



5204 - Probing the Dynamical History and the Mid-IR SED of WD 1856b

Cycle: 3, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Mary Anne Limbach (PI)	University of Michigan
Dr. Ryan J MacDonald (CoI) (CoPI)	University of Michigan
Dr. Andrew Vanderburg (CoI) (CoPI)	Massachusetts Institute of Technology
Dr. Simon Blouin (CoI) (CSA Member)	University of Victoria
Sydney Jenkins (CoI)	Massachusetts Institute of Technology
Dr. Caroline Morley (CoI)	University of Texas at Austin
Dr. Kevin Stevenson (CoI)	The Johns Hopkins University Applied Physics Laboratory
Dr. Elena Gallo (CoI)	University of Michigan
Christopher O'Connor (CoI)	Cornell University
Dr. Siyi Xu (CoI)	NOIRLab - Gemini North (HI)

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1		MIRI Imaging	(1) LP-141-14
	2		MIRI Imaging	(1) LP-141-14

ABSTRACT

The WD 1856 system hosts the only known transiting exoplanet around a white dwarf, WD 1856 b, a gas giant with an orbital separation of 0.02 AU. Recent NIRSpect observations of WD 1856 b have presented a perplexing and unexpected outcome. The observations provide further evidence that the exoplanet candidate is likely in the planetary mass regime, while conversely finding it has a temperature far above what is expected for the estimated age and mass of this planet. This mystery can most readily be solved by obtaining a better understanding of the exoplanet's dynamical

history. There are currently two possible explanations for WD 1856 b's arrival at its current location, either common-envelope evolution or high eccentricity migration. If the latter is responsible for the planet's migration to its current location, then there is likely a higher mass planet in the WD 1856 system that kicked it in. We propose an efficient MIRI direct imaging + common proper motion program to search for additional exoplanets in this system to constrain the migration mechanism of WD 1856 b. Additionally, WD 1856 b outshines its host star in the mid-IR, and the proposed observations will provide the first flux measurement of this exoplanet in the mid-IR from 5-25 microns via IR excess in the blended white dwarf + planet SED, allowing for improved characterization of the planet's spectrum and physical parameters. In particular, the observations will probe the emission temperature, atmospheric C/H ratio and disequilibrium chemistry of the exoplanet.

OBSERVING DESCRIPTION

We request 4.4 hours of MIRI imaging observations to (1) search for additional exoplanets in this system, and (2) measure the infrared excess due to the known unresolved exoplanet orbiting the white dwarf WD 1856+534. We will use a 4-point cycling dither pattern to mitigate bad pixel effects. We will image the system at 2 epochs separated by >320 days (proper motion is 247 mas/yr, corresponds to >2 pixels of motion between epochs). Epoch 1 imaging filters: F560W, F770W, F1000W, F1130W, F1280W, F1550W and F1800W. Epoch 2 imaging filters: F1550W and F1800W. This measurement should NOT be conducted during a transit or eclipse event in the system. Transit and eclipse times are predicted using an updated ephemeris listed in the scientific justification and given as a special constraint. The transit and eclipse duration are 8 minutes and occur every 16.9 hours.

Proposal 5204 - Targets - Probing the Dynamical History and the Mid-IR SED of WD 1856b

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	LP-141-14	RA: 18 57 39.3437 (284.4139321d)	Proper Motion RA: 240.749 mas/yr	
			Dec: +53 30 33.30 (53.50925d)	Proper Motion Dec: -52.47000008239411 mas/yr	
			Equinox: J2000	Epoch of Position: 2000	
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[White dwarfs]				

Proposal 5204 - Observation 1 - Probing the Dynamical History and the Mid-IR SED of WD 1856b

Observation	Proposal 5204, Observation 1										Wed Jun 12 20:00:38 GMT 2024
	Diagnostic Status: Warning										
	Observing Template: MIRI Imaging										
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
	(Observation 1) Informational (Form): The Visit Planner and Spike may produce different schedulability results.										
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous		
	(1)	LP-141-14	RA: 18 57 39.3437 (284.4139321d) Dec: +53 30 33.30 (53.50925d) Equinox: J2000			Proper Motion RA: 240.749 mas/yr Proper Motion Dec: -52.47000008239411 mas/yr Epoch of Position: 2000					
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[White dwarfs]										
Template	Subarray										
	FULL										
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	CYCLING	1	4						DEFAULT	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F560W	FASTR1	10	1	1	Dither 1	4	4	111.002	165050
	2	F770W	FASTR1	10	1	1	Dither 1	4	4	111.002	165050
	3	F1000W	FASTR1	12	1	1	Dither 1	4	4	133.202	165050
	4	F1280W	FASTR1	25	1	1	Dither 1	4	4	277.504	165050
	5	F1500W	FASTR1	40	1	1	Dither 1	4	4	444.006	165050
	6	F1800W	FASTR1	40	3	1	Dither 1	4	12	1354.22	165050
	7	F1130W	FASTR1	36	1	1	Dither 1	4	4	399.606	
Special Requirements	Phase 0.02 to 0.88 with period 0.7039696085 Days and zero-phase 2459038.4358981 HJD										
	2 After 1 by 320 Days to <None specified> Same Aperture PA 1, 2										

Proposal 5204 - Observation 2 - Probing the Dynamical History and the Mid-IR SED of WD 1856b

Observation	Proposal 5204, Observation 2										Wed Jun 12 20:00:38 GMT 2024
	Diagnostic Status: Warning										
	Observing Template: MIRI Imaging										
Diagnostics	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
	(Observation 2) Informational (Form): The Visit Planner and Spike may produce different schedulability results.										
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous	
	(1)	LP-141-14	RA: 18 57 39.3437 (284.4139321d)				Proper Motion RA: 240.749 mas/yr				
			Dec: +53 30 33.30 (53.50925d)				Proper Motion Dec: -52.47000008239411 mas/yr				
			Equinox: J2000				Epoch of Position: 2000				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.										
Template	Category=Star										
	Description=[White dwarfs]										
Dithers	Subarray										
	FULL										
Spectral Elements	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	CYCLING	1	4						DEFAULT	
Special Requirements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F1500W	FASTR1	40	1	1	Dither 1	4	4	444.006	165050
	2	F1800W	FASTR1	40	3	1	Dither 1	4	12	1354.22	165050
Special Requirements	Phase 0.02 to 0.88 with period 0.7039696085 Days and zero-phase 2459038.4358981 HJD										
	2 After 1 by 320 Days to <None specified> Same Aperture PA 1, 2										