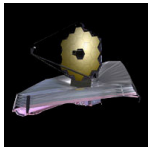

9431 - First Images of our Young Jupiter Neighbor

Cycle: 4, Proposal Category: DD

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	Roll 1 F444W	NIRCam Coronagraphic Imaging	(1) -eps-Eri
	2	Roll 2 F444W	NIRCam Coronagraphic Imaging	(1) -eps-Eri
	3	Ref F444W	NIRCam Coronagraphic Imaging	(2) -del-Eri

ABSTRACT

Epsilon Eridani, the tenth closest star to our Solar System, is often described as a younger version of the Sun. Hosting a richly complex debris disk and a Jupiter-like planet, it has been the target of many hundreds of hours of telescope time. The Jovian companion, detected with the radial

velocities (RV) technique, has, however, eluded a direct detection. For the first time, given the recent orbit and mass estimates obtained with RV data and the combination of Hipparcos, Gaia and HST/FGS astrometry data, JWST/NIRCam is expected to have the sensitivity needed to image it. Previous observations with NIRCam observed a marginal candidate with a relative astrometry and photometry consistent with the planet, however, its position coincided with a bright speckle which precluded a statically significant detection. We propose to follow-up this candidate to validate it as the Jupiter-like planet. The rationale for requesting DD time is based on predictions with a newly-published orbital model that shows that the planet will likely be undetectable for the next two years. The 4-5 micron photometry delivered by this program will constrain the planet's physical properties such as radius, effective temperature, metallicity, and the presence of water clouds. Given that a precise dynamical mass measurement is already available for Epsilon Eridani b, a photometric detection uniquely enables a test of substellar evolutionary models in the low-mass, low-temperature regime. We contend that the scientific significance of this potential discovery alone justifies a DDT observation: this would be the coldest and lowest mass planet, with a dynamical mass, ever imaged, a true Jupiter analog.

OBSERVING DESCRIPTION

The proposed observations consist of a set of imaging sequences with NIRCam filter F444W (and simultaneous, dual-band F210M) of the system epsilon Eridani. The aim is to image a previously detected source near this star.

Proposal 9431 - Targets - First Images of our Young Jupiter Neighbor

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	-eps-Eri	RA: 03 32 55.8445 (53.2326854d) Dec: -09 27 29.74 (-9.45826d) Equinox: J2000	Proper Motion RA: -974.758 mas/yr Proper Motion Dec: 20.876 mas/yr Parallax: 0.3105773" 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=[K stars]*				
(2)	-del-Eri	RA: 03 43 14.9005 (55.8120854d) Dec: -09 45 48.21 (-9.76339d) Equinox: J2000	Proper Motion RA: -93.634 mas/yr Proper Motion Dec: 744.36 mas/yr Parallax: 0.11002540000000001" 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=[K stars]*				

Observation

Proposal 9431, Observation 1: Roll 1 F444W Fri Jul 18 13:00:18 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(Roll 1 F444W (Obs 1)) Warning (Form): Science observations should be linked to at least one other compatible science observation by an Aperture PA Offset of 1-14 degrees

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

(Roll 1 F444W (Obs 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)	-eps-Eri	RA: 03 32 55.8445 (53.2326854d) Dec: -09 27 29.74 (-9.45826d) Equinox: J2000	Proper Motion RA: -974.758 mas/yr Proper Motion Dec: 20.876 mas/yr Parallax: 0.3105773" 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=[K stars]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 -eps-Eri	F335M	BRIGHT (ND Square)	BRIGHT2	9	1	1	0.956	251794

Template

Module	Occulting Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK335R	true	SUB320A335R	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	3	1	1	32.21	1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F210M	F444W	BRIGHT2	10	200	1	200	4494.064	251794

PSF References	Ref F444W (Obs 3) (PSF Reference; Filters [F210M/F444W]) Additional Justification: false
Special Requirements	Between Dates 08-AUG-2025:00:00:00 and 03-OCT-2025:00:00:00 No Parallel Attachments Group Observations 1, 2, 3, Non-interruptible V3 PA Offset 1 from 2 by 10 to 15 Degrees (Same offsets in Aperture)

Observation

Proposal 9431, Observation 2: Roll 2 F444W Fri Jul 18 13:00:18 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(Roll 2 F444W (Obs 2)) Warning (Form): Science observations should be linked to at least one other compatible science observation by an Aperture PA Offset of 1-14 degrees

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Roll 2 F444W (Obs 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)	-eps-Eri	RA: 03 32 55.8445 (53.2326854d) Dec: -09 27 29.74 (-9.45826d) Equinox: J2000	Proper Motion RA: -974.758 mas/yr Proper Motion Dec: 20.876 mas/yr Parallax: 0.3105773" 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=[K stars]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 -eps-Eri	F335M	BRIGHT (ND Square)	BRIGHT2	9	1	1	0.956	251794

Template

Module	Occulting Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK335R	true	SUB320A335R	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	3	1	1	32.21	1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F210M	F444W	BRIGHT2	10	200	1	200	4494.064	251794

PSF References	Ref F444W (Obs 3) (PSF Reference; Filters [F210M/F444W]) Additional Justification: false
Special Requirements	No Parallel Attachments Group Observations 1, 2, 3, Non-interruptible V3 PA Offset 1 from 2 by 10 to 15 Degrees (Same offsets in Aperture)

Observation

Proposal 9431, Observation 3: Ref F444W Fri Jul 18 13:00:18 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(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)	-del-Eri	RA: 03 43 14.9005 (55.8120854d)	Proper Motion RA: -93.634 mas/yr	
		Dec: -09 45 48.21 (-9.76339d)	Proper Motion Dec: 744.36 mas/yr	
		Equinox: J2000	Parallax: 0.11002540000000001"	
			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=[K stars]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 -del-Eri	F335M	BRIGHT (ND Square)	BRIGHT2	9	1	1	0.956	251794

Template

Module	Occulting Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK335R	false	SUB320A335R	9-POINT-CIRCLE

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F210M	F444W	BRIGHT2	10	40	9	360	8089.315	251794

PSF References

PSF Reference: true

Special Requirements	Group Observations 1, 2, 3, Non-interruptible