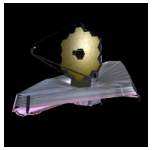

11575 - Spectral Characterization of Sedna-like Objects as Fossil Records of Solar System Formation with NIRSpec

Cycle: 5, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
sedna-like objects				
	1	2023 KQ14	NIRSpec IFU Spectroscopy	(1) 2023KQ14
	2	Leleakuhonua	NIRSpec IFU Spectroscopy	(2) Leleakuhonua

ABSTRACT

We propose to obtain near-infrared spectra of two Sedna-like objects (541132 Lelekhonua and 2023 KQ14) to investigate the surface properties of this unique and distant population of trans-Neptunian objects (TNOs). Sedna-like objects spend the majority of their orbital lifetimes at heliocentric distances far beyond the influence of solar wind irradiation, potentially preserving surface compositions that reflect their primordial formation environments. Previous JWST cycles have already targeted Sedna and 2012 VP113, but no observations have yet been conducted for the other two known members of this class.

Recent theoretical/observational work suggests that the spectral characteristics of these bodies may depend on both their original formation regions and their heliocentric distances during the early Solar System. Sedna, being one of the largest known TNOs, shows surface properties that resemble

other large TNOs but may not provide a full picture of this class. Expanding the sample to include Lelekhonua and 2023 KQ14 is therefore essential for evaluating whether spectral diversity among Sedna-like objects reflects compositional gradients inherited from different regions of the outer Solar System.

JWST's sensitivity in the near-infrared provides the first opportunity to characterize the full set of known Sedna-like objects. These observations will not only constrain the surface chemistry of individual bodies, but also offer critical insight into the formation pathways of high-perihelion TNOs and their role in shaping our understanding of the outermost Solar System.

OBSERVING DESCRIPTION

This program consists of 2 observations, both using the NIRSpec IFU with the Prism/CLEAR configuration. The targets are the Sedna-like objects 541132 Lelekhonua and 2023 KQ14. Both objects have sufficiently well-determined ephemerides such that no target acquisition is required. As extremely distant trans-Neptunian objects, their apparent sky motions are very slow and well within the 75 mas/s Solar System Target Window default limit.

Each target has at least one suitable visibility window within Cycle 5 while outside the MAZ. Because of their faintness, the total exposure times are designed to be approximately 4.5 hours, in order to achieve comparable signal-to-noise across the full 0.6–5.3 m wavelength range.

The total charged time of the program is XX hours, with a total science exposure of YY hours. The breakdown is as follows:
1. 2023 KQ14: ~5.9 hours (science), ~8.1 hours (total)
2. 541132 Lelekhonua: ~5.9 hours (science), ~8.1 hours (total)

The expected data volume exceeds the middle data excess threshold. This is required to achieve the necessary S/N for extremely faint Sedna-like targets using the NIRSpec/Prism IFU configuration, and remains within the permissible limits.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	2023KQ14	TYPE=ASTEROID,A=250.0679474237761,E=0.7370249039390946,I=10.99528818274681,O=72.0885184764268,W=199.2155526048832,M=356.2594520127039,EQUINOX=J2000,EPOCH=03-DEC-2022:00:00:00,EpochTimeScale=TDB		
Comments: Extended=NO				
(2)	Leleakuhonua	TYPE=ASTEROID,A=1062.136603634751,E=0.939057494080568 4,I=11.66948508856894,O=300.9623405298694,W=118.4456730982617,M=359.3608073969577,EQUINOX=J2000,EPOCH=10-JUL-2017:00:00:00,EpochTimeScale=TDB		
Comments: Extended=NO				

Observation

Proposal 11575, Observation 1: 2023 KQ14

Fri Mar 13 21:08:20 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 1:1) Warning (Form): Data Excess over middle threshold

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

(2023 KQ14 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	2023KQ14	TYPE=ASTEROID,A=250.0679474237761,E=0.7370249039390946,I=10.99528818274681,O=72.0885184764268,W=199.2155526048832,M=356.2594520127039,EQUINOX=J2000,EPOCH=03-DEC-2022:00:00:00,EpochTimeScale=TDB		

Comments: Extended=NO

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	PRISM/CLEAR	NRSIRS2RAPID	90	4	false	true	NONE	4	16	21241.424	

Special Requirements

DEFAULT WINDOW: ANGULAR RATE 2023KQ14 FROM JWST LESS THAN 0.075

Observation

Proposal 11575, Observation 2: Leleakuhonua

Fri Mar 13 21:08:20 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 2:1) Warning (Form): Data Excess over middle threshold

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

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

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(2)	Leleakuhonua	TYPE=ASTEROID,A=1062.136603634751,E=0.9390574940805684,I=11.66948508856894,O=300.9623405298694,W=118.4456730982617,M=359.3608073969577,EQUINOX=J2000,EPOCH=10-JUL-2017:00:00:00,EpochTimeScale=TDB		

Comments: Extended=NO

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	PRISM/CLEAR	NRSIRS2RAPID	90	4	false	true	NONE	4	16	21241.424	

Special Requirements

DEFAULT WINDOW: ANGULAR RATE Leleakuhonua FROM JWST LESS THAN 0.075