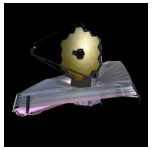

1412 - Characterizing 51 Eridani Exoplanetary System

Cycle: 1, Proposal Category: GTO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
51 Eri b				
	1	51 Eri - NIRCam - Roll 1 - MASK430R	NIRCam Coronagraphic Imaging	(1) 51-ERI
	2	51 Eri - NIRCam - Roll 1 - MASKLWB	NIRCam Coronagraphic Imaging	(1) 51-ERI
	3	Ref star - NIRCam - MASK430R	NIRCam Coronagraphic Imaging	(2) HD-30562
	4	Ref star - NIRCam - MASKLWB	NIRCam Coronagraphic Imaging	(2) HD-30562
	5	51 Eri - NIRCam - Roll 2 - MASKLWB	NIRCam Coronagraphic Imaging	(1) 51-ERI
	6	51 Eri - NIRCam - Roll 2 - MASK430R	NIRCam Coronagraphic Imaging	(1) 51-ERI

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Repeat of MASKLWB obs under WOPR 88691				
	12	51 Eri - NIRCam - Roll 1 - MASKLWB - Retry	NIRCam Coronagraphic Imaging	(1) 51-ERI
	14	Ref star - NIRCam - MASKLWB - Retry	NIRCam Coronagraphic Imaging	(2) HD-30562
	15	51 Eri - NIRCam - Roll 2 - MASKLWB - Retry	NIRCam Coronagraphic Imaging	(1) 51-ERI

ABSTRACT

The 51 Eridani system harbors one of the faintest and potentially lowest-mass exoplanets yet directly imaged. This program will observe and characterize the known planet 51 Eri b, and conduct a deep search at wide separations for fainter lower-mass planets that cannot be detected from the ground.

A key technical challenge in observing 51 Eri b is its small separation from the host star, ~0.4 arcsec. By instead positioning the target star behind the narrow end of the MASKLWB occulting wedge (a nonstandard mode but one which is possible via an already-existing pointing override available as an engineering option in APT) and using careful PSF subtraction, we will push the inner working angle in to 0.3 arcsec (~ 2 lambda/D at 4 microns). We will observe 51 Eri b in four medium band filters from 3 to 4.6 microns, all using the narrow end of the MASKLWB coronagraph occulter. In addition to its direct science results, this program will pioneer and assess performance in this new small angle observing mode to allow it to be offered to the community in future cycles.

These observations are obtained in direct partnership with the NIRCam GTO team as a single joint APT program to increase efficiency. This includes (a) deep searches for lower-mass outer planets, using the MASK430R occulter and wide filters (F356W and F444W) with NIRCam GTO time (b) and characterization of the known planet using MASKLWB, NARROW and four medium filters (F335M, F410M, F430M, F460M) with Telescope Scientist GTO time. Coordinated MIRI-US GTO observations will also study the 51 Eri system at longer wavelengths.

OBSERVING DESCRIPTION

SUMMARY AND OVERALL OBSERVING STRATEGY

This program will observe 51 Eridani using two of the NIRCam coronagraphs in six filters: MASKLWB to image the known planetary companion 51 Eri b with F335M, F410M, F430M, and F460M; and MASK430R to image the region around 51 Eridani A to look for additional faint companions

further from the star in deep F356W and F444W observations. Because the companion is currently at ~0.4" and moving closer to the star in projected separation, with an expected separation in 2022.5 of 0.35" (= ~2.5 lambda/D at 4.5 microns), we will use the narrow end of the LWB coronagraph to minimize the Inner Working Angle. To achieve the best possible contrast, we will make use of Small Grid Dither technique and KLIP algorithm to build an optimal PSF reference for subtraction from each integration in our observations. We follow the recommended coronagraphic practices of observing the science target in 2 rolls and observing a nearby PSF reference star in an un-interrruptible sequence.

