

# 2304 - Hot Take on a Cool World: Does Trappist-1c Have an Atmosphere?

Cycle: 1, Proposal Category: GO

# INVESTIGATORS

Name	Institution	E-Mail
Dr. Laura Kreidberg (PI) (ESA Member)	Max Planck Institute for Astronomy	kreidberg@mpia.de
Daniel Koll (CoI)	Massachusetts Institute of Technology	dkoll@mit.edu
Dr. Laura Schaefer (CoI)	Stanford University	lkschaef@stanford.edu
Dr. Caroline Morley (CoI) (US Admin CoI)	University of Texas at Austin	cmorley@utexas.edu
Dr. Renyu Hu (CoI)	Jet Propulsion Laboratory	renyu.hu@jpl.nasa.gov
Dr. Michael Gillon (CoI) (ESA Member)	Universite de Liege	michael.gillon@uliege.be
Prof. Emeline Bolmont (CoI) (ESA Member)	Universite de Namur	emeline.bolmont@unamur.be
Dr. Avi Mandell (CoI)	NASA Goddard Space Flight Center	avram.m.mandell@nasa.gov
Dr. Eric Agol (CoI)	University of Washington	agol@uw.edu
Prof. Victoria Suzanne Meadows (CoI)	University of Washington	meadows@uw.edu
Dr. Franck Selsis (CoI) (ESA Member)	Universite de Bordeaux	franck.selsis@u-bordeaux.fr
Prof. Julien de Wit (CoI)	Massachusetts Institute of Technology	jdewit@mit.edu

## **OBSERVATIONS**

Folder	Observation	Label	Observing Template	Science Target
Observa	ation Folder			
	1		MIRI Imaging	(1) TRAPPIST-1
	2		MIRI Imaging	(1) TRAPPIST-1
	3		MIRI Imaging	(1) TRAPPIST-1
	4		MIRI Imaging	(1) TRAPPIST-1

ABSTRACT

## JWST Proposal 2304 (Created: Wednesday, October 13, 2021 at 7:00:39 PM Eastern Standard Time) - Overview

Rocky exoplanets are abundant in the Galaxy. However, it is still unknown how often, and under what conditions, these small worlds can maintain atmospheres. Here we propose to measure thermal emission from the dayside of TRAPPIST-1c, a terrestrial exoplanet with temperature similar to that of Venus. This planet is the coolest rocky world with thermal emission that can be detected with JWST. Our observations will constrain the planet's surface pressure and the atmospheric carbon dioxide abundance, and distinguish at 4 sigma confidence between a bare rock planet and a Venus-like composition. The presence of a thick atmosphere would be a positive indication that the TRAPPIST-1 planets formed in a volatile-rich environment, motivating an aggressive observing program for the cooler, potentially habitable planets in this remarkable system.

## **OBSERVING DESCRIPTION**

Our observations consist of time series photometry during four eclipses of the planet TRAPPIST-1c.

For each eclipse, the observations will be performed with the MIRI F1500W filter and must be executed in a continuous sequence. Each of the four visits must be timed to coincide with eclipses of the planet (which occur approximately every 2.4 days).

# Proposal 2304 - Targets - Hot Take on a Cool World: Does Trappist-1c Have an Atmosphere?

10	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
ets	(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d)	Proper Motion RA: 0.062299806210057845 sec of	
Lg			Dec: -05 02 36.46 (-5.04346d)	time/yr	
н			Equinox: J2000	Proper Motion Dec: -0.479402999985723 arcsec/yr	
ğ			1	Epoch of Position: 2015.5	
<u>×.</u>	Comments: T	This object was generated by the	targetselector and retrieved from the SIMBAD database.		
ш	Category=St	ar			
"	Category=St Description=	ar :[M dwarfs. M stars]			

