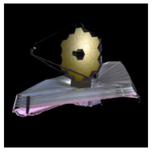

8155 - Storms are Brewing in the ONC: Variability Monitoring of 50 Substellar Worlds

Cycle: 4, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRCam Time Series	(1) Orion-Nebula-Cluster
	2		NIRCam Time Series	(1) Orion-Nebula-Cluster

Folder	Observation	Label	Observing Template	Science Target
	3		NIRCam Imaging	(2) -45-Ori
	4		NIRCam Imaging	(3) -ups-Ori
	5		NIRCam Imaging	(4) -d-Ori
	6	Residual Persistence Check	NIRCam Dark	NONE
	7	Residual Persistence Check	NIRCam Dark	NONE
	8	Residual Persistence Check	NIRCam Dark	NONE

ABSTRACT

We propose NIRCam dual-band variability monitoring of 50 substellar worlds in the Orion Nebula Cluster (ONC) for 36 hours. This program will observe a similarly aged (1-3 Myr) population of substellar worlds (2-75 Jupiter masses), probing two distinct atmospheric depths by capturing light curves in two bands simultaneously—on and off the water absorption feature, with the ability to measure phase lags between the two different pressure levels. These observations will offer crucial insights into how atmospheric variability shapes the characteristics of substellar objects, helping to identify trends, outliers, and targets for future spectroscopic follow-up. We will be able to detect variability with amplitudes below 0.5% for most of the sample.

The program will provide measurements of rotation periods for dozens of substellar objects, including the free-floating planetary-mass worlds down to 2 Jupiter masses, aiding in extending gyrochronology into the substellar regime and tracing the angular momentum evolution of planetary-mass objects and brown dwarfs. Additionally, these data will allow us to explore how slowed rotational collapse may influence the radii of young substellar worlds. The resulting time-domain catalog of the ONC produced from this program would provide a legacy resource for a wide range of future studies.

OBSERVING DESCRIPTION

This program will conduct two NIRCam full field of view time series observation of the ONC: two 18-hour blocks, separated by a ~24-hour gap. The gap is required: due to JWST's data limit constraints, full-field dual-band monitoring reaches a limit after 18 hours of observation.

We use the F162M shortwave filter and the F250M longwave filter. We will read out the full detector in the rapid readout pattern at 5 groups/int (54 seconds), which is the minimum number of groups/int. This provides excellent sensitivity of substellar worlds within the field of view: e.g., based on our ETC calculations, binning the data to 15-min results in SNRs of ~200 at F250M and ~300 at F162M on the 12 Jupiter-mass, 20th magnitude substellar world. Where saturation is not an issue (which is dependent on stellar brightness/mass and the extinction), the program will also produce lightcurves for many of the stars in the field of view.

Our pointing in the ONC was chosen as it maximizes the number of substellar worlds we can observe with this program. To determine how many are captured, we leveraged archival catalogs listing the magnitude, extinction and mass estimate for sources in the ONC.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	Orion-Nebula-Cluster	RA: 05 35 15.0576 (83.8127400d) Dec: -05 23 22.41 (-5.38956d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0.00248" Epoch of Position: 2023	
Comments: RA and DEC of pointing were input manually. *Category=Stellar Cluster* *Description=[Young star clusters]*				
(2)	-45-Ori	RA: 05 35 39.4842 (83.9145175d) Dec: -04 51 21.84 (-4.85607d) Equinox: J2000	Proper Motion RA: -2.113 mas/yr Proper Motion Dec: 8.501 mas/yr Parallax: 0.0087664" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Star* *Description=[A stars]*				
(3)	-ups-Ori	RA: 05 31 55.8600 (82.9827500d) Dec: -07 18 5.54 (-7.30154d) Equinox: J2000	Proper Motion RA: -0.704 mas/yr Proper Motion Dec: -4.884999975729443 mas/yr Parallax: 0.0024567" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Star* *Description=[O stars]*				
(4)	-d-Ori	RA: 05 38 53.0832 (84.7211800d) Dec: -07 12 46.19 (-7.21283d) Equinox: J2000	Proper Motion RA: -15.401999999999997 mas/yr Proper Motion Dec: -49.30200002490892 mas/yr Parallax: 0.022958700000000002" Epoch of Position: 2000	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Star* *Description=[A stars]*				

Observation

Proposal 8155, Observation 1

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Time Series

Diagnostics

(Observation 1) 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 1:1) Warning (Form): Data Excess over middle threshold

(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.

(Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	Orion-Nebula-Cluster	RA: 05 35 15.0576 (83.8127400d) Dec: -05 23 22.41 (-5.38956d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0.00248" Epoch of Position: 2023	

Comments: RA and DEC of pointing were input manually.
Category=Stellar Cluster
Description=[Young star clusters]

Acquisition

#	Target
1	NONE

Template

Module	Subarray
B	FULLP

Spectral Elements

#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	F162M	F150W2	CLEAR	F250M	RAPID	5	1000	1	1000	64409.883	

Special Requirements

Aperture PA Range 268.9 to 269.1 Degrees (V3 268.63890237 to 268.83890237)
Offset -10.95 arcsec, -10.91 arcsec
Time Series Observation
No Parallel Attachments
Persistence Risk

2 After 1 by 40 Hours to 50 Hours
6 After 1 by 30.6 Hours to 2 Days, Exclusive Use Of Instrument
Same Aperture PA 1, 2, 3, 4, 5

Observation

Proposal 8155, Observation 2

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Time Series

Diagnostics

(Observation 2) 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 2:1) Warning (Form): Data Excess over middle threshold

(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.