In addition to the intrinsic scientific value of characterizing 51 Eri, a strong secondary goal of this program is assessing coronagraphic performance and observing strategies for close-in companions. We are using an engineering mode aperture to position the star at the narrow end of the bar coronagraph. (Specifically, the "SIAF Fiducial Point Override" SR to use the NRCA5_MASKLWB_NARROW aperture point.) We recognize this is in some sense an unsupported mode, but are using our joint position as GTO observers and STScI staff scientists to demonstrate and calibrate this new mode, hopefully to allow it to be offered generally in future cycles (in a similar way to how the HST STIS BAR5 position was commissioned.)

Ordering Of Observations

All observations are grouped by a "Sequence Observations, Non-Interruptible" special requirement (aka "Seq Non-Int SR") to ensure the PSF calibrator is observed close in time to the science target.

Within that we order the observations to maximize efficiency by minimizing slews: We first obtain the observations uing both coronagraph masks (430R and LWB) at PA roll 1, then all observations for the PSF star, then all science observations in roll 2. By placing the PSF star in the middle and carefully selecting the order in which the MASK430R and MASKLWB observations are obtained we have tried to reduce the time delta between science observations and the PSF reference while still maintaining good efficiency by not adding more slews.

Choice of PSF star

We searched SIMBAD for stars of equal or slightly greater brightness within 10 degrees of the science target. We also chose to prioritize the W1-W2 color of the PSF star in order to minimize systematics in the deep search component of this program.

Given those criteria our chosen PSF calibrator is HD 30562, which has an identical W1-W2 color to the science target, similar spectral type (F8V), and is relatively nearby (4 deg separation). We note that HD 30562 is itself a known exoplanet host star, with a 1.3 MJup planet in a 2.3 AU orbit, detected by radial velocity. The planet cannot be spatially resolved by JWST. Furthermore, this star's estimated age is ~4 Gyr, putting the planet below the NIRCam detection floor. The fact that this is a well studied system is valuable, since the substantial available data on this star confirms it will appear optically single at JWST's resolution.

NOTE ON RESTRICTED FUNCTIONALITY

As explained above this program uses the Restricted special requirement "Fiducial Point Override" to place the targets at a different location along the coronagraph bar than is nominal. After discussions with NIRCam support scientists and others here at STScI we believe this should "work as is" using the existing functionality that's already in PPS and other systems. We will gladly work with the PC and others to review things and address any issues that may arise. In particular we will want to carefully review the visit files before execution to double-check positioning of the target stars will be as desired. Thanks much.

EXPOSURE TIMES

Companion Characterization:

Exposure times were calculated in the JWST ETC assuming the companion at a separation of 1.5" and perfect subtraction. We made this decision since the narrow end of the MASKLWB is not an option via the ETC web site. We also did separate coronagraphic simulations using the Pandeia engine and Pandeia-coronagraphy Python package to more directly model the narrow occulter mode and validate our predictions for that.

Based on coronagraphy simulations, we anticipate SNR for the companion to range from ~10 to ~15 in a single roll for F335M through F460M filters. The exposure settings chosen in terms of groups and ints were verified in the ETC to not produce any warnings.

The PSF star is the same brightness as the target and thus we held the total integration time the same to ensure similar to peak-pixel intensity. However, since we are using the 5-POINT dither pattern we are reducing the ints at each dither position by ~2x to keep the total exposure time from becoming excessive ("excessive" taken to mean PSF exposure time >= 2x the total on-source science exposure time summed across the two rolls). Since the full set of PSF calibrator dither positions is combined to generate the KLIP eigenbasis, we do not need to achieve the same SNR per each individual dither position as on the science target. Specifically we expect the SNR of the PSF relative to the science target to be between 1/sqrt(5), for individual dither positions, and 5*sqrt(5), for the combined KLIP reference library mean PSF mode. We will of course assess how well this all works in practice and share best practices with the community.

Deep Search:

The filters were chosen to maximize the throughput for any faint companions that might be present in the field. Since this part of the program is less sensitive to PSF centering mismatch, we chose not to dither the PSF star.

Absolute PA and PA Offset Special Requirements, and Implied Time Constraints

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We used the Coronagraphic Target Visibility Tool to plan the PA special requirements.

