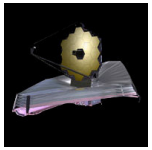

5390 - HD 131488: A Unique Laboratory to Probe Volatile Transportation Mechanism in the Epoch of Terrestrial Planet Formation

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
HD 131488				
	1	HD 131488	NIRSpec IFU Spectroscopy	(1) HD-131488

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	3	HD 131488-Cal	NIRSpec IFU Spectroscopy	(6) HD-135848

ABSTRACT

Studies of the Solar system suggest that comets can deliver volatile and refractory elements from the outer solar system to Earth during the epoch of terrestrial planet formation. Even as a mature planetary system, solar system comets outgassing CO gas and H2O vapor were caught in the act. JWST Cycle 1 observations have discovered CO fundamental emission in a young, and exocomet-active planetary system, HD 131488. This is the first time that CO ro-vibrational emission at near-infrared wavelengths has been discovered in a debris disk. We propose a follow-up observation to map the CO distribution and the hot dust emission in HD 131488, with NIRSpec IFU G395H/F290lP disperser and filter combination. We will test several hypotheses for the cometary delivery models by mapping and comparing the spatial distribution of 12CO and 13CO transitions that probe various gas populations and search for dust disk asymmetry due to exocometary delivery. The detailed characterization of HD 131488 will benchmark our understanding of volatiles in an exoplanetary system.

OBSERVING DESCRIPTION

Summary:

We propose NIRSpec IFU observations with G395H/F290LP filter and grating settings to map the spatial distribution of (1) the cold CO population with spatially-resolved 12CO and 13CO ro-vibrational emission lines, (2) hot dust via continuum excess emission, (3) to determine the warm CO gas column density, and (4) to search for H2O ro-vibrational emission in 2.9-3.1 and 4.5-5 micron with a better SNR than that of the existing Fixed Slit observations.

Observation design

Target acquisition and dithering pattern:

Since our target stars are too bright to use for WATA, we have selected a calibrator star from the Gaia Archive within 1 arcmin of the targets and J magnitudes of 11.532. We propose WATA for target acquisition to improve the pointing position for our bright science target. The observation uses the “cycling” dither pattern with 9-point dithers and a small offset size (0.25’’) for all wavelengths to improve spatial sampling. Obs1 observes the science target. Obs2 is a dedicated calibrator observation to improve the PSF subtraction of the star from the disk.

Exposure times:

Using ETC, we will request 4 groups/int and 1 int/exposure setting, because this setup will allow us to achieve a SNR~700. We request 5 groups/int and 5 int/exposure settings for our calibrator star to match the SNR of our science target. We estimate the SNR of CO map to be at least 50 per spaxel

across the disk using the ETC NIRSpec IFU simulation tool.

Regarding APT warning: “Warning (Form) The slew between the acquisition exposure and the farthest science exposure is 73.275 Arcsec (larger than the recommended limit of 65.000 Arcsec) and may result in reduced or no schedulability.”
We note that this is a follow-up observation of HD131488 NIRSpec fixed slit observation. In cycle 1, HD 131488 has been observed with the exact same acquisition target which proves that this warning should not be a concern to our observation.

Special Requirement:
We request our science target and our PSF calibration star observation be in sequence and non-interruptible to get the most accurate representation of the background to facilitate PSF subtraction.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HD-131488	RA: 14 55 8.0036 (223.7833483d) Dec: -41 07 13.75 (-41.12049d) Equinox: J2000	Proper Motion RA: -0.0016065593845063372 sec of time/yr Proper Motion Dec: -0.022292999983619666 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[A stars, Circumstellar disks, Circumstellar dust, Circumstellar gas]* *Extended=NO*				
(2)	TAHD131488	RA: 14 55 7.1658 (223.7798575d) Dec: -41 07 53.42 (-41.13151d) Equinox: J2000	Proper Motion RA: -6.126033842 mas/yr Proper Motion Dec: -1.040490401 mas/yr Epoch of Position: 2015.5	
Comments: Target acquisition for HD 131488 *Category=Star* *Description=[G stars]*				
(3)	TYC-4433-1800-1	RA: 18 08 34.7360 (272.1447333d) Dec: +69 27 28.72 (69.45798d) Equinox: J2000	Proper Motion RA: 4.501 mas/yr Proper Motion Dec: 8.391 mas/yr Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[A dwarfs]*				
(6)	HD-135848	RA: 15 18 49.6377 (229.7068238d) Dec: -41 20 49.32 (-41.34703d) Equinox: J2000	Proper Motion RA: -5.001 mas/yr Proper Motion Dec: -8.159000003615802 mas/yr Parallax: 0.0012002" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Star* *Description=[A stars]*				
(8)	Gaia-DR3-6004132081005056000	RA: 15 18 50.6697 (229.7111238d) Dec: -41 21 24.34 (-41.35676d) Equinox: J2000	Proper Motion RA: -4.913 mas/yr Proper Motion Dec: -7.677999906263722 mas/yr Parallax: 0.002055" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *This Gaia DR3 target does not have an effective temperature and hence the description for the stellar type is unknown. "F star" is put there to prevent errors.* *Category=Star* *Description=[F stars]*				
(9)	TAHD-135848	RA: 15 18 50.1835 (229.7090979d) Dec: -41 20 53.25 (-41.34812d) Equinox: J2000	Proper Motion RA: 0.038108489000210743 mas/yr Proper Motion Dec: -1.5240654308193298 mas/yr Parallax: 0.2723171244634498" Epoch of Position: 2016	
Comments: This Gaia DR3 target is not resolved by the fixed target resolver, but has a Gaia-based effective temperature and hence stellar type. *Category=Star* *Description=[G stars]* *Extended=NO*				

Observation

Proposal 5390, Observation 1: HD 131488

Thu Oct 31 02:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(HD 131488 (Obs 1)) Warning (Form): The slew between the acquisition exposure and the farthest science exposure is 66.272 Arcsec (larger than the recommended limit of 65.000 Arcsec) and may result in reduced or no schedulability. See more information in the diagnostic browser.

(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)	HD-131488	RA: 14 55 8.0036 (223.7833483d) Dec: -41 07 13.75 (-41.12049d) Equinox: J2000	Proper Motion RA: -0.0016065593845063372 sec of time/yr Proper Motion Dec: -0.022292999983619666 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[A stars, Circumstellar disks, Circumstellar dust, Circumstellar gas]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 TAHD131488	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	172754

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	SMALL	1	9	

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	4	1	false	true	NONE	9	9	483.155	172754

Special Requirements

Aperture PA Range 161 to 234 Degrees (V3 22.02835083 to 95.02835083)
Aperture PA Range 341 to 19 Degrees (V3 202.02835083 to 240.02835083)

Group Observations 1, 3, Non-interruptible

Observation

Proposal 5390, Observation 3: HD 131488-Cal

Thu Oct 31 02:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

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
(6)	HD-135848	RA: 15 18 49.6377 (229.7068238d) Dec: -41 20 49.32 (-41.34703d) Equinox: J2000	Proper Motion RA: -5.001 mas/yr Proper Motion Dec: -8.159000003615802 mas/yr Parallax: 0.0012002" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[A stars]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	8 Gaia-DR3-6004132081005056000	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	214998

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	SMALL	1	9	

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	5	5	false	true	NONE	9	45	2898.928	172754

Special Requirements	Group Observations 1, 3, Non-interruptible