(Visit 2:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	Orion-Nebula-Cluster	RA: 05 35 15.0576 (83.8127400d) Dec: -05 23 22.41 (-5.38956d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0.00248" Epoch of Position: 2023	

Comments: RA and DEC of pointing were input manually.
Category=Stellar Cluster
Description=[Young star clusters]

Acquisition

#	Target
1	NONE

Template

Module	Subarray
B	FULLP

Spectral Elements

#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	F162M	F150W2	CLEAR	F250M	RAPID	5	1000	1	1000	64409.883	

Special Requirements

Offset -10.95 arcsec, -10.91 arcsec
Time Series Observation
No Parallel Attachments
Persistence Risk

2 After 1 by 40 Hours to 50 Hours
3 After 2 by <None specified> to 2 Days
7 After 2 by 30.6 Hours to 2 Days, Exclusive Use Of Instrument
Same Aperture PA 1, 2, 3, 4, 5

Observation

Proposal 8155, Observation 3

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Visit 3:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Observation 3) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 3:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

(Visit 3:2) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	-45-Ori	RA: 05 35 39.4842 (83.9145175d) Dec: -04 51 21.84 (-4.85607d) Equinox: J2000	Proper Motion RA: -2.113 mas/yr Proper Motion Dec: 8.501 mas/yr Parallax: 0.0087664" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[A stars]

Template

Module	Subarray
B	FULLP

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRASCA	5	STANDARD	24" (LARGE)	1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F162M+F150W2	F250M	RAPID	5	7	35	5	2201.038	

Special Requirements

Sequence Visits within 53.0 Days
Visits Same PA
Offset -10.95 arcsec, -10.91 arcsec

3 After 2 by <None specified> to 2 Days
Sequence Observations 3, 4, 5, Non-interruptible
Same Aperture PA 1, 2, 3, 4, 5

Observation

Proposal 8155, Observation 4

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 4) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	-ups-Ori	RA: 05 31 55.8600 (82.9827500d) Dec: -07 18 5.54 (-7.30154d) Equinox: J2000	Proper Motion RA: -0.704 mas/yr Proper Motion Dec: -4.884999975729443 mas/yr Parallax: 0.0024567" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[O stars]

Template

Module	Subarray
B	FULLP

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRASCA	5	STANDARD	16" (MEDIUM)	1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F162M+F150W2	F250M	RAPID	5	6	30	5	1878.935	

Special Requirements

Offset -10.95 arcsec, -10.91 arcsec

Sequence Observations 3, 4, 5, Non-interruptible
Same Aperture PA 1, 2, 3, 4, 5

Observation

Proposal 8155, Observation 5

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 5) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 5:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	-d-Ori	RA: 05 38 53.0832 (84.7211800d) Dec: -07 12 46.19 (-7.21283d) Equinox: J2000	Proper Motion RA: -15.401999999999997 mas/yr Proper Motion Dec: -49.30200002490892 mas/yr Parallax: 0.022958700000000002" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[A stars]

Template

Module	Subarray
B	FULLP

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRASCA	5	STANDARD	16" (MEDIUM)	1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F162M+F150W2	F250M	RAPID	5	6	30	5	1878.935	

Special Requirements

Offset -16.0 arcsec, -20.0 arcsec
Persistence Risk

8 After 5 by 13.2 Hours to 2 Days, Exclusive Use Of Instrument
Sequence Observations 3, 4, 5, Non-interruptible
Same Aperture PA 1, 2, 3, 4, 5

Observation

Proposal 8155, Observation 6: Residual Persistence Check

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Dark

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Template

Module	Subarray	Science Template	Occulting Mask	No. of Output Channels
B	FULL	Imaging		4

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	MEDIUM8	10	1	1	1	1052.203	

Special Requirements

6 After 1 by 30.6 Hours to 2 Days, Exclusive Use Of Instrument

Observation

Proposal 8155, Observation 7: Residual Persistence Check

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Dark

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Template

Module	Subarray	Science Template	Occulting Mask	No. of Output Channels
B	FULL	Imaging		4

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	MEDIUM8	10	1	1	1	1052.203	

Special Requirements

7 After 2 by 30.6 Hours to 2 Days, Exclusive Use Of Instrument

Observation

Proposal 8155, Observation 8: Residual Persistence Check

Fri Aug 29 18:00:09 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Dark

Diagnostics

(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Template

Module	Subarray	Science Template	Occulting Mask	No. of Output Channels
B	FULL	Imaging		4

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	MEDIUM8	10	1	1	1	1052.203	

Special Requirements

8 After 5 by 13.2 Hours to 2 Days, Exclusive Use Of Instrument