The scheduling window is fairly narrowly constrained because the companion is at very small angular separation and in order to make this observation feasible at all we must orient that as close as possible to perpendicular to the MASKLWB occulting bar. In circa mid 2022, the planet 51 Eri b is predicted to be at position angle ~124. The orientation of the companion away from the occulting bar is maximized right at the end of its visibility window near day of year 292. Even then it will still be a challenge.

We have set up the program to use that scheduling opportunity. With the selected PA range tolerances the scheduling window is 4 days wide; if possible we would prefer scheduling near the end of that window, with the aperture PA as high as possible. That is, we would prefer aperture PA=295 rather than 292 if that can be scheduled. At that scheduling window we can get up to 14 deg roll between the two orientations which is also beneficial.

In particular we:
- Set "Same PA as" SRs linking the 2 science observations at each roll angle. This is to ensure consistent positioning of the target in both NIRCam datasets. It also increases observational efficiency slightly by avoiding rolls between those visits.
- Set the "Aperture PA offset" SR between the two observations in each filter to the range 13 to 15 deg, which is near the maximum available roll.
- Set an absolute "Aperture PA Range" SR to the range 292-296 deg for Observation 1, which positions the companion at the farthest separation from the coronagraph. Putting roll 1 near PA~296 also yields good target positioning in roll 2 as well after applying the offset SR. The 4 degree range yields about a 4 day scheduling window.

If for scheduling reasons it proves necessary to loosen constraints, we can work with our PC to adjust the Special Requirements and evaluate tradeoffs against reduced science performance by partially blocking the companion.

Target Acquisition

The target star is bright, ETC calculations indicate a high SNR > 100 acquisition can be obtained with the BRIGHT2 readout with groups=65, ints=1 which yields SNR~140. This high SNR should allow accurate centroiding to 1 mas or better. The exposure time is only ~6 s. We checked there is no danger of saturation, which would only happen for exposure times > 100 s. Since there is high SNR and plenty of leeway in the dynamic range we can use the same TA settings for the PSF star too without needing a separate ETC calculation.

NOTE ON GTO TIME ACCOUNTING

Observations 1, 3, and 6 (the MASK430R observations) should be charged to the NIRCam GTO team.
Observations 2, 4, and 5 (the MASKLWB observations) should be charged to the Telescope Scientist GTO team.
The time for the 1800s initial slew should be split evenly between the two teams.

Proposal 1412 - Targets - Characterizing 51 Eridani Exoplanetary System

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	
Comments: F star, *H=4.770, K=4.537* *Category=Star* *Description=[Exoplanets]* *Extended=NO*				
(2)	HD-30562	RA: 04 48 36.3850 (72.1516042d) Dec: -05 40 26.56 (-5.67404d) Equinox: J2000	Proper Motion RA: 311.523 mas/yr Proper Motion Dec: -248.847 mas/yr Parallax: 0.0379" Epoch of Position: 2000	
Comments: PSF star for 51 Eri. This is a high proper motion star. *K=4.310* *Category=Calibration* *Description=[Coronagraphic]*				

Observation

Proposal 1412, Observation 1: 51 Eri - NIRCam - Roll 1 - MASK430R Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Error

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(51 Eri - NIRCam - Roll 1 - MASK430R (Obs 1)) Error (Form): Short Filter is a required field.

(51 Eri - NIRCam - Roll 1 - MASK430R (Obs 1)) Error (Form): Short Filter is a required field.

(51 Eri - NIRCam - Roll 1 - MASK430R (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

(51 Eri - NIRCam - Roll 1 - MASK430R (Obs 1)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.

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

(51 Eri - NIRCam - Roll 1 - MASK430R (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	

Comments: F star,

H=4.770, K=4.537
Category=Star
Description=[Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 51-ERI	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.5

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK430R	true	SUB320A430R	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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		F356W	MEDIUM8	2	31	1	31	630.299	40834.6
2		F444W	DEEP8	2	41	1	41	1271.928	40834.7

PSF References	Ref star - NIRCam - MASK430R (Obs 3) (PSF Reference; Filters [null/F356W, null/F444W]) 51 Eri - NIRCam - Roll 2 - MASK430R (Obs 6) (Filters [null/F356W, null/F444W]) Additional Justification: false
Special Requirements	Sequence Observations 1, 2, 3, 4, 5, 6, Non-interruptible Aperture PA Offset 1 from 6 by -13 to -15 Degrees (Same offsets in V3) Same Aperture PA 1, 2 (V3 PAs differ)

