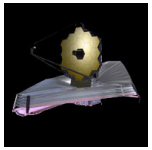

1294 - Thermal Emission Spectroscopy of beta Pictoris' Prototypical Debris Disk

Cycle: 1, Proposal Category: GTO

INVESTIGATORS

Name	*Institution*
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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
beta Pic Spectroscopy				
	1	beta Pic Background - MIRI MRS Spectroscopy	MIRI Medium Resolution Spectroscopy	(2) -BET-PIC-BACKGROUND
	2	beta Pic disk - MIRI MRS Spectroscopy	MIRI Medium Resolution Spectroscopy	(1) -BET-PIC
	3	beta Pic star - MIRI MRS Spectroscopy	MIRI Medium Resolution Spectroscopy	(1) -BET-PIC
	4	beta Pic PSF - MIRI MRS Spectroscopy	MIRI Medium Resolution Spectroscopy	(3) -N-CAR
eta-Tel_MRS				
	5	eta-Tel_MRS	MIRI Medium Resolution Spectroscopy	(4) -ETA-TEL
eta-Crv_MRS				
	8	eta-Crv_MRS	MIRI Medium Resolution Spectroscopy	(10) EXZ-ETA-CRV

ABSTRACT

The exoplanetary system around Beta Pictoris is the one of the nearest and best studied planetary systems. High contrast imaging has revealed the presence of a ~10 MJup planet with an orbital semi-major axis ~10 AU (Lagrange et al. 2009). ALMA CO J=1-0 observations have revealed offset emission that may be generated by collisional destruction of CO rich cometary bodies, trapped into a mean motion resonance with a second undetected planet (Dent et al. 2014). Multi-wavelength imaging observations have revealed a spectacular edge-on disk extending up to ~1400 AU away from the star in scattered light and thermal emission.

We plan to obtain a MIRI MRS (5 tile by 1 tile) mosaic at ~5-28 micron of the inner ~9” (180 AU) of the Beta Pic disk to map the shapes of the 10 and 20 micron silicate emission features as a function of position from the central star. Herschel PACS mapping of the 69 micron Forsterite feature indicates that (1) the silicates have an Iron fraction (Mg2-2xFe2xSiO4, x~0.29) consistent with asteroids that (2) have been processed at high temperatures even at large distances from the star (de Vries et al. 2012). By contrast, higher spatial resolution Subaru mid-infrared COMICS spectra indicate the silicates are Mg-rich with the crystalline component centered on the star and small grains located at 6.4, 16, and 30 AU from the star (Okamoto et al. 2004). We plan to place our observations into context with NIRCam and MIRI coronagraphic observations of the disk imaged at high SNR in scattered light and thermal emission in a collaborative program with Telescope Scientist Matt Mountain.

We constrain the timing for the mosaic to force the disk to be parallel to the long direction of the rectangular mosaic to facilitate extraction of the spectrum along the disk midplane as a function of position from the central star. Assuming that the disk has a position angle 32 degrees East of North and that slicer optics are rotated by -8 degrees in the V2, V3 coordinate system, we require a spacecraft PA of 18 - 30 degrees.

In addition, we plan to observe beta Pic Moving Group member eta Tel, another young A-type member with gas emission (C II, Riviere-Marichalar et al. 2014) and a weak silicate emission feature (Chen et al. 2006). ESO 3.6 m/TIMMI2 observations in the N (12.9 micron) and Q2 filters suggest that the bright, thermal emission from the disk will be compact (<0.5", Smith et al. 2010). Thus, we observe eta Tel with a single, dithered pointing.

OBSERVING DESCRIPTION

This observation uses the MIRI MRS Ch1-4 to map silicate emission in the extended, edge-on disk around beta Pic and the compact disk around eta Tel.

The beta Pic disk has been observed at MIRI infrared wavelengths using Gemini/T-ReCS (Telesco et al. 2000) and Spitzer/MIPS (Ballering et al. 2016) with a position angle of 32 deg (East from North) and a radial extent of 20". We have constructed a MIRI MRS mosaic (5 row x 1 column) that

we constrain to be executed when the disk is aligned with the long direction of the mosaic. This forces the MRS slices to be nearly orthogonal to the disk.For each mosaic tile, we enable a 4-point extended source map to improve subslice sampling for improve spatial resolution when our image cubes are combined. Assuming that the slicer optics are rotated by -8 degrees in the V2, V3 coordinate system and a 0.97" dither along the slice direction, we therefore require a spacecraft PA of 16 - 32 degrees.

