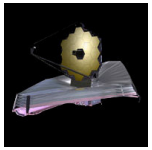

5816 - Lifting the Veil: A Direct Measure of Dust Properties and Extinction in a Planet Opened Gap

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
First visit				
	3	Ref coro	NIRCam Coronagraphic Imaging	(4) HD-153135
	1	Roll 1 coro	NIRCam Coronagraphic Imaging	(5) EM-AS-209
	2	Roll 2 coro	NIRCam Coronagraphic Imaging	(5) EM-AS-209
	4	Roll 1 imaging	NIRCam Imaging	(5) EM-AS-209
	5	Roll 2 imaging	NIRCam Imaging	(5) EM-AS-209

ABSTRACT

In the complex realm of protoplanetary disks, our understanding of dust properties and their evolution during planet formation stages remains highly uncertain, primarily due to the lack of empirical constraints. To enhance our ability to observe and characterize the dust properties in protoplanetary disks, we propose a pioneering study employing the cutting-edge capabilities of the JWST/NIRCam instrument. This program leverages the unique opportunity arisen from the serendipitous detection of a background star aligned with the outer gap of the AS209 disk traced by ALMA CO and IR scattered light observations, where at least one protoplanet is suspected to be forming. The proposed multi-band observations will provide the photometric SED of the extincted star over a wide wavelength range. This unique setting will enable us to accomplish two critical objectives. Firstly, we will empirically determine the properties of dust grains in a protoplanetary disk gap, shedding light on their characteristics and composition. These information will provide valuable constraints to understand dust evolution processes. Secondly, we aim to measure the extinction within the planet-forming gap for the first time, a crucial information to interpret direct imaging searches of embedded protoplanets.

OBSERVING DESCRIPTION

This program aims at characterizing a background star shining through the CO and scattered light gap of the outer AS209 disk. The faint source is located 1.4 arcsec from the star. We will observe in coronagraphic mode with F182M, F210M, F300M and F335M. We will perform PFS subtraction using a combination of ADI and RDI. Hence, we will observe the target with two spacecraft roll angles and in addition we will observe a reference star.

In addition, we will obtain the photometry of the background star (or detection limits) in four more filters: F070W, F090W, F115W and F250M. Here to perform PSF subtraction we will only deploy ADI and thus for each filter we will observe with tow roll angles.

It is essential that all the photometries are obtained during the same visit, as delays cause the background object to shine through different regions of the disk gap. Hence, we set the entire visit (Obs3+Obs1+Obs2+Obs4+Obs5) to non-interruptible.

We have optimized the sequence in order to reduce slewing times: we plan to first observe the coronagraphic reference (2 couples of filters, 2 rolls), and then move to AS209 in coronagraphic mode (2 couples of filters, 2 rolls) and finally stay on AS209 and perform the non-coronagraphic observations (3 couples of filters, 2 rolls).

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	HD-153135	RA: 16 58 9.5093 (254.5396221d) Dec: -14 22 20.88 (-14.37247d) Equinox: J2000	Proper Motion RA: -5.266 mas/yr Proper Motion Dec: -1.3519999583877507 mas/yr Parallax: 0.0058196" 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]

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	EM-AS-209	RA: 16 49 15.3035 (252.3137646d) Dec: -14 22 8.64 (-14.36907d) Equinox: J2000	Proper Motion RA: -7.365999999999999 mas/yr Proper Motion Dec: -23.65800007737562 mas/yr Parallax: 0.0082477" 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, Protoplanetary disks]

Observation

Proposal 5816, Observation 3: Ref coro

Thu Jul 18 23:00:10 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
(4)	HD-153135	RA: 16 58 9.5093 (254.5396221d) Dec: -14 22 20.88 (-14.37247d) Equinox: J2000	Proper Motion RA: -5.266 mas/yr Proper Motion Dec: -1.3519999583877507 mas/yr Parallax: 0.0058196" 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	SAME	F335M	BRIGHT (ND Square)	MEDIUM8	17	1	1	8.48	174035.12

Template

Module	Coronagraphic Mask	Obtain Astrometric Confirmation Images?	Subarray	Dither Pattern
A	MASK335R	false	SUB320A335R	5-POINT-DIAMOND

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	F300M	MEDIUM2	7	3	5	15	1010.55	
2	F210M	F335M	MEDIUM2	7	3	5	15	1010.55	

