685733.4	RA: 04 39 19.3000 (69.8304167d) Dec: -68 57 33.40 (-68.95928d) Equinox: J2000 <i>Comments: Post-RGB (not Post-AGB), but no option in the Description selector.</i> <i>Category=Star</i> <i>Description=[Post-asymptotic giant branch]</i>										
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray		Grating Wheel Direction			
	F1000W	ALL			NO			FULL		NEUTRAL			
Dithers	#	Dither Type				Optimized For				Direction			
	1	2-Point				EXTENDED SOURCE				NEGATIVE			
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	SHORT(A)	MRSLONG		FASTR1	66	4	1	Dither 1	2	8	1481.871	90552
	1	SHORT(A)	MRSSHORT		FASTR1	66	4	1	Dither 1	2	8	1481.871	
	2	MEDIUM(B)	MRSLONG		FASTR1	66	4	1	Dither 1	2	8	1481.871	
	2	MEDIUM(B)	MRSSHORT		FASTR1	66	4	1	Dither 1	2	8	1481.871	
	3	LONG(C)	MRSLONG		FASTR1	66	4	1	Dither 1	2	8	1481.871	
	3	LONG(C)	MRSSHORT		FASTR1	66	4	1	Dither 1	2	8	1481.871	