The eta Tel disk has been observed at MIRI infrared wavelengths using ESO 3.6 m/TIMMI2 (Smith et al. 2010) and Spitzer/MIPS (Rebull et al. 2008) and appears marginally spatially resolved with a disk radius ~0.5" (24 AU). Since the eta Tel disk is compact, we observe this target using a single mosaic tile. In addition, we place no constraints on when this observation can be executed.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	-BET-PIC	RA: 05 47 17.0877 (86.8211988d) Dec: -51 03 59.44 (-51.06651d) Equinox: J2000	Proper Motion RA: 4.65 mas/yr Proper Motion Dec: 83.10 mas/yr Parallax: 0.05144" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Debris disks]* *Extended=YES*				
(2)	-BET-PIC-BACKGROUND	RA: 05 47 6.3034 (86.7762642d) Dec: -51 02 55.85 (-51.04885d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Calibration* *Description=[Telescope/sky background]*				
(3)	-N-CAR	RA: 06 34 58.5668 (98.7440283d) Dec: -52 58 32.03 (-52.97556d) Equinox: J2000	Proper Motion RA: -8.469571867308019E-4 sec of time/yr Proper Motion Dec: 0.010539999999999999 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Calibration* *Description=[A stars, Point spread function]*				
(4)	-ETA-TEL	RA: 19 22 51.2520 (290.7135500d) Dec: -54 25 27.43 (-54.42429d) Equinox: J2000	Proper Motion RA: 0.002935368081408041 sec of time/yr Proper Motion Dec: -0.08253599992258387 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Circumstellar disks, Circumstellar dust, Circumstellar gas, Circumstellar matter, Debris disks]*				
(10)	EXZ-ETA-CRV	RA: 12 32 4.2265 (188.0176104d) Dec: -16 11 45.62 (-16.19601d) Equinox: J2000	Proper Motion RA: -425.17 mas/yr Proper Motion Dec: -57.23 mas/yr Parallax: 0.0547" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Debris disks]*				

Observation

Proposal 1294, Observation 1: beta Pic Background - MIRI MRS Spectroscopy Mon Jun 12 22:00:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [beta Pic disk - MIRI MRS Spectroscopy (Obs 2), beta Pic star - MIRI MRS Spectroscopy (Obs 3)]

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
(2)	-BET-PIC-BACKGROUND	RA: 05 47 6.3034 (86.7762642d) Dec: -51 02 55.85 (-51.04885d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Calibration
Description=[Telescope/sky background]

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	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	15	6	1	None	1	6	263.629	
1	SHORT(A)	MRSLONG		FASTR1	15	6	1	None	1	6	263.629	
1	SHORT(A)	MRSSHORT		FASTR1	5	16	1	None	1	16	263.629	
2		IMAGER	F770W	FASTR1	15	6	1	None	1	6	263.629	
2	MEDIUM(B)	MRSLONG		FASTR1	15	6	1	None	1	6	263.629	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	16	1	None	1	16	263.629	
3		IMAGER	F770W	FASTR1	15	6	1	None	1	6	263.629	
3	LONG(C)	MRSLONG		FASTR1	15	6	1	None	1	6	263.629	
3	LONG(C)	MRSSHORT		FASTR1	5	16	1	None	1	16	263.629	

Special Requirements	Sequence Observations 1, 2, 3, 4, Non-interruptible

Observation

Proposal 1294, Observation 2: beta Pic disk - MIRI MRS Spectroscopy Mon Jun 12 22:00:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[beta Pic Background - MIRI MRS Spectroscopy (Obs 1), beta Pic star - MIRI MRS Spectroscopy (Obs 3)]

Diagnostics

(Visit 2:1) Warning (Form): Data Excess over lower threshold

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

(beta Pic disk - MIRI MRS Spectroscopy (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	-BET-PIC	RA: 05 47 17.0877 (86.8211988d) Dec: -51 03 59.44 (-51.06651d) Equinox: J2000	Proper Motion RA: 4.65 mas/yr Proper Motion Dec: 83.10 mas/yr Parallax: 0.05144" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Debris disks]
Extended=YES