Observation

Proposal 1412, Observation 2: 51 Eri - NIRCam - Roll 1 - MASKLWB Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Error

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 1 - MASKLWB (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
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Warning (Form): The order of link [PA Offset 5 from 2] combined with the order of the SEQ NON-INT reduces scheduling flexibility.
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Warning (Form): The selected fiducial point is not a standard option for the instrument.
(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.
(51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	

Comments: F star,

H=4.770, K=4.537
Category=Star
Description=[Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 51-ERI	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.5

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASKLWB	true	SUB400X256ALWB	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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		F335M	BRIGHT2	10	40	1	40	893.706	
2		F410M	BRIGHT2	10	40	1	40	893.706	
3		F430M	BRIGHT2	10	60	1	60	1340.558	
4		F460M	BRIGHT2	10	40	1	40	893.706	

PSF References

Ref star - NIRCam - MASKLWB (Obs 4) (PSF Reference; Filters [null/F335M, null/F410M, null/F430M, null/F460M])
51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5) (Filters [null/F335M, null/F410M, null/F430M, null/F460M])

Additional Justification: false

Special Requirements

Aperture PA Range 292 to 296 Degrees (V3 291.46789991 to 295.46789991)
Offset 0.0 arcsec, 0.069 arcsec
Fiducial Point Override NRCA5_MASKLWB_NARROW

Sequence Observations 1, 2, 3, 4, 5, 6, Non-interruptible
Aperture PA Offset 5 from 2 by -15 to -13 Degrees (Same offsets in V3)
Same Aperture PA 1, 2 (V3 PAs differ)

Observation

Proposal 1412, Observation 3: Ref star - NIRCam - MASK430R Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Error

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(Ref star - NIRCam - MASK430R (Obs 3)) Error (Form): Short Filter is a required field.

(Ref star - NIRCam - MASK430R (Obs 3)) Error (Form): Short Filter is a required field.

(Ref star - NIRCam - MASK430R (Obs 3)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.

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

(Ref star - NIRCam - MASK430R (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	HD-30562	RA: 04 48 36.3850 (72.1516042d) Dec: -05 40 26.56 (-5.67404d) Equinox: J2000	Proper Motion RA: 311.523 mas/yr Proper Motion Dec: -248.847 mas/yr Parallax: 0.0379" Epoch of Position: 2000	

Comments: PSF star for 51 Eri. This is a high proper motion star.

K=4.310
Category=Calibration
Description=[Coronagraphic]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 HD-30562	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.11

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK430R	false	SUB320A430R	5-POINT-BOX

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		F356W	SHALLOW2	4	12	5	60	1155.792	40834.12
2		F444W	SHALLOW4	6	14	5	70	2246.418	40834.13

PSF References

PSF Reference: true

Special Requirements	
	Sequence Observations 1, 2, 3, 4, 5, 6, Non-interruptible Same Aperture PA 3, 4 (V3 PAs differ)

Observation

Proposal 1412, Observation 4: Ref star - NIRCam - MASKLWB Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Error

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(Ref star - NIRCam - MASKLWB (Obs 4)) Error (Form): Short Filter is a required field.
(Ref star - NIRCam - MASKLWB (Obs 4)) Error (Form): Short Filter is a required field.
(Ref star - NIRCam - MASKLWB (Obs 4)) Error (Form): Short Filter is a required field.
(Ref star - NIRCam - MASKLWB (Obs 4)) Error (Form): Short Filter is a required field.
(Ref star - NIRCam - MASKLWB (Obs 4)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.
(Ref star - NIRCam - MASKLWB (Obs 4)) Warning (Form): The selected fiducial point is not a standard option for the instrument.
(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.
(Ref star - NIRCam - MASKLWB (Obs 4)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	HD-30562	RA: 04 48 36.3850 (72.1516042d) Dec: -05 40 26.56 (-5.67404d) Equinox: J2000	Proper Motion RA: 311.523 mas/yr Proper Motion Dec: -248.847 mas/yr Parallax: 0.0379" Epoch of Position: 2000	

Comments: PSF star for 51 Eri. This is a high proper motion star.

