



## 9239 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST

### MIRI and NIRCAM

Cycle: 3, Proposal Category: DD

#### INVESTIGATORS

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#### OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
March 2025				
	1		MIRI Imaging	(1) 2024YR4
	2		NIRCam Imaging	(1) 2024YR4

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
March 2025-repeat				
	5		MIRI Imaging	(1) 2024YR4
	6		MIRI Imaging	(1) 2024YR4
	7		NIRCam Imaging	(1) 2024YR4
	8		NIRCam Imaging	(1) 2024YR4
May 2025				
	3		NIRCam Imaging	(1) 2024YR4
	4		MIRI Imaging	(1) 2024YR4

## ABSTRACT

The asteroid 2024 YR4 was discovered on 25 December 2024, and at this writing has a ~1% chance of impacting the Earth on 22 December 2032. 2024 YR4 enters the JWST observing window in March 2025 and MIRI observations will enable the only size measurements that will be possible until 2028. The availability of sooner accurate and high-quality size measurement, only possible using JWST MIRI in Spring 2025, will be essential for narrowing the range of possible outcomes and allowing effective planning for reconnaissance or impact-prevention missions with arrivals in 2028, and/or preparations for civil defense approaches in the event of a 2032 impact of YR4. The goals of the observations are to determine the size of 2024 YR4 and thus the magnitude of the threat it poses to the Earth, and to provide additional positional measurements to improve the quality of 2024 YR4’s orbit after it is no longer observable from Earthbased facilities. The proposed JWST observations of YR4’s size will be crucial for developing effective mitigation strategies if needed.

We ask for a very modest amount of time in order to make mid-IR and near-IR photometric and astrometric measurements of YR4, which can be analyzed using multiple thermal models to provide a robust estimate of size. This, in turn, will be used by NASA, ESA, and other space agencies to assess options most efficiently.

## OBSERVING DESCRIPTION

We request MIRI imaging in March with 3 filters: F1280W, F1130W, and F1500W. We will cycle through the latter two filters with the F1280W filter in-between each other filter observation. We propose using roughly 20-minute exposures, which average over YR4’s entire rotation period (and allows measurements up the ramp to potentially allow rotationally-resolved studies of thermal properties). Five exposures of 20 minutes totals 100 minutes not including overhead. We also propose 20 minutes of integration using NIRCAM with the F150W2 and F322W2 filters to allow better thermal modeling and for use to augment ground-based astrometric efforts. With the additional 20 minutes, the March 2025 request is for two hours

JWST Proposal 9239 (Created: Wednesday, April 2, 2025, 12:00:29PM Eastern Standard Time) - Overview of integrtions.

We also request 20 minutes of NIRCAM time in May 2025 using the same filters as above, for purposes of obtaining astrometric data.

In total, 6.3 hours are requested when overhead is included.

Proposal 9239 - Targets - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Solar System Targets	#	Name	Level 1	Level 2	Level 3
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 .O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB		
	<i>Comments: Extended=NO</i>				

Proposal 9239 - Observation 1 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	<b>Proposal 9239, Observation 1</b> <b>Diagnostic Status: Warning</b> Observing Template: MIRI Imaging										
	(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.										
<b>Diagnostics</b>											
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>			<b>Level 2</b>			<b>Level 3</b>		
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 ,O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB  <i>Comments: Extended=NO</i>								
<b>Template</b>	Subarray										
	FULL										
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>	<b>Starting Point</b>	<b>Number of Points</b>	<b>Points</b>	<b>Starting Set</b>	<b>Number of Sets</b>	<b>Optimized For</b>	<b>Direction</b>	<b>Pattern Size</b>	
	1	CYCLING	1	4		1	1			LARGE	
<b>Spectral Elements</b>	<b>#</b>	<b>Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Exposures/Dith</b>	<b>Dither</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	F1280W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	2	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	3	F1500W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	4	F1280W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	5	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	6	F1500W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
<b>Special Requirements</b>	Between Dates 01-MAR-2025:00:00:00 and 24-MAR-2025:00:00:00  Group Observations 1, 2, Non-interruptible  DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075										

Proposal 9239 - Observation 2 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	<p>Proposal 9239, Observation 2</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCAM Imaging</p>									
<b>Diagnostics</b>	<p>(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> <p>(Observation 2) Informational (Form): The Visit Planner and Spike may produce different schedulability results.</p>									
<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3					
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 .O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB							
	<i>Comments: Extended=NO</i>									
<b>Template</b>	Module				Subarray					
	B				FULL					
<b>Dithers</b>	#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions				
	1	INTRAMODULE	4	STANDARD		1				
<b>Spectral Elements</b>	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F150W2	F322W2	RAPID	10	3	12	4	1374.307	
<b>Special Requirements</b>	<p>Offset 40.0 arcsec, 40.0 arcsec</p> <p>Group Observations 1, 2, Non-interruptible</p> <p>DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075</p>									