Pro	oposal 2304 - Observa	ation 1 - Hot Ta	ike on a C	ool World: Do	es Trappis	t-1c Have	an Atmospher	e?			
Observation	Proposal 2304, Observation 1 Diagnostic Status: Warning Observing Template: MIRI Imaging										
Diagnostics	(Observation 1) Warning (Form): (Visit 1:1) Warning (Form): Over	Exposure Duration exce heads are provisional unt	eds the limit of 1 il the Visit Planr	0000.0 seconds. Above aer has been run.	this limit it is pos	sible that a Hig	h Gain Antenna move m	ay occur during the	exposure.		
Fixed Targets	# Name Target Coordinates   (1) TRAPPIST-1 RA: 23 06 30.3341 (346.6263921d)   Dec: -05 02 36.46 (-5.04346d) Equinox: J2000   Comments: This object was generated by the targetselector and retrieved from the SIMBAD databat   Category=Star					Targ. Coord. CorrectionsMiscellaneousProper Motion RA: 0.062299806210057845 sec of time/yrProper Motion Dec: -0.479402999985723 arcsec/yrProper Motion Dec: -0.479402999985723 arcsec/yrEpoch of Position: 2015.5se.					
Template	Subarray FULL										
nts	# Filter	<b>Readout Pattern</b>	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	<b>Total Dithers</b>	Total Integrations	Total Exposure Time	ETC Wkbk.Calc	
Spectral Eleme	1 F1500W	FASTR1	13	298	1	None	1	298	11574.692	54020	
Special Requirements	Phase 0.9595709274573754 to 0.9 Aperture PA Range 74.449705 to Aperture PA Range 254.4499705 Time Series Observation No Parallel	9767747881138114 with 154.449705 Degrees (V: to 334.449705 Degrees (	period 2.421937 3 69.61545176 to V3 249.6157172	Days and zero-phase 2 9 149.61545176) 26 to 329.61545176)	1457258.58728 HJ	D					

Pr	op	osal 2304 - Observati	ion 2 - Hot Ta	ike on a C	ool World: Do	es Trappist	-1c Have	an Atmospher	e?		
Observation	P C	Proposal 2304, Observation 2 Diagnostic Status: Warning Observing Template: MIRI Imaging								Thu Oct 14	00:00:39 GMT 2021
Diagnostics	() () )	Observation 2) Warning (Form): Ex Visit 2:1) Warning (Form): Overhea	posure Duration exce ids are provisional un	eds the limit of 1	0000.0 seconds. Above her has been run.	this limit it is pos	sible that a High	h Gain Antenna move m	ay occur during the	exposure.	
Fixed Targets	# () () () () () () () () () () () () ()	#     Name     Target Coordinates       (1)     TRAPPIST-1     RA: 23 06 30.3341 (346.6263921d)       Dec: -05 02 36.46 (-5.04346d)     Equinox: J2000       Comments: This object was generated by the targetselector and retrieved from the SIMBAD of Category=Star     Description=[M dwarfs M stars]			63921d) 6d) rom the SIMBAD datab	Targ. Coord. CorrectionsMiscellaneousProper Motion RA: 0.062299806210057845 sec of time/yrProper Motion Dec: -0.479402999985723 arcsec/yr Epoch of Position: 2015.5atabase.					
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nts	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	<b>Total Dithers</b>	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
Spectral Eleme	1	F1500W	FASTR1	13	298	1	None	1	298	11574.692	54020
Special Requirements	P A T N	hase 0.9595709274573754 to 0.976 sperture PA Range 74.449705 to 15 sperture PA Range 254.4499705 to ime Series Observation Io Parallel	7747881138114 with 4.449705 Degrees (V 334.449705 Degrees (	period 2.421937 3 69.61545176 to V3 249.6157172	Days and zero-phase 2 149.61545176) 6 to 329.61545176)	2457258.58728 HJ	0				