K=4.310
Category=Calibration
Description=[Coronagraphic]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 HD-30562	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.11

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASKLWB	false	SUB400X256ALWB	5-POINT-BAR

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		F335M	BRIGHT2	10	20	5	100	2234.264	
2		F410M	BRIGHT2	10	18	5	90	2010.838	
3		F430M	BRIGHT2	10	28	5	140	3127.97	
4		F460M	BRIGHT2	10	18	5	90	2010.838	

PSF References	PSF Reference: true
Special Requirements	Offset 0.0 arcsec, 0.069 arcsec Fiducial Point Override NRCA5_MASKLWB_NARROW Sequence Observations 1, 2, 3, 4, 5, 6, Non-interruptible Same Aperture PA 3, 4 (V3 PAs differ)

Observation

Proposal 1412, Observation 5: 51 Eri - NIRCam - Roll 2 - MASKLWB Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Error

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Error (Form): Short Filter is a required field.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Warning (Form): Science observations should be linked to at least one other compatible science observation by an Aperture PA Offset of 1-14 degrees
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Warning (Form): The order of link [PA Offset 5 from 2] combined with the order of the SEQ NON-INT reduces scheduling flexibility.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Warning (Form): The selected fiducial point is not a standard option for the instrument.
(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.
(51 Eri - NIRCam - Roll 2 - MASKLWB (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	

Comments: F star,

H=4.770, K=4.537
Category=Star
Description=[Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 51-ERI	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.5

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASKLWB	true	SUB400X256ALWB	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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		F335M	BRIGHT2	10	40	1	40	893.706	
2		F410M	BRIGHT2	10	40	1	40	893.706	
3		F430M	BRIGHT2	10	60	1	60	1340.558	
4		F460M	BRIGHT2	10	40	1	40	893.706	

PSF References

Ref star - NIRCam - MASKLWB (Obs 4) (PSF Reference; Filters [null/F335M, null/F410M, null/F430M, null/F460M])
51 Eri - NIRCam - Roll 1 - MASKLWB (Obs 2) (Filters [null/F335M, null/F410M, null/F430M, null/F460M])

Additional Justification: false

Special Requirements

Offset 0.0 arcsec, 0.069 arcsec
Fiducial Point Override NRCA5_MASKLWB_NARROW

Sequence Observations 1, 2, 3, 4, 5, 6, Non-interruptible
Aperture PA Offset 5 from 2 by -15 to -13 Degrees (Same offsets in V3)
Same Aperture PA 5, 6 (V3 PAs differ)

Observation

Proposal 1412, Observation 6: 51 Eri - NIRCam - Roll 2 - MASK430R Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Error

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(51 Eri - NIRCam - Roll 2 - MASK430R (Obs 6)) Error (Form): Short Filter is a required field.

(51 Eri - NIRCam - Roll 2 - MASK430R (Obs 6)) Error (Form): Short Filter is a required field.

(51 Eri - NIRCam - Roll 2 - MASK430R (Obs 6)) Warning (Form): Science observations should be linked to at least one other compatible science observation by an Aperture PA Offset of 1-14 degrees

(51 Eri - NIRCam - Roll 2 - MASK430R (Obs 6)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.

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

(51 Eri - NIRCam - Roll 2 - MASK430R (Obs 6)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	

Comments: F star,

H=4.770, K=4.537
Category=Star
Description=[Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 51-ERI	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.5

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK430R	true	SUB320A430R	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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		F356W	MEDIUM8	2	31	1	31	630.299	40834.6
2		F444W	DEEP8	2	41	1	41	1271.928	40834.7

PSF References	Ref star - NIRCam - MASK430R (Obs 3) (PSF Reference; Filters [null/F356W, null/F444W]) 51 Eri - NIRCam - Roll 1 - MASK430R (Obs 1) (Filters [null/F356W, null/F444W]) Additional Justification: false
Special Requirements	Sequence Observations 1, 2, 3, 4, 5, 6, Non-interruptible Aperture PA Offset 1 from 6 by -13 to -15 Degrees (Same offsets in V3) Same Aperture PA 5, 6 (V3 PAs differ)

Observation

Proposal 1412, Observation 12: 51 Eri - NIRCam - Roll 1 - MASKLWB - Retry Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Comments: Retry of Obs 2. Flight readiness of this visit should be held pending for NIRCam team to complete their planned improvements to coron TA and to astrometric knowledge of MASKLWB positions.

