

5037 - Confirmation of the closest directly detected exoplanet: a super-Jupiter orbiting Eps Ind A

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

Folder	Observation	Label	Observing Template	Science Target
Observa	ation Folder			
	1	BG_dituc F1550C	MIRI Coronagraphic Imaging	(3) BG-NEAR-DI-TUC
	2	BG_epsindi F1550C	MIRI Coronagraphic Imaging	(3) BG-NEAR-DI-TUC
	3	DITuc F1550C	MIRI Coronagraphic Imaging	(2) V-DI-Tuc
	4	EpsIndi F1550C	MIRI Coronagraphic Imaging	(1) -eps-Ind

JWST Proposal 5037 (Created: Thursday, February 29, 2024 at 7:00:46 PM Eastern Standard Time) - Overview

ABSTRACT

We will confirm that a candidate companion to Eps Ind A is indeed a massive planet, and detect (or place stringent constraints on) a second massive planet in the system. Eps Ind A is the ideal location to search for solar-age exoplanets: the system is nearby, hosts a known RV planet, and is comoving with a benchmark brown dwarf binary. Even super-Jupiters orbiting the ~4Gyr Eps Ind A could be as cold as ~200K, far older and colder than any imaged planet to date. Only JWST, with its excellent mid-IR sensitivity, can detect such companions - and these companions would be exquisite targets for detailed atmospheric characterization in future cycles. Radial velocity and astrometric measurements suggest a planet with mass ~3Mjup and semi-major axis ~8-11au - readily resolvable and detectable with JWST/MIRI.

JWST Cycle 1 images of Eps Ind A reveal a candidate companion that is consistent in color and magnitude with a massive (~10Mjup) planet. However, the position angle and mass of the candidate is different than expected from RV/astrometric models of the companion orbit - perhaps suggesting there are two giant planets in this system, with only one of these detected in the MIRI images. No counterpart is seen at the background location in archival Spitzer 8um and 24um images, and the object is challenging to explain as a chance-aligned background. A second epoch of observations will allow us to test for common proper motion to confirm that the source is a planet and not a chance-aligned background, carry out preliminary orbit fitting efforts to constrain a planet mass and test planet evolution models, and place further constraints on a proposed second candidate in the system.

OBSERVING DESCRIPTION

We will observe Eps Ind Ab with JWST/MIRI coronagraphic imaging, with the F1550C filter and the FQPM coronagraph. We will also collect PSF reference images of DI Tuc, using the 5-point small grid dither technique. This allows data to be reduced using reference differential imaging (RDI); we do not use angular differential imaging (ADI) for this target. It has been shown that ADI does not significantly improve performance, especially at small projected separations (Carter+2023), where companions would be significantly self-subtracted due to the small roll angles acheivable with JWST.

Our program aims to redetect a bright companion at ~4" from the host star, previously detected in Cycle 1. We also aim to reach deep sensitivities at the position angles that were not detectable during the cycle 1 observations due to the coronagraph bounday. We therefore provide a PA aperture constraint of between 53deg and 83deg (+ n x 90deg), justified in detail in the technical description. There are no orientation constraints for the reference star.

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We will also collect background observations matching both the science and technical setup. This is needed to subtract of the glowstick feature present in MIRI cornagraphic images.

We include all of the observations in a non-interruptible block. It is crucial that the science and PSF observations are collected in a non-interruptible block since the JWST PSF is time-variable, and it is crucial to collect the background observations in a non-interruptible block, to mimic the science background as closesly as possible.

Proposal 5037 - Targets - Confirmation of the closest directly detected exoplanet: a super-Jupiter orbiting Eps Ind A

	# Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous					
	(1) -eps-Ind	RA: 22 03 21.6536 (330.8402233d)	Proper Motion RA: 3966.6610000000005 mas/yr						
		Dec: -56 47 9.52 (-56.78598d)	e: -56 47 9.52 (-56.78598d) Proper Motion Dec: -2536.1920000932514 mas/yr						
		Equinox: J2000	Epoch of Position: 2000						
, s	Comments: This object was generated by Category=Star Description=[K stars] Extended=NO	with targetselector and retrieved from the SIMBAD database.							
gets	(2) V-DI-Tuc	RA: 22 16 8.1950 (334.0341458d)	Proper Motion RA: 18.257 mas/yr						
Tar		Dec: -57 34 5.06 (-57.56807d)	Proper Motion Dec: -12.32699999036413 mas/yr						
١Ę		Equinox: J2000	Epoch of Position: 2000						
Fixe	Comments: This object was generated by Category=Star Description=[M giants] Extended=NO	v the targetselector and retrieved from the SIMBAD database.							
	(3) BG-NEAR-DI-TUC	RA: 22 17 54.0000 (334.4750000d)							
		Dec: -57 28 50.00 (-57.48056d)							
		Equinox: J2000							
	Comments: Category=Calibration Description=[Telescope/sky background	11							

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	Proposal 5037, Observation											0:00:46 GMT 2024
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Observation	Background Observation Fo	r: [DITuc F15500	C (Obs 3), EpsInd	i F1550C (Obs 4)]							
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Diagnostics	(Visit 1:1) Warning (Form):	Overheads are pr	ovisional until the	e Visit Planner ha	as been run.							
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<u>Pr</u>	oposal 5037 - Observation 1 - Confirmation of the closest directly detected exoplanet: a super-Jupiter orbiting Eps Ind A
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<u>Pr</u>	oposal 5037 - Observation 2 - Confirmation of the closest directly detected exoplanet: a super-Jupiter orbiting Eps Ind A
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ati	Diagnostic Status: Warn	-										
<u> </u>	Observing Template: MIF											
Observation	Background Observations	:[BG_dituc F1550C	C (Obs 1), BG_eps	sindi F1550C (Obs 2	2)]							
Diagnostics	(Visit 3:1) Warning (Forn	i): Overheads are pi	rovisional until th	e Visit Planner has t	oeen run.							
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PSF References	PSF Reference: true											

<u>Pro</u>	oposal 5037 - Observation 3 - Confirmation of the closest directly detected exoplanet: a super-Jupiter orbiting Eps Ind A
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Observation	Proposal 5037, Observation 4 Diagnostic Status: Warning Observing Template: MIRI Con Background Observations:[BG]	onagraphic Imagin	-	0C (Obs 2)]					Fri Mar 01	00:00:46 GMT 2024	
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get	(1) -eps-Ind		.: 22 03 21.6536 (330.8	<i>'</i>	Proper Motion RA: 396		-				
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References											
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Aperture PA Range 53 to 83 Degrees (V3 48.16455103 to 78.16455103)
Aperture PA Range 143 to 173 Degrees (V3 138.16455103)
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