PSF References

PSF Reference: true

Special Requirements	
	Offset -0.006 arcsec, -0.012 arcsec Group Observations 1, 2, 3, 4, 5, Non-interruptible

Observation

Proposal 5816, Observation 1: Roll 1 coro Thu Jul 18 23:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(Roll 1 coro (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 coro (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	EM-AS-209	RA: 16 49 15.3035 (252.3137646d) Dec: -14 22 8.64 (-14.36907d) Equinox: J2000	Proper Motion RA: -7.365999999999999 mas/yr Proper Motion Dec: -23.65800007737562 mas/yr Parallax: 0.0082477" 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, Protoplanetary disks]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F335M	BRIGHT (ND Square)	DEEP2	65	1	1	64.358	174035.11

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	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	F182M	F300M	DEEP8	19	5	1	5	1972.481	
2	F210M	F335M	DEEP8	19	5	1	5	1972.481	

PSF References	Ref coro (Obs 3) (PSF Reference; Filters [F182M/F300M, F210M/F335M]) Additional Justification: false
Special Requirements	Offset -0.006 arcsec, -0.012 arcsec No Parallel Attachments Group Observations 1, 2, 3, 4, 5, Non-interruptible Aperture PA Offset 1 from 2 by 10 to 14 Degrees (Same offsets in V3)

Observation

Proposal 5816, Observation 2: Roll 2 coro Thu Jul 18 23:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Coronagraphic Imaging

Diagnostics

(Roll 2 coro (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 coro (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	EM-AS-209	RA: 16 49 15.3035 (252.3137646d) Dec: -14 22 8.64 (-14.36907d) Equinox: J2000	Proper Motion RA: -7.365999999999999 mas/yr Proper Motion Dec: -23.65800007737562 mas/yr Parallax: 0.0082477" 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, Protoplanetary disks]

Acquisition

#	Target	Filter	Target Brightness	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F335M	BRIGHT (ND Square)	DEEP2	65	1	1	64.358	174035.11

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	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	F182M	F300M	DEEP8	19	5	1	5	1972.481	
2	F210M	F335M	DEEP8	19	5	1	5	1972.481	

PSF References	Ref coro (Obs 3) (PSF Reference; Filters [F182M/F300M, F210M/F335M]) Additional Justification: false
Special Requirements	Offset -0.006 arcsec, -0.012 arcsec No Parallel Attachments Group Observations 1, 2, 3, 4, 5, Non-interruptible Aperture PA Offset 1 from 2 by 10 to 14 Degrees (Same offsets in V3)

Observation

Proposal 5816, Observation 4: Roll 1 imaging Thu Jul 18 23:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Roll 1 imaging (Obs 4)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	EM-AS-209	RA: 16 49 15.3035 (252.3137646d) Dec: -14 22 8.64 (-14.36907d) Equinox: J2000	Proper Motion RA: -7.365999999999999 mas/yr Proper Motion Dec: -23.65800007737562 mas/yr Parallax: 0.0082477" 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, Protoplanetary disks]

Template

Module	Subarray
B	SUB320

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	SUBARRAY_DITHER	4	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F070W	F405N+F444W	RAPID	10	30	120	4	1413.59	
2	F090W	F323N+F322W2	RAPID	10	30	120	4	1413.59	
3	F115W	F250M	RAPID	10	40	160	4	1884.787	

Special Requirements

Group Observations 1, 2, 3, 4, 5, Non-interruptible
Aperture PA Offset 5 from 4 by 10 to 14 Degrees (Same offsets in V3)

Observation

Proposal 5816, Observation 5: Roll 2 imaging Thu Jul 18 23:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Roll 2 imaging (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	EM-AS-209	RA: 16 49 15.3035 (252.3137646d) Dec: -14 22 8.64 (-14.36907d) Equinox: J2000	Proper Motion RA: -7.365999999999999 mas/yr Proper Motion Dec: -23.65800007737562 mas/yr Parallax: 0.0082477" 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, Protoplanetary disks]

Template

Module	Subarray
B	SUB320

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	SUBARRAY_DITHER	4	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F070W	F405N+F444W	RAPID	10	30	120	4	1413.59	
2	F090W	F323N+F322W2	RAPID	10	30	120	4	1413.59	
3	F115W	F250M	RAPID	10	40	160	4	1884.787	

Special Requirements

Group Observations 1, 2, 3, 4, 5, Non-interruptible
Aperture PA Offset 5 from 4 by 10 to 14 Degrees (Same offsets in V3)