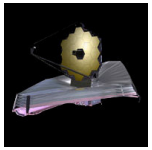

3548 - Exometeorology: Weather on an Isolated World Beyond Our Own

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	3	NIRSPEC TSO	NIRSpec Bright Object Time Series	(2) SIMP-J013656.5+093347.3
	4	MIRI TSO	MIRI Low Resolution Spectroscopy	(2) SIMP-J013656.5+093347.3
	5	MIRI Background	MIRI Low Resolution Spectroscopy	(2) SIMP-J013656.5+093347.3

ABSTRACT

With the launch of JWST, we are entering the era of direct exoplanet characterization studies. Based on the handful of directly-imaged exoplanets studied to date, it is clear that interpretation of these discoveries hinges on a thorough understanding of their condensate clouds. Spectroscopic time-

series monitoring provides a means to investigate these clouds in detail. We propose to obtain phase-resolved coverage of the highly variable, isolated exoplanet analog SIMP J0136+09 by observing one full rotation each with the NIRSPec and MIRI instruments. By obtaining complete longitudinal information of an extrasolar atmosphere at 1-14 m we will perform the most detailed phase-resolved atmospheric investigation of any extrasolar atmosphere to date. The proposed program will enable us to

1) Pinpoint the mechanisms driving variability
2) Perform spatially-resolved atmospheric retrievals on an imaged extrasolar atmosphere for the first time

The results of this program will provide crucial insight on the importance of time-varying atmospheric processes for brown dwarfs, isolated planetary-mass objects and bona fide directly-imaged exoplanets.

OBSERVING DESCRIPTION

We propose for MIRI/LRS and NIRSpec Bright Object Time-Series observations of our target SIMPJ 0135+09. We will cover a full rotation period with each instrument, resulting in full phase coverage of the atmosphere from 0.6 14 μm. Light curve shapes of brown dwarfs often change dramatically over a couple of days so it is essential that our observations are taken in a non-interruptible sequence. This will ensure that we capture SIMPJ 0136+09 in the same atmospheric state across the full wavelength range.

MIRI Monitoring:

We will observe SIMPJ 0136+09 using the MIRI time-series template to ensure high stability and precision across all wavelengths. We will use the MIRI LRS slitless mode with the P750L disperser to prevent slit losses, disabling dithers to ensure photometric stability, and utilizing the FAST readout mode to provide many samples up the ramp. Following the MIRI Time Series Observations Recommendations and the latest recommendations from the Transiting Exoplanet Community Early Release Science Program, we add an additional 60 minutes of settling time before the observation to mitigate the effects of the ramp systematic. For brown dwarfs, the JWST ETC has built-in low-temperature, log(g)=5 PHOENIX models.We adopt the Teff = 1100 PHOENIX model for our ETC calculations. Our ETC calculations predict an SNR 100 with 5-minute cadence, and SNR 260 with 30-minute cadence. We show the 30-minute cadence sensitivity in Figure 3. We will be sensitive to the predicted variability across the full MIRI spectral range. Variability observations have never been carried out at wavelengths > 5 μm so these observations will be transformative for our understanding of clouds in extrasolar atmospheres.

NIRSpec Monitoring:

We propose JWST/NIRSpec monitoring of SIMPJ 0136+09 to cover a full rotation. Following the recommended strategies for time series observations with NIRSpec, we will use the Bright Object Time Series (BOTS) mode with the Prism filter and S1600A1 slit. We use the SUB2048

subarray, the NRS readout pattern and 3 groups per integration to achieve 12 s cadence. Following recommendations from the JWST User Documentation's Step-by-Step ETC Guide for NIRSpec BOTS Observations and consultation with the JWST helpdesk, we add on a 30 minute settling time at the beginning of our observation. According to the JWST/ETC, we will reach SNR 775 with 5-minute cadence and SNR 1870 with 30-minute cadence). The observations will provide spectroscopic variability observations at unprecedented sensitivity, providing the most detailed information to date for studying the time-varying atmospheric properties of an isolated giant planet analog.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	SIMP-J013656.5+093347.3	RA: 01 36 57.9000 (24.2412500d) Dec: +09 33 47.05 (9.56307d) Equinox: J2000	Proper Motion RA: 1238.244 mas/yr Proper Motion Dec: -16.156 mas/yr Parallax: 0.1634478" Epoch of Position: 2016	

Comments: Coordinates updated by J. Vos on 6/27: Gaia EDR3
Category=Star
Description=[Brown dwarfs]
Extended=NO

Observation

Proposal 3548, Observation 3: NIRSPEC TSO Wed Jul 05 22:01:16 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(NIRSPEC TSO (Obs 3)) Warning (Form): Exposure Duration exceeds the limit of 10000.0 seconds. Above this limit it is possible that a High Gain Antenna move may occur during the exposure.

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	SIMP-J013656.5+093347.3	RA: 01 36 57.9000 (24.2412500d) Dec: +09 33 47.05 (9.56307d) Equinox: J2000	Proper Motion RA: 1238.244 mas/yr Proper Motion Dec: -16.156 mas/yr Parallax: 0.1634478" Epoch of Position: 2016	

Comments: Coordinates updated by J. Vos on 6/27: Gaia EDR3
Category=Star
Description=[Brown dwarfs]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	142236

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	7	5726	1	1	5726	10477.206	142236

Special Requirements

Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, Non-interruptible

Observation

Proposal 3548, Observation 4: MIRI TSO Wed Jul 05 22:01:16 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

(MIRI TSO (Obs 4)) Warning (Form): Exposure Duration exceeds the limit of 10000.0 seconds. Above this limit it is possible that a High Gain Antenna move may occur during the exposure.

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	SIMP-J013656.5+093347.3	RA: 01 36 57.9000 (24.2412500d) Dec: +09 33 47.05 (9.56307d) Equinox: J2000	Proper Motion RA: 1238.244 mas/yr Proper Motion Dec: -16.156 mas/yr Parallax: 0.1634478" Epoch of Position: 2016	

Comments: Coordinates updated by J. Vos on 6/27: Gaia EDR3
Category=Star
Description=[Brown dwarfs]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F560W	FAST	4	1	1	0.636	142236

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	5	1	1	1	1	0.795		F560W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	120	575	575	1	1	11065.049	142236

Special Requirements

Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, Non-interruptible

Observation

Proposal 3548, Observation 5: MIRI Background

Wed Jul 05 22:01:16 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	SIMP-J013656.5+093347.3	RA: 01 36 57.9000 (24.2412500d) Dec: +09 33 47.05 (9.56307d) Equinox: J2000	Proper Motion RA: 1238.244 mas/yr Proper Motion Dec: -16.156 mas/yr Parallax: 0.1634478" Epoch of Position: 2016	

Comments: Coordinates updated by J. Vos on 6/27: Gaia EDR3
Category=Star
Description=[Brown dwarfs]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F560W	FAST	4	1	1	0.636	142236

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
1	FASTR1	5	1	1	1	1	0.795		F560W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	120	10	10	1	1	192.279	142236

Special Requirements

Offset 15.0 arcsec, 0.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, Non-interruptible