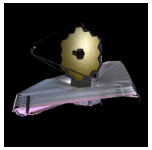

6463 - Testing a new formation tracer for cold gas giant planets with JWST/MIRI

Cycle: 3, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Polychronis Alexandros Patapis (PI) (ESA Member)	**Eidgenossische Technische Hochschule Zurich (ETHZ)**
Ms. Helena Kuehnle (CoI) (ESA Member)	Eidgenossische Technische Hochschule Zurich (ETHZ)
Dr. Paul Molliere (CoI) (ESA Member) (CoPI)	Max Planck Institute for Astronomy
Mr. Evert Nasedkin (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Niall Whiteford (CoI) (US Admin CoI)	American Museum of Natural History
Dr. Haiyang S Wang (CoI) (ESA Member)	Eidgenossiche Technische Hochschule (ETH)
Prof. David Barrado Navascues (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero.
Dr. Sascha Patrick Quanz (CoI) (ESA Member)	Eidgenossiche Technische Hochschule (ETH)
Danny Gasman (CoI) (ESA Member)	Institute of Astronomy, KU Leuven

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
MRS				
	1	COCONUTS 2B	MIRI Medium Resolution Spectroscopy	(1) COCONUTS-2-B

ABSTRACT

COCONUTS 2 b is the nearest and coldest directly imaged exoplanet to date.

However, it is also the second most widely separated exoplanet from its host star, raising questions about how this 6 Jupiter mass planet formed.

With an equilibrium temperature below 500 K, the atmosphere will be dominated by ammonia in the mid-infrared, allowing for the first time the detection of nitrogen isotopes in an exoplanet atmosphere and the use of the 14N/15N ratio as a tracer of exoplanet formation.

This novel isotope ratio has been used in the solar system, finding that rocky and icy bodies are more enriched in 15N, similar to protoplanetary disks, than the gas giants which share a composition with nearby pre-stellar cores.

By measuring this ratio in COCONUTS 2 b via MIRI/MRS observation, we can compare the isotope ratio to that of the recently observed brown dwarf WISE-J1828, and robustly determine whether it formed through a star-like or planet-like mechanism. This ratio will likely be relevant for new directly imaged exoplanets around mature, nearby stars.

OBSERVING DESCRIPTION

We will obtain 1.85 hours of MIRI/MRS observations of the widely-separated, directly-imaged exoplanet COCONUTS 2 b. With a temperature below 500 K, and a distance of only 11 pc, it is the single best candidate for constraining nitrogen isotopes of any exoplanet. We will use all three filters of the MIRI/MRS to obtain an SNR of 10 or better per wavelength channel, sufficient to measure the 14N/15N isotope ratio to a precision of ZZ dex.

Proposal 6463 - Targets - Testing a new formation tracer for cold gas giant planets with JWST/MIRI

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	COCONUTS-2-B	RA: 07 51 8.4136 (117.7850567d)	Proper Motion RA: -104.8 mas/yr	
		Dec: -76 34 52.26 (-76.58118d)	Proper Motion Dec: -189.6999999644322 mas/yr	
		Equinox: J2000	Parallax: 0.0979"	
			Epoch of Position: 2024.21	

Comments: Corrected coordinates according to program 3514 observation 2 (LRS TA verification image)
Category=Star
Description=[Exoplanets, Y dwarfs]
Extended=NO

Observation

Proposal 6463, Observation 1: COCONUTS 2B

Mon Aug 12 20:01:07 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(COCONUTS 2B (Obs 1)) Warning (Form): Imager Filter overlap.

(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)	COCONUTS-2-B	RA: 07 51 8.4136 (117.7850567d)	Proper Motion RA: -104.8 mas/yr	
		Dec: -76 34 52.26 (-76.58118d)	Proper Motion Dec: -189.6999999644322 mas/yr	
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			Epoch of Position: 2024.21	

Comments: Corrected coordinates according to program 3514 observation 2 (LRS TA verification image)
Category=Star
Description=[Exoplanets, Y dwarfs]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F1000W	FASTGRPAVG8	8	1	1	177.603	178392.4

Template

Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
All MRS	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	F560W	FASTR1	10	2	1	Dither 1	4	8	233.103	
1	SHORT(A)	MRSLONG		FASTR1	200	1	1	Dither 1	4	4	2220.032	
1	SHORT(A)	MRSSHORT		FASTR1	200	1	1	Dither 1	4	4	2220.032	
2		IMAGER	F1000W	FASTR1	10	2	1	Dither 1	4	8	233.103	
2	MEDIUM(B)	MRSLONG		FASTR1	200	1	1	Dither 1	4	4	2220.032	
2	MEDIUM(B)	MRSSHORT		FASTR1	200	1	1	Dither 1	4	4	2220.032	
3		IMAGER	F1500W	FASTR1	10	2	1	Dither 1	4	8	233.103	
3	LONG(C)	MRSLONG		FASTR1	200	1	1	Dither 1	4	4	2220.032	
3	LONG(C)	MRSSHORT		FASTR1	200	1	1	Dither 1	4	4	2220.032	