Test of MASKLWB_NARROW override is intentional use of an unproven mode experimentally, to obtain better inner working angle than is possible using the default positions on MASKLWB.

The PA special requirements on obs 12 and 15 is necessary to place the known planet 51 Eri b nearly orthogonal to the MASKLWB occulter, motivated by maximizing the detectability of the planet. The expected PA of the planet in October 2023 is ~ 109 deg, from orbit fits to literature and recent unpublished GRAVITY astrometry. Thus aperture PA ~289 deg would position the planet orthogonal to the bar. The PA requirements set here result in Obs 12 aperture PA ~ 294, Obs 15 aperture PA ~ 280, thus roughly balanced on either side of the optimal PA. This setup also maximizes the available roll range for delta PA, which is increased when target are near the inner edge of the field of regard; maximizing the delta roll is especially important for a companion at such small separation (0.3 arcsec).

Diagnostics

(51 Eri - NIRCam - Roll 1 - MASKLWB - Retry (Obs 12)) Warning (Form): Science observations should be linked to at least one other compatible science observation by an Aperture PA Offset of 1-14 degrees

(51 Eri - NIRCam - Roll 1 - MASKLWB - Retry (Obs 12)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.

(51 Eri - NIRCam - Roll 1 - MASKLWB - Retry (Obs 12)) Warning (Form): The order of link [PA Offset 15 from 12] combined with the order of the SEQ NON-INT reduces scheduling flexibility.

(51 Eri - NIRCam - Roll 1 - MASKLWB - Retry (Obs 12)) Warning (Form): The selected fiducial point is not a standard option for the instrument.

(Visit 12:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(51 Eri - NIRCam - Roll 1 - MASKLWB - Retry (Obs 12)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 12:1) 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)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	

Comments: F star,

H=4.770, K=4.537
Category=Star
Description=[Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 51-ERI	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.5

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASKLWB	true	SUB400X256ALWB	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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	F182M	F335M	BRIGHT2	10	40	1	40	893.706	
2	F182M	F410M	BRIGHT2	10	40	1	40	893.706	
3	F210M	F430M	BRIGHT2	10	60	1	60	1340.558	
4	F200W	F460M	BRIGHT2	10	40	1	40	893.706	

PSF References

Ref star - NIRCam - MASKLWB - Retry (Obs 14) (PSF Reference; Filters [F200W/F460M, F182M/F335M, F182M/F410M, F210M/F430M])
51 Eri - NIRCam - Roll 2 - MASKLWB - Retry (Obs 15) (Filters [F200W/F460M, F182M/F335M, F182M/F410M, F210M/F430M])

Additional Justification: false

Special Requirements

Aperture PA Range 292 to 296 Degrees (V3 291.46789991 to 295.46789991)
Offset 0.0 arcsec, -0.015 arcsec
Fiducial Point Override NRCA5_MASKLWB_NARROW

Sequence Observations 12, 14, 15, Non-interruptible
Aperture PA Offset 15 from 12 by -15 to -13 Degrees (Same offsets in V3)

Observation

Proposal 1412, Observation 14: Ref star - NIRCam - MASKLWB - Retry Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Comments: Retry of Obs 4. Flight readiness of this visit should be held pending for NIRCam team to complete their planned improvements to coron TA and to astrometric knowledge of MASKLWB positions.

See further comments on obs 12.

Diagnostics

(Ref star - NIRCam - MASKLWB - Retry (Obs 14)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.

(Ref star - NIRCam - MASKLWB - Retry (Obs 14)) Warning (Form): The selected fiducial point is not a standard option for the instrument.