Pro	oposal	2304 - Observat	tion 3 - Hot Ta	ke on a C	ool World: Do	es Trappis	t-1c Have	an Atmospher	e?		
Observation	Proposal Diagnost Observing	2304, Observation 3 ic Status: Warning g Template: MIRI Imaging	2							Thu Oct 14	00:00:39 GMT 2021
Diagnostics	(Observa) (Visit 3:1	tion 3) Warning (Form): E. ) Warning (Form): Overhe	xposure Duration excee eads are provisional unt	eds the limit of 16	0000.0 seconds. Above er has been run.	this limit it is pos	sible that a High	n Gain Antenna move m	ay occur during the	exposure.	
Fixed Targets	#     Name     Target Coordinates       (1)     TRAPPIST-1     RA: 23 06 30.3341 (346.6263921d)       Dec: -05 02 36.46 (-5.04346d)     Equinox: J2000       Comments: This object was generated by the targetselector and retrieved from the SIMBAD date Category=Star       Description=IM dwarfs. M stars1				63921d) 5d) rom the SIMBAD datab	Targ. Coord. CorrectionsMiscellaneousProper Motion RA: 0.062299806210057845 sec of time/yrProper Motion Dec: -0.479402999985723 arcsec/yrProper Motion Dec: -0.479402999985723 arcsec/yr Epoch of Position: 2015.5Epoch of Position: 2015.5					
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nts	#	Filter	<b>Readout Pattern</b>	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	<b>Total Dithers</b>	Total Integrations	Total Exposure Time	ETC Wkbk.Calc
Spectral Eleme	1	F1500W	FASTR1	13	297	1	None	1	297	11535.841	54020
Special Requirements	Phase 0.9 Aperture Aperture Time Ser No Parall	595709274573754 to 0.97 PA Range 74.449705 to 15 PA Range 254.449705 to 15 PA Range 254.4499705 to ies Observation el	67747881138114 with 54.449705 Degrees (V 334.449705 Degrees (	period 2.421937 69.61545176 to V3 249.6157172	Days and zero-phase 2 149.61545176) 6 to 329.61545176)	2457258.58728 HJ	D				

Pro	oposal 2304 - Observat	tion 4 - Hot Ta	ke on a Co	ool World: Do	es Trappis	t-1c Have	an Atmospher	e?		
Observation	Proposal 2304, Observation 4   Thu     Diagnostic Status: Warning   Observing Template: MIRI Imaging									
Diagnostics	(Observation 4) Warning (Form): E (Visit 4:1) Warning (Form): Overhe	xposure Duration excee eads are provisional unt	eds the limit of 10	0000.0 seconds. Above er has been run.	this limit it is pos	sible that a High	n Gain Antenna move m	ay occur during the	exposure.	
Fixed Targets	#     Name     Target Coordinates       (1)     TRAPPIST-1     RA: 23 06 30.3341 (346.6263921d)       Dec: -05 02 36.46 (-5.04346d)     Equinox: J2000       Comments: This object was generated by the targetselector and retrieved from the SIMBAD do Category=Star       Description=IM dwarfs     M stars1				Targ. Coord. CorrectionsMiscellaneousProper Motion RA: 0.062299806210057845 sec of time/yrProper Motion Dec: -0.479402999985723 arcsec/yr Epoch of Position: 2015.5atabase.					
Template	Subarray FULL									
nts	# Filter	<b>Readout Pattern</b>	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	<b>Total Dithers</b>	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
Spectral Eleme	1 F1500W	FASTR1	13	297	1	None	1	297	11535.841	54020
Special Requirements	Phase 0.9595709274573754 to 0.97 Aperture PA Range 74.449705 to 1: Aperture PA Range 254.4499705 to Time Series Observation No Parallel	67747881138114 with 54.449705 Degrees (V 334.449705 Degrees (	period 2.421937 69.61545176 to V3 249.6157172	Days and zero-phase 2 149.61545176) 6 to 329.61545176)	2457258.58728 HJ	D				