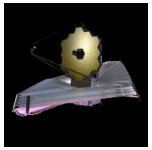

4090 - Follow the trace: Direct detection of a dynamically ejected young planet outside a circumbinary disk

Cycle: 2, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	Science target observation roll 1	NIRCam Coronagraphic Imaging	(1) V-DG-CRA
	2	Science target observation roll 2	NIRCam Coronagraphic Imaging	(1) V-DG-CRA

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	3	Reference Star	NIRCam Coronagraphic Imaging	(3) UCAC4_267-178509

ABSTRACT

Stellar multiple systems offer some of the most challenging environments for planet formation. Tidal interaction of stellar binaries with the planet-forming disks can lead to truncation, formation of cavities, warps and spirals. Dynamic interaction with forming planets can lead to their ejection from the system. Possibly explaining the population of free floating planets or (some) of the gas giants directly imaged at wide orbital separations. Recent observations of a young nearby binary system have revealed a unique opportunity to directly observe this process in action. A newly detected circumbinary disk in the system shows a clear signature of the recent ejection of a planet. Using the superior sensitivity of JWST and NIRCam from space we now propose to directly detect this planet. This will not only give us a unique laboratory to study dynamic star-planet-disk interaction but also will enable future studies of the atmosphere of a planet otherwise inaccessible to direct observations.

OBSERVING DESCRIPTION

In this program we aim to detect a young planet that was recently dynamically ejected from the inner parts of the DG CrA binary system. DG CrA is surrounded by a circumbinary disk, detected in near infrared scattered light. In these existing observations a radial tail-like feature is present crossing the circumbinary disk that is consistent with hydrodynamic models of ejected planets.
The putative planet should be a gas-giant with a current angular separation from the inner stellar binary of more than 2 arcsec.

We are proposing NIRCam coronagraphic observations with the F444W filter in the primary channel and the MASK335R coronagraph. We will execute two observations of the science target with the DEEP8 readout pattern at two different orientations of the telescope to enable angular differential imaging for increased contrast. Additionally we will observe one reference star for reference differential imaging. We will be sensitive to young planets down to 2 Saturn masses with this strategy. The total amount of time charged will be 4.6h.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-DG-CRA	RA: 19 01 55.2526 (285.4802192d) Dec: -37 23 41.23 (-37.39479d) Equinox: J2000	Proper Motion RA: 5.329339785670863E-4 sec of time/yr Proper Motion Dec: -0.024627999914628163 arcsec/yr Parallax: 0.00662" Epoch of Position: 2015.5	
Comments: This is the science target of this proposal. DG CrA is a close (240 mas separation) multiple system with a primary of spectral type K5 and an early M companion. H-band magnitudes are 9.9 for the primary star and 11.9 for the companion. The system is surrounded by a circumbinary disk extending out to ~1 arcsec. The disk is visible in near infrared scattered light from the ground but is significantly fainter than the central stars. *Category=Star* *Description=[Circumstellar disks, Exoplanet Systems, Multiple stars, T Tauri stars]* *Extended=NO*				
(2)	CD-36-13007	RA: 18 48 0.9025 (282.0037604d) Dec: -36 24 52.72 (-36.41464d) Equinox: J2000	Proper Motion RA: -0.028297430309663883 sec of time/yr Proper Motion Dec: -0.3095690000918694 arcsec/yr Epoch of Position: 2015.5	
Comments: This is the PSF reference star for our science observation. Based on the Gaia data base this should be a single star. *Category=Calibration* *Description=[Coronagraphic, Point spread function]* *Extended=NO*				
(3)	UCAC4_267-178509	RA: 19 07 12.4057 (286.8016904d) Dec: -36 45 19.42 (-36.75539d) Equinox: J2000	Proper Motion RA: 2.066 mas/yr Proper Motion Dec: -8.977 mas/yr Epoch of Position: 2015.5	
Comments: This is the PSF reference star for our science observation. Based on our VLT/SPHERE vetting there should be no bright contaminants in the field. *Category=Calibration* *Description=[Coronagraphic, Point spread function]* *Extended=NO*				