(Visit 14:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	HD-30562	RA: 04 48 36.3850 (72.1516042d) Dec: -05 40 26.56 (-5.67404d) Equinox: J2000	Proper Motion RA: 311.523 mas/yr Proper Motion Dec: -248.847 mas/yr Parallax: 0.0379" Epoch of Position: 2000	

Comments: PSF star for 51 Eri. This is a high proper motion star.

K=4.310
Category=Calibration
Description=[Coronagraphic]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 HD-30562	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.11

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASKLWB	true	SUB400X256ALWB	5-POINT-BAR

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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	F182M	F335M	BRIGHT2	10	20	5	100	2234.264	
2	F182M	F410M	BRIGHT2	10	18	5	90	2010.838	
3	F210M	F430M	BRIGHT2	10	28	5	140	3127.97	
4	F200W	F460M	BRIGHT2	10	18	5	90	2010.838	

PSF References	PSF Reference: true
Special Requirements	Offset 0.0 arcsec, -0.015 arcsec Fiducial Point Override NRCA5_MASKLWB_NARROW Sequence Observations 12, 14, 15, Non-interruptible

Observation

Proposal 1412, Observation 15: 51 Eri - NIRCam - Roll 2 - MASKLWB - Retry Mon Oct 09 15:00:11 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Comments: Retry of Obs 5. Flight readiness of this visit should be held pending for NIRCam team to complete their planned improvements to coron TA and to astrometric knowledge of MASKLWB positions.

See further comments on obs 12.

Diagnostics

(51 Eri - NIRCam - Roll 2 - MASKLWB - Retry (Obs 15)) Warning (Form): Science observations should be linked to at least one other compatible science observation by an Aperture PA Offset of 1-14 degrees

(51 Eri - NIRCam - Roll 2 - MASKLWB - Retry (Obs 15)) Warning (Form): The NO PARALLEL ATTACHMENTS requirement is expected for NIRCam Coronagraphic Imaging.

(51 Eri - NIRCam - Roll 2 - MASKLWB - Retry (Obs 15)) Warning (Form): The order of link [PA Offset 15 from 12] combined with the order of the SEQ NON-INT reduces scheduling flexibility.

(51 Eri - NIRCam - Roll 2 - MASKLWB - Retry (Obs 15)) Warning (Form): The selected fiducial point is not a standard option for the instrument.

(Visit 15:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(51 Eri - NIRCam - Roll 2 - MASKLWB - Retry (Obs 15)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 15:1) 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)	51-ERI	RA: 04 37 36.1323 (69.4005513d) Dec: -02 28 24.77 (-2.47355d) Equinox: J2000	Proper Motion RA: 44.22 mas/yr Proper Motion Dec: -64.39 mas/yr Parallax: 0.03398" Epoch of Position: 2000	

Comments: F star,

H=4.770, K=4.537
Category=Star
Description=[Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 51-ERI	F335M	BRIGHT (ND Square)	BRIGHT2	65	1	1	6.574	40834.5

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASKLWB	true	SUB400X256ALWB	NONE

Confirmation

#	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time	Conf. Total Dithers
1	RAPID	4	1	1	42.947	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	F182M	F335M	BRIGHT2	10	40	1	40	893.706	
2	F182M	F410M	BRIGHT2	10	40	1	40	893.706	
3	F210M	F430M	BRIGHT2	10	60	1	60	1340.558	
4	F200W	F460M	BRIGHT2	10	40	1	40	893.706	

PSF References	Ref star - NIRCam - MASKLWB - Retry (Obs 14) (PSF Reference; Filters [F200W/F460M, F182M/F335M, F182M/F410M, F210M/F430M]) 51 Eri - NIRCam - Roll 1 - MASKLWB - Retry (Obs 12) (Filters [F200W/F460M, F182M/F335M, F182M/F410M, F210M/F430M]) Additional Justification: false
Special Requirements	Offset 0.0 arcsec, -0.015 arcsec Fiducial Point Override NRCA5_MASKLWB_NARROW Sequence Observations 12, 14, 15, Non-interruptible Aperture PA Offset 15 from 12 by -15 to -13 Degrees (Same offsets in V3)