Acquisition

#	Target
1	NONE

Template

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

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
3	1	10.0	10.0	0.0	0.0	ROW_ORDER

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	15	6	1	Dither 1	4	24	1054.515	
1	SHORT(A)	MRSLONG		FASTR1	15	6	1	Dither 1	4	24	1054.515	
1	SHORT(A)	MRSSHORT		FASTR1	5	16	1	Dither 1	4	64	1054.515	
2		IMAGER	F770W	FASTR1	15	6	1	Dither 1	4	24	1054.515	
2	MEDIUM(B)	MRSLONG		FASTR1	15	6	1	Dither 1	4	24	1054.515	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	16	1	Dither 1	4	64	1054.515	
3		IMAGER	F770W	FASTR1	15	6	1	Dither 1	4	24	1054.515	
3	LONG(C)	MRSLONG		FASTR1	15	6	1	Dither 1	4	24	1054.515	
3	LONG(C)	MRSSHORT		FASTR1	5	16	1	Dither 1	4	64	1054.515	

Special Requirements

Aperture PA Range 16 to 32 Degrees (V3 16.0 to 32.0)

Sequence Observations 1, 2, 3, 4, Non-interruptible
Same Aperture PA 2, 3

Observation

Proposal 1294, Observation 3: beta Pic star - MIRI MRS Spectroscopy Mon Jun 12 22:00:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[beta Pic Background - MIRI MRS Spectroscopy (Obs 1), beta Pic disk - MIRI MRS Spectroscopy (Obs 2)]

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(beta Pic star - MIRI MRS Spectroscopy (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	-BET-PIC	RA: 05 47 17.0877 (86.8211988d)	Proper Motion RA: 4.65 mas/yr	
		Dec: -51 03 59.44 (-51.06651d)	Proper Motion Dec: 83.10 mas/yr	
		Equinox: J2000	Parallax: 0.05144"	
			Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Debris disks]
Extended=YES

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	FND	FAST	4	1	1	11.1	6928

Template

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

Dithers

#	Dither Type	Optimized For	Direction
1	4-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	F770W	FASTR1	15	5	1	Dither 1	4	20	876.913	
1	SHORT(A)	MRSLONG		FASTR1	15	5	1	Dither 1	4	20	876.913	
1	SHORT(A)	MRSSHORT		FASTR1	5	14	1	Dither 1	4	56	921.313	
2		IMAGER	F770W	FASTR1	15	5	1	Dither 1	4	20	876.913	
2	MEDIUM(B)	MRSLONG		FASTR1	15	5	1	Dither 1	4	20	876.913	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	14	1	Dither 1	4	56	921.313	
3		IMAGER	F770W	FASTR1	15	5	1	Dither 1	4	20	876.913	
3	LONG(C)	MRSLONG		FASTR1	15	5	1	Dither 1	4	20	876.913	
3	LONG(C)	MRSSHORT		FASTR1	5	14	1	Dither 1	4	56	921.313	

Special Requirements	
	Aperture PA Range 16 to 32 Degrees (V3 16.0 to 32.0) Sequence Observations 1, 2, 3, 4, Non-interruptible Same Aperture PA 2, 3

Observation

Proposal 1294, Observation 4: beta Pic PSF - MIRI MRS Spectroscopy Mon Jun 12 22:00:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(Visit 4:1) Warning (Form): Data Excess over lower threshold

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	-N-CAR	RA: 06 34 58.5668 (98.7440283d) Dec: -52 58 32.03 (-52.97556d) Equinox: J2000	Proper Motion RA: -8.469571867308019E-4 sec of time/yr Proper Motion Dec: 0.010539999999999999 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Calibration
Description=[A stars, Point spread function]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	FND	FAST	4	1	1	11.1	133000.13

