



1902 - High resolution, high contrast kernel phase imaging with NIRCcam

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Kernel phase imaging of HIP 75056 A				
	1	SCI	NIRCcam Imaging	(1) HD-136164
	2	CAL	NIRCcam Imaging	(2) HD-135067

ABSTRACT

JWST offers excellent sensitivity, but its mirror size and therefore its angular resolution are constrained by the limited space in the Ariane V payload fairing. For this reason, super-resolution imaging is of particular interest to JWST and an aperture mask has been installed for this purpose inside the NIRISS instrument. In the past few years, kernel phase interferometry has been developed as a viable advancement to aperture masking. Kernel phase is a post-processing technique for full pupil images that achieves similar resolution than aperture masking (down to $0.5 \lambda/D$) and is particularly suitable for space-borne telescopes. Since kernel phase does not need a physical mask that blocks $\sim 85\%$ of the light to be placed in the pupil plane, it achieves higher throughput and therefore higher efficiency. Here, we propose to calibrate the kernel phase technique for the NIRCcam

instrument, since the impact of an increased angular resolution will be most powerful at the shortest wavelengths. Kernel phase interferometry will expand the parameter space accessible by JWST and give rise to high-contrast, high-resolution imaging such as the direct detection of forming giant planets or imaging of circumstellar outflows and nebulosities.

OBSERVING DESCRIPTION

Observations of a benchmark target for kernel phase post-processing analysis. The selected target is HIP 75056 A, which has a 20-30 Jupiter masses brown dwarf companion at an angular separation of ~ 125 mas.

NIRCam dual-band high-contrast imaging in the F164N+F323N, F187N+F405N, and F212N+F470N filter pairs is performed in order to obtain a broad spectral coverage. The companion will be detected at $0.8-3 \lambda/D$ (depending on the wavelength) with the kernel phase technique. This will enable us to develop the tools required for a kernel phase analysis of NIRCam data in general and to derive detection limits for this technique.

Similar observations of a PSF reference (HD 135067) will be performed. This will enable us to investigate the PSF stability of JWST and to determine the best possible calibration strategy for the kernel phase technique.

The requested total time including overheads amounts to 4.26 hours. All observations will be done with the small SUB64P subarray and RAPID readout mode in order to avoid the short wavelength detector to saturate.

As is required for calibration GO proposals, we checked with the help desk for approval (ticket #INC0161989). We were informed that no planned commissioning or calibration activities (by either the NIRCam nor NIRISS instrument teams) would acquire data similar to what we propose here, and approval was granted.

Proposal 1902 - Targets - High resolution, high contrast kernel phase imaging with NIRCam

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HD-136164	RA: 15 20 13.3645 (230.0556854d) Dec: -34 55 31.97 (-34.92555d) Equinox: J2000	Proper Motion RA: -0.0018097402430856321 sec of time/yr Proper Motion Dec: -0.026019999927484605 arcsec/yr Epoch of Position: 2015.5	
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[A stars, Brown dwarfs]				
(2)	HD-135067	RA: 15 13 56.1391 (228.4839129d) Dec: -26 03 4.22 (-26.05117d) Equinox: J2000	Proper Motion RA: -8.642009428069668E-4 sec of time/yr Proper Motion Dec: -3.420000666665146E-4 arcsec/yr Epoch of Position: 2015.5	
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Calibration Description=[Point spread function]				

Proposal 1902 - Observation 1 - High resolution, high contrast kernel phase imaging with NIRCcam

Thu Oct 21 16:00:49 GMT 2021

Observation	<p>Proposal 1902, Observation 1: SCI Diagnostic Status: Warning Observing Template: NIRCcam Imaging</p>															
	<p>(SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (SCI (Obs 1)) Warning (Form): Pointing performance insufficient (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>															
Diagnosics																
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>HD-136164</td> <td>RA: 15 20 13.3645 (230.0556854d) Dec: -34 55 31.97 (-34.92555d) Equinox: J2000</td> <td>Proper Motion RA: -0.0018097402430856321 sec of time/yr Proper Motion Dec: -0.026019999927484605 arcsec/yr Epoch of Position: 2015.5</td> <td></td> </tr> </tbody> </table>	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(1)	HD-136164	RA: 15 20 13.3645 (230.0556854d) Dec: -34 55 31.97 (-34.92555d) Equinox: J2000	Proper Motion RA: -0.0018097402430856321 sec of time/yr Proper Motion Dec: -0.026019999927484605 arcsec/yr Epoch of Position: 2015.5		<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[A stars, Brown dwarfs]</p>				
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Template	Module		Subarray													
	B		SUB64P													
Dithers																
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Proposal 1902 - Observation 1 - High resolution, high contrast kernel phase imaging with NIRCam

	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
Spectral Elements	1	F164N+F150W2	F323N+F322W2	RAPID	5	194	194	1	58.883	59639.2
	2	F164N+F150W2	F323N+F322W2	RAPID	5	194	194	1	58.883	59639.2
	3	F164N+F150W2	F323N+F322W2	RAPID	5	194	194	1	58.883	59639.2
	4	F164N+F150W2	F323N+F322W2	RAPID	5	194	194	1	58.883	59639.2
	5	F164N+F150W2	F323N+F322W2	RAPID	5	194	194	1	58.883	59639.2
	6	F164N+F150W2	F323N+F322W2	RAPID	5	194	194	1	58.883	59639.2
	7	F187N	F405N+F444W	RAPID	7	194	194	1	78.345	59639.3
	8	F187N	F405N+F444W	RAPID	7	194	194	1	78.345	59639.3
	9	F187N	F405N+F444W	RAPID	7	194	194	1	78.345	59639.3
	10	F187N	F405N+F444W	RAPID	7	194	194	1	78.345	59639.3
	11	F187N	F405N+F444W	RAPID	7	194	194	1	78.345	59639.3
	12	F187N	F405N+F444W	RAPID	7	194	194	1	78.345	59639.3
	13	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	14	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	15	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	16	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	17	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	18	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	19	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	20	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	21	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
	22	F212N	F470N+F444W	RAPID	9	191	191	1	96.295	59639.4
Special Requirements	Before Date 01-MAY-2023:00:00:00									
	Group Observations 1, 2, Non-interruptible									

Proposal 1902 - Observation 2 - High resolution, high contrast kernel phase imaging with NIRCam

Special Requirements

Before Date 01-MAY-2023:00:00:00

Group Observations 1, 2, Non-interruptible