Observation

Proposal 4090, Observation 1: Science target observation roll 1

Fri Mar 08 18:00:20 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

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

(Science target observation roll 1 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-DG-CRA	RA: 19 01 55.2526 (285.4802192d) Dec: -37 23 41.23 (-37.39479d) Equinox: J2000	Proper Motion RA: 5.329339785670863E-4 sec of time/yr Proper Motion Dec: -0.024627999914628163 arcsec/yr Parallax: 0.00662" Epoch of Position: 2015.5	

Comments: This is the science target of this proposal. DG CrA is a close (240 mas separation) multiple system with a primary of spectral type K5 and an early M companion. H-band magnitudes are 9.9 for the primary star and 11.9 for the companion. The system is surrounded by a circumbinary disk extending out to ~1 arcsec. The disk is visible in near infrared scattered light from the ground but is significantly fainter than the central stars.
Category=Star
Description=[Circumstellar disks, Exoplanet Systems, Multiple stars, T Tauri stars]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 V-DG-CRA	F335M	FAINT	RAPID	33	1	1	1.708	144779.3

Template

Module	Coronagraphic 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	2	2	75.157	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	F200W	F444W	DEEP8	10	11	1	11	2222.759	

PSF References	Reference Star (Obs 3) (PSF Reference; Filters [F200W/F444W]) Science target observation roll 2 (Obs 2) (Filters [F200W/F444W]) Additional Justification: false
Special Requirements	No Parallel Attachments Sequence Observations 1, 2, 3, Non-interruptible Aperture PA Offset 2 from 1 by 9 to 14 Degrees (Same offsets in V3)

Observation

Proposal 4090, Observation 2: Science target observation roll 2

Fri Mar 08 18:00:20 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

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

(Science target observation roll 2 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-DG-CRA	RA: 19 01 55.2526 (285.4802192d) Dec: -37 23 41.23 (-37.39479d) Equinox: J2000	Proper Motion RA: 5.329339785670863E-4 sec of time/yr Proper Motion Dec: -0.024627999914628163 arcsec/yr Parallax: 0.00662" Epoch of Position: 2015.5	

Comments: This is the science target of this proposal. DG CrA is a close (240 mas separation) multiple system with a primary of spectral type K5 and an early M companion. H-band magnitudes are 9.9 for the primary star and 11.9 for the companion. The system is surrounded by a circumbinary disk extending out to ~1 arcsec. The disk is visible in near infrared scattered light from the ground but is significantly fainter than the central stars.
Category=Star
Description=[Circumstellar disks, Exoplanet Systems, Multiple stars, T Tauri stars]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 V-DG-CRA	F335M	FAINT	RAPID	33	1	1	1.708	144779.3

Template

Module	Coronagraphic 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	2	2	75.157	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	F200W	F444W	DEEP8	10	11	1	11	2222.759	

PSF References	Reference Star (Obs 3) (PSF Reference; Filters [F200W/F444W]) Science target observation roll 1 (Obs 1) (Filters [F200W/F444W]) Additional Justification: false
Special Requirements	No Parallel Attachments Sequence Observations 1, 2, 3, Non-interruptible Aperture PA Offset 2 from 1 by 9 to 14 Degrees (Same offsets in V3)

Observation

Proposal 4090, Observation 3: Reference Star

Fri Mar 08 18:00:20 GMT 2024

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
(3)	UCAC4_267-178509	RA: 19 07 12.4057 (286.8016904d)	Proper Motion RA: 2.066 mas/yr	
		Dec: -36 45 19.42 (-36.75539d)	Proper Motion Dec: -8.977 mas/yr	
		Equinox: J2000	Epoch of Position: 2015.5	

Comments: This is the PSF reference star for our science observation. Based on our VLT/SPHERE vetting there should be no bright contaminants in the field.
Category=Calibration
Description=[Coronagraphic, Point spread function]
Extended=NO

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	3 UCAC4_267-178509	F335M	FAINT	RAPID	9	1	1	0.504	144779.3

Template

Module	Coronagraphic 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	F200W	F444W	DEEP8	10	1	9	9	1818.621	

PSF References

PSF Reference: true

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