Proposal 9239 - Observation 5 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	Proposal 9239, Observation 5 Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(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.										
<b>Solar System Targets</b>	#	Name	Level 1			Level 2			Level 3		
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 ,O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB  Comments: Extended=NO								
<b>Template</b>	Subarray										
	FULL										
<b>Dithers</b>	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	CYCLING	1	4		1	1			LARGE	
<b>Spectral Elements</b>	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F1280W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	2	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	3	F1500W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
<b>Special Requirements</b>	Between Dates 01-MAR-2025:00:00:00 and 31-MAR-2025:00:00:00										
	Sequence Observations 5, 6, 7, 8, Non-interruptible										
	DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075										

Proposal 9239 - Observation 6 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	Proposal 9239, Observation 6 Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(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.										
<b>Solar System Targets</b>	#	Name	Level 1			Level 2			Level 3		
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 ,O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB  Comments: Extended=NO								
<b>Template</b>	Subarray										
	FULL										
<b>Dithers</b>	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	CYCLING	1	4		1	1			LARGE	
<b>Spectral Elements</b>	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F1280W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	2	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	3	F1500W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
<b>Special Requirements</b>	Between Dates 01-MAR-2025:00:00:00 and 31-MAR-2025:00:00:00										
	Sequence Observations 5, 6, 7, 8, Non-interruptible										
	DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075										

Proposal 9239 - Observation 7 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	Proposal 9239, Observation 7 Diagnostic Status: Warning Observing Template: NIRCAM Imaging									
<b>Diagnostics</b>	(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.									
<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3					
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 .O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB			Comments: Extended=NO				
<b>Template</b>	Module			Subarray						
	B			FULL						
<b>Dithers</b>	#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions				
	1	INTRAMODULE	4	STANDARD		1				
<b>Spectral Elements</b>	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F150W2	F322W2	RAPID	5	3	12	4	730.1	
<b>Special Requirements</b>	Offset 40.0 arcsec, 40.0 arcsec Sequence Observations 5, 6, 7, 8, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075									

Proposal 9239 - Observation 8 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	Proposal 9239, Observation 8 Diagnostic Status: Warning Observing Template: NIRCAM Imaging									
	(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.									
<b>Diagnosics</b>										
<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3					
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 .O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB				Comments: Extended=NO			
<b>Template</b>	Module				Subarray					
	B				FULL					
<b>Dithers</b>	#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions				
	1	INTRAMODULE	4	STANDARD		1				
<b>Spectral Elements</b>	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F150W2	F322W2	RAPID	5	3	12	4	730.1	
<b>Special Requirements</b>	Offset 40.0 arcsec, 40.0 arcsec Sequence Observations 5, 6, 7, 8, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075									

Proposal 9239 - Observation 3 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	Proposal 9239, Observation 3 Diagnostic Status: Warning Observing Template: NIRCAM Imaging									
	(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.									
<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3					
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 .O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB  <i>Comments: Extended=NO</i>							
<b>Template</b>	Module				Subarray					
	B				FULL					
<b>Dithers</b>	#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions				
	1	INTRAMODULEBOX	4	STANDARD		1				
<b>Spectral Elements</b>	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	F150W2	F322W2	RAPID	10	3	12	4	1374.307	
<b>Special Requirements</b>	Between Dates 20-APR-2025:00:00:00 and 20-MAY-2025:00:00:00 Offset 40.0 arcsec, 40.0 arcsec  Group Observations 3, 4, Non-interruptible  DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075									

Proposal 9239 - Observation 4 - Size Measurements of a Potential Earth-Impacting Asteroid with JWST MIRI and NIRCAM

Wed Apr 02 17:00:29 GMT 2025

<b>Observation</b>	Proposal 9239, Observation 4 Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(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.										
<b>Diagnosics</b>											
<b>Solar System Targets</b>	#	Name	Level 1			Level 2			Level 3		
	(1)	2024YR4	TYPE=ASTEROID,A=2.516631822852012,E=0.6616 47033157221,I=3.408453660757707 ,O=271.3686665171037,W=134.3636107857152,M=1 2.48557354340625,EQUINOX=J2000,EPOCH=12- JAN-2025:00:00:00,EpochTimeScale=TDB  Comments: Extended=NO								
<b>Template</b>	Subarray										
	FULL										
<b>Dithers</b>	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	CYCLING	1	4		1	1			LARGE	
<b>Spectral Elements</b>	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	2	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
	3	F1000W	FASTR1	27	4	1	Dither 1	4	16	1232.118	
<b>Special Requirements</b>	Between Dates 20-APR-2025:00:00:00 and 20-MAY-2025:00:00:00  Group Observations 3, 4, Non-interruptible  DEFAULT WINDOW: ANGULAR RATE 2024YR4 FROM JWST LESS THAN 0.075										