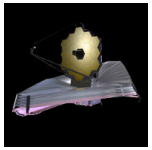

9079 - JWST/NIRCam multi-color monitoring of a rare catastrophic collision directly imaged in a nearby planetary system

Cycle: 4, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Paul George Kalas (PI)	**University of California - Berkeley**
Dr. Maxwell Andrew Millar-Blanchaer (CoI)	University of California - Santa Barbara
Dr. Jason J. Wang (CoI)	Northwestern University
Dr. Robert J De Rosa (CoI) (ESA Member)	European Southern Observatory - Chile
Dr. Bin Ren (CoI) (ESA Member)	Observatoire de la Cote d'Azur
Dr. Michael P. Fitzgerald (CoI)	University of California - Los Angeles
Dr. Grant Kennedy (CoI) (ESA Member)	University of Warwick
Prof. Mark Wyatt (CoI) (ESA Member)	University of Cambridge
Dr. Thomas M. Esposito (CoI)	University of California - Berkeley

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRCam Imaging	(1) -alf-PsA
	2		NIRCam Imaging	(1) -alf-PsA
	3		NIRCam Imaging	(1) -alf-PsA
	4		NIRCam Imaging	(1) -alf-PsA
	5		NIRCam Imaging	(1) -alf-PsA
	6		NIRCam Imaging	(1) -alf-PsA
	7		NIRCam Imaging	(1) -alf-PsA
	8		NIRCam Imaging	(1) -alf-PsA

ABSTRACT

A fundamental process in the evolution of planetary systems involves constructive and destructive collisions. These are rarely observed in real time except in the solar system. For extrasolar planetary systems, debris disks represent destructive collisions among planetesimals. In the Fomalhaut system, the HST-detected source known as Fomalhaut b has been interpreted as a direct imaging observation of a fresh dust cloud produced in 2004 by a rare catastrophic planetesimal collision. Various studies examined its dimming over time, changes in morphology, and radial acceleration. Here we show that a new source similar to Fomalhaut b has appeared near the dust belt in recent HST/STIS data. If the catastrophic collision model is correct, Fomalhaut “b2” is predicted to expand in size due to radiation pressure and Keplerian shear, become fainter, and follow a trajectory that initially appears Keplerian and evolves to radial. It is unknown if b2 represents a collision between refractory asteroids or icy bodies. Here we propose a multi-cycle NIRCam campaign to measure changes in b2's brightness, color, position, and morphology over the next three years. Since b2 is very faint and HST/STIS does not have filters, JWST is the only observatory capable of tracking the evolution of b2 in real time with a suite of filters that are diagnostic of spectral features seen in asteroids and icy Kuiper Belt objects. The findings will provide exceptionally rare empirical data to inform the theory of collisional processes. Studying b2 will also serve as invaluable preparation for the HWO mission that will need to distinguish between compact transient dust clouds and authentic planetary signals.

OBSERVING DESCRIPTION

The goal is to image a faint point source Fom b2 13"at PA=311 relative to the bright star Fomalhaut. To avoid saturation and the need to use coronagraphy which reduces the throughput, we will offset the NIRCam field so that the star lies 2"-4" outside the field of view. The PSF halo and diffraction spikes still interfere with high-contrast imaging on the detector and we will roll the telescope by 2.3 - 9 degrees (depending on schduling feasibility) for each of the filters used for imaging. A PA contraint is needed to prevent diffraction spikes from falling on Fom b2. To achieve our scientific goals of comparing the colors of Fom b2 to solar system asteroids and icy Kuiper Belt objects, we select dual-band imaging in the F090W, F140M, F182M, and F210M filters in the SW channel and F300M and F360M in the LW channel.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d)	Proper Motion RA: 328.95 mas/yr	
		Dec: -29 37 20.05 (-29.62224d)	Proper Motion Dec: -164.67000000375265 mas/yr	
		Equinox: J2000	Parallax: 0.12981"	
			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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Observation

Proposal 9079, Observation 1

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F210M	F300M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Aperture PA Range 265 to 266 Degrees (V3 264.94737309 to 265.94737309)
Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 2 from 1 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 2

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F210M	F300M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 2 from 1 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 3

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 3) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 3:1) 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F182M	F360M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Aperture PA Range 265 to 266 Degrees (V3 264.94737309 to 265.94737309)
Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 4 from 3 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 4

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 4) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 4:1) 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F182M	F360M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 4 from 3 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 5

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 5) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 5:1) 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F140M	F300M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Aperture PA Range 265 to 266 Degrees (V3 264.94737309 to 265.94737309)
Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 6 from 5 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 6

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

(Observation 6) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 6:1) 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F140M	F300M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 6 from 5 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 7

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Observation 7) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 7:1) 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F360M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Aperture PA Range 265 to 266 Degrees (V3 264.94737309 to 265.94737309)
Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 8 from 7 by 6 to 8 Degrees (Same offsets in V3)

Observation

Proposal 9079, Observation 8

Tue Jun 24 16:00:21 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Observation 8) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 8:1) 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)	-alf-PsA	RA: 22 57 39.0463 (344.4126929d) Dec: -29 37 20.05 (-29.62224d) Equinox: J2000	Proper Motion RA: 328.95 mas/yr Proper Motion Dec: -164.67000000375265 mas/yr Parallax: 0.12981" 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=[A stars, Circumstellar disks, Circumstellar dust, Exoplanet Systems, Exoplanets]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F360M	SHALLOW4	10	1	5	5	2630.509	

Special Requirements

Offset 69.0 arcsec, 0.0 arcsec

Group Observations 1, 2, 3, 4, 5, 6, 7, 8, Non-interruptible
Aperture PA Offset 8 from 7 by 6 to 8 Degrees (Same offsets in V3)