Template

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

Dithers

#	Dither Type	Optimized For	Direction
1	4-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	F770W	FASTR1	15	10	1	Dither 1	4	40	1764.925	
1	SHORT(A)	MRSLONG		FASTR1	15	10	1	Dither 1	4	40	1764.925	
1	SHORT(A)	MRSSHORT		FASTR1	5	28	1	Dither 1	4	112	1853.727	
2		IMAGER	F770W	FASTR1	15	10	1	Dither 1	4	40	1764.925	
2	MEDIUM(B)	MRSLONG		FASTR1	15	10	1	Dither 1	4	40	1764.925	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	28	1	Dither 1	4	112	1853.727	
3		IMAGER	F770W	FASTR1	15	10	1	Dither 1	4	40	1764.925	
3	LONG(C)	MRSLONG		FASTR1	15	10	1	Dither 1	4	40	1764.925	
3	LONG(C)	MRSSHORT		FASTR1	5	28	1	Dither 1	4	112	1853.727	

Special Requirements	Sequence Observations 1, 2, 3, 4, Non-interruptible

Observation

Proposal 1294, Observation 5: eta-Tel_MRS Mon Jun 12 22:00:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(eta-Tel_MRS (Obs 5)) Warning (Form): Imager Filter overlap.

(eta-Tel_MRS (Obs 5)) Warning (Form): Imager Filter overlap.

(eta-Tel_MRS (Obs 5)) Warning (Form): Imager Filter overlap.

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	-ETA-TEL	RA: 19 22 51.2520 (290.7135500d) Dec: -54 25 27.43 (-54.42429d) Equinox: J2000	Proper Motion RA: 0.002935368081408041 sec of time/yr Proper Motion Dec: -0.08253599992258387 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar disks, Circumstellar dust, Circumstellar gas, Circumstellar matter, Debris disks]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 -ETA-TEL	FND	FAST	10	1	1	27.75	90212.1

Template

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

Dithers

#	Dither Type	Optimized For	Direction
1	4-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	F1280W	FASTR1	11	7	1	Dither 1	4	28	921.313	
1	LONG(C)	MRSLONG		FASTR1	17	6	1	Dither 1	4	24	1187.717	
1	LONG(C)	MRSSHORT		FASTR1	5	17	1	Dither 1	4	68	1121.116	
2		IMAGER	F1280W	FASTR1	11	7	1	Dither 1	4	28	921.313	
2	MEDIUM(B)	MRSLONG		FASTR1	17	6	1	Dither 1	4	24	1187.717	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	17	1	Dither 1	4	68	1121.116	
3		IMAGER	F1280W	FASTR1	11	7	1	Dither 1	4	28	921.313	
3	SHORT(A)	MRSLONG		FASTR1	17	6	1	Dither 1	4	24	1187.717	
3	SHORT(A)	MRSSHORT		FASTR1	5	17	1	Dither 1	4	68	1121.116	

Observation

Proposal 1294, Observation 8: eta-Crv_MRS Mon Jun 12 22:00:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(eta-Crv_MRS (Obs 8)) Warning (Form): Imager Filter overlap.
(eta-Crv_MRS (Obs 8)) Warning (Form): Imager Filter overlap.
(eta-Crv_MRS (Obs 8)) Warning (Form): Imager Filter overlap.
(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(10)	EXZ-ETA-CRV	RA: 12 32 4.2265 (188.0176104d) Dec: -16 11 45.62 (-16.19601d) Equinox: J2000	Proper Motion RA: -425.17 mas/yr Proper Motion Dec: -57.23 mas/yr Parallax: 0.0547" Epoch of Position: 2000	

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

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	10 EXZ-ETA-CRV	FND	FAST	4	1	1	11.1	90179.4

Template

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

Dithers

#	Dither Type	Optimized For	Direction
1	4-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	F1280W	FASTR1	11	6	1	Dither 1	4	24	788.111	
1	LONG(C)	MRSLONG		FASTR1	15	6	1	Dither 1	4	24	1054.515	
1	LONG(C)	MRSSHORT		FASTR1	5	15	1	Dither 1	4	60	987.914	
2		IMAGER	F1280W	FASTR1	11	6	1	Dither 1	4	24	788.111	
2	MEDIUM(B)	MRSLONG		FASTR1	15	6	1	Dither 1	4	24	1054.515	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	15	1	Dither 1	4	60	987.914	
3		IMAGER	F1280W	FASTR1	11	6	1	Dither 1	4	24	788.111	
3	SHORT(A)	MRSLONG		FASTR1	15	6	1	Dither 1	4	24	1054.515	
3	SHORT(A)	MRSSHORT		FASTR1	5	15	1	Dither 1	4	60	987.914	