



6780 - A Deep Look at Quaoar's Ring System

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>
Occultation				
	1	Occultation	NIRCam Time Series	(1) OccultedStar

ABSTRACT

With the discovery of rings around small bodies in the past decade, a new and exciting field of study has been established. These discoveries were enabled by the observations of stellar occultations, which can reveal compact ring structures beyond the resolving limit of telescopes. Quaoar, a trans-Neptunian object (TNO) and dwarf planet candidate, has the most intriguing of these ring systems. It has two rings, both outside of the Roche limit, that exhibit interesting spatial/azimuthal variations. Understanding the stability and formation of these rings is crucial to our knowledge of small body rings, satellite formation around TNOs, and planet/planetesimal formation as a whole. On 2024-08-28, Quaoar and its ring system will occult a star from the perspective of JWST, providing the opportunity to probe Quaoar's ring system in unprecedented detail. This event is likely to be one of the best opportunities to characterize Quaoar's rings during the lifetime of JWST's mission. We propose a small 3.69 hour DD program to observe this event using NIRCam. Our proposed observations enable detections of the inner and outer rings at 5 and 8 sigma, respectively, and should be able to detect (or place upper limits on) additional, even more diffuse, rings. The fantastic spatial resolution provided by NIRCam's rapid observing cadence will also allow us to detect structure present within the rings, furthering our understanding of the rings' dynamical environment.

The simultaneous observations in multiple wavelengths can also probe the composition and size of ring particles.

OBSERVING DESCRIPTION

We propose to use NIRCcam in its highest observing cadence mode. We plan on imaging using the B module, with the SUB64P subarray. Filters in the short-wavelength channel (SWC) and long-wavelength channel (LWC) are F150W2 and F322W2, respectively, to maximize the SNR of the observations. RAPID readout pattern is used with 3 groups/integration and 26575 total exposures. SNR for each exposure is expected to be 38 and 20 in the SWC and LWC, respectively. This allows detection of the known rings at >5-sigma confidence, and allows detections of thin (10 km) diffuse rings.

Observations should start between 2024-08-28 09:30 and 2024-08-28 10:15, allowing for detection of centrality at 2024-08-28 10:38:33. Small drops in brightness leading up to the event will signal the presence of rings. Observations outside of the main event will be used to construct a direct image of the system.

Proposal 6780 - Targets - A Deep Look at Quaoar's Ring System

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	OccultedStar	RA: 18 31 41.2286 (277.9217858d) Dec: -15 07 52.25 (-15.13118d) Equinox: J2000	Proper Motion RA: -0.970 mas/yr Proper Motion Dec: -6.170 mas/yr Parallax: 0.0001737" Epoch of Position: 2016	Comments: Star is Gaia DR3 4103291293710742656. Category=Star Description=[A stars] Extended=NO

Proposal 6780 - Observation 1 - A Deep Look at Quaoar's Ring System

Mon Aug 12 21:01:05 GMT 2024

Observation	<p>Proposal 6780, Observation 1: Occultation</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRCam Time Series</p>											
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
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	<p><i>Comments: Star is Gaia DR3 4103291293710742656.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[A stars]</i></p> <p><i>Extended=NO</i></p>											
Acquisition	#										Target	
	1										NONE	
Template	Module					Subarray						
	B					SUB64P						
Spectral Elements	#	Short Pupil	Short Filter	Long Pupil	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	CLEAR	F150W2	CLEAR	F322W2	RAPID	3	26575	1	26575	5400.04	
Special Requirements	<p>Between Dates 28-AUG-2024:09:30:00 and 28-AUG-2024:10:15:00</p> <p>Time Series Observation</p> <p>No Parallel Attachments</p>											