



## 7996 - ToO Observations of Stellar Occultations by TNO Ring Systems

Cycle: 4, 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>
Observation Folder				
	1	Haumea Occultation Example	NIRCam Time Series	(1) GenericOccultedStar
	2	Quaoar Occultation	NIRCam Time Series	(2) OccultedStar_Quaoar

### ABSTRACT

In recent years, ring systems have been discovered around trans-Neptunian objects (TNOs) and dwarf planets Haumea and Quaoar. These ring systems were discovered during stellar occultations, when the target passes in front of a distant background star. Rings around small bodies are mysterious and subject to intense study and debate in the small body community. Currently, no consensus has been reached regarding the formation, evolution, and stability of these rings system. To enable further study of these enigmatic ring systems, we propose a 6 hour target-of-opportunity (ToO) program to observe stellar occultations by Quaoar and Haumea. We request two activations, one each for Haumea and Quaoar, totalling 6 charged hours. We estimate the probability of activation is 22% and 78% for Haumea and Quaoar, respectively. Given the low activation probability (esp. for Haumea), we request carry-over status, allowing lifetime activation probabilities of 40% and 95% for Haumea and Quaoar. Our observations will allow us to (1) complete a census of the ring systems, (2) search for spatial and temporal variability within each ring system, and (3) examine the material properties of the rings using NIRCam's multi-channel observing capabilities. JWST's aperture, ultra-fast readout, and multi-channel

observing make JWST the premier facility to observe stellar occultations of dwarf planet rings. Understanding dwarf planet rings opens up various avenues of research with broad interest across the astronomy and planetary science communities, as well as the public at large.

### **OBSERVING DESCRIPTION**

The requested observations are target of opportunity (ToO) observations of stellar occultations by Quaoar and Haumea. Stellar occultations can be predicted ~6 weeks out from candidate events, requiring the use of ToO observations. Each activation will be observations of an occultation using NIRCam time series imaging. Although exact instrument set up depends on the event details, observations will be high cadence, using NIRCam's smallest subarray (SUB64P) in RAPID readout mode. We aim for SNR ~ 50 on the occulted star in the SWC. We aim to choose the shortest wavelength filter possible while still achieving high imaging cadence.

Observations should last around 40 minutes total, allowing us to observe the drops in flux caused by the rings occulting the star. Observations should start ~20 minutes before the predicted event midtime. The event midtime should be accurate to within ~20 seconds.

Proposal 7996 - Targets - ToO Observations of Stellar Occultations by TNO Ring Systems

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(2)	OccultedStar_Quaoar	RA: 18 36 43.8405 (279.1826688d) Dec: -15 09 44.56 (-15.16238d) Equinox: J2000	Proper Motion RA: -4.043 mas/yr Proper Motion Dec: -9.346 mas/yr Parallax: 0.0005306" Epoch of Position: 2016.0	
Generic Targets	#	Name	Criteria	Description	
	(1)	GenericOccultedStar	ToO will be activated when an event allowing SNR ~ 50 with a occultation probability of >95% is predicted.		

# Proposal 7996 - Observation 1 - ToO Observations of Stellar Occultations by TNO Ring Systems

Mon Aug 25 21:00:08 GMT 2025

<b>Observation</b>	<p><b>Proposal 7996, Observation 1: Haumea Occultation Example</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCcam Time Series</p>											
<b>Diagnostics</b>	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Generic Targets</b>	<b>#</b>	<b>Name</b>	<b>Criteria</b>					<b>Description</b>				
	(1)	GenericOccultedStar	ToO will be activated when an event allowing SNR ~ 50 with a occultation probability of >95% is predicted.									
<b>Acquisition</b>	<b>#</b>										<b>Target</b>	
	1										NONE	
<b>Template</b>	<b>Module</b>						<b>Subarray</b>					
	B						SUB64P					
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Short Filter</b>	<b>Long Pupil</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Exposures/Dith</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	CLEAR	F070W	CLEAR	F322W2	RAPID	3	16000	1	16000	3251.2	
<b>Special Requirements</b>	<p>Time Series Observation</p> <p>No Parallel Attachments</p> <p>Target Of Opportunity Response Time 21 Days, Carry-Over</p> <p>DEFAULT WINDOW: ANGULAR RATE HAUMEA FROM JWST LESS THAN 0.075</p>											

Proposal 7996 - Observation 2 - ToO Observations of Stellar Occultations by TNO Ring Systems

Mon Aug 25 21:00:09 GMT 2025

<b>Observation</b>	<p><b>Proposal 7996, Observation 2: Quaoar Occultation</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCcam Time Series</p>											
<b>Diagnostics</b>	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(2)	OccultedStar_Quaoar	RA: 18 36 43.8405 (279.1826688d) Dec: -15 09 44.56 (-15.16238d) Equinox: J2000			Proper Motion RA: -4.043 mas/yr Proper Motion Dec: -9.346 mas/yr Parallax: 0.0005306" Epoch of Position: 2016.0						
	<i>Comments:</i> Category=Star Description=[A stars] Extended=NO											
<b>Acquisition</b>	<b>#</b>										<b>Target</b>	
	1										NONE	
<b>Template</b>	<b>Module</b>					<b>Subarray</b>						
	B					SUB64P						
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Short Filter</b>	<b>Long Pupil</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Exposures/Dith</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	CLEAR	F150W2	CLEAR	F322W2	RAPID	9	6492	1	6492	3273.007	
<b>Special Requirements</b>	Between Dates 01-OCT-2025:03:49:00 and 01-OCT-2025:04:09:00 Time Series Observation No Parallel Attachments  DEFAULT WINDOW: ANGULAR RATE HAUMEA FROM JWST LESS THAN 0.075											