18196 - Characterizing an onging outburst of a rare centaur C/2023 RS61 with joint JWST and HST observations

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) C2023RS61	WFC3/UVIS	1	11-Sep-2025 12:00:13.0	yes

1 Total Orbits Used

ABSTRACT

Centaurs are small bodies scattered from the trans-Neptunian region, carrying invaluable information on the composition of trans-Neptunian objects. About 10% of centaurs show cometary activity, poorly understood and often unpredictable.

In early 2025 centaur C/2023 RS61 developed a wide tail not aligned with the anti-solar direction. Follow-up images from July 2025 show a weak, anti-solar oriented tail, while on August 10 the brightness of C/2023 RS61 suddenly increased by >4 magnitudes, indicative of a powerful outburst. Archival images reveal at least two more brightening events in the past, suggesting this object is indeed a rare distant outbursting Centaur with rapidly changing coma morphology. Moreover, it is a dynamically new centaur, meaning the nucleus has not yet been significantly thermally processed, therefore offering a unique opportunity to analyze volatiles driving a distant activity on a nearly-pristine small body, with the potential to trace back its formation location in the protosolar disc.

We propose 5.5 hours and 1 orbit respectively of joint JWST and HST observations to characterize the rare centaur C/2023 RS61 (PANSTARRS) that has undergone at least four major outbursts and displays an unusually red dust coma. The proposed program will allow to acquire high-resolution spectra of the gas species driving the current outburst complemented with the detailed inner dust coma morphology linking the gas species to their nucleiographic sources.

Time-critical DD time is necessary, as C/2023 RS61 is undergoing a powerful outburst, meaning the coma brightness will likely decrease rapidly and disappear before the start of a new regular observing cycle.

OBSERVING DESCRIPTION

The observations proposed are to investige the gas species (e.g., CO, CH4, or CO2) driving the activity in the recently discovered active centaur C/2023 RS61 (PANSTARRS) using the JWST NIRSpec IFU Prism mode during Cycle 4. The observations have dedicated background observations due to the extended nature of the target's gas and dust comae. The science and background observations are sequenced together and non-interruptible to ensure the most accurate measure of the background. Also, HST WFC3/UVIS imaging data are to be collected close in time (+/- ~ 3 days) for high-resolution inner coma morphology data for a deeper understanding of the outburst vs. persistent low-level activity.

Visit

Proposal 18196, Visit 01, scheduled Thu Sep 11 16:00:14 GMT 2025

Diagnostic Status: Informational

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(Visit 01) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1), (2)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	C2023RS61	TYPE=COMET,Q=8.000601912855959,E=0.3276831041371935,I=19.94378143878478,O=347.0154081198834,W=119.3522397524865,T=30-NOV-2028:05:20:02,TTimeScale=TDB,EQUINOX=J2000,EPOCH=02-FEB-2025:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Active Centaur Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	C/2023 RS61 HST (2039750)	(1) C2023RS61	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	FLASH=14		Pattern 1, Exps 1-1 in Visit 01 (1)	60 Secs (240 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	C/2023 RS61 HST (2039750)	(1) C2023RS61	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	FLASH=14		Pattern 1, Exps 2-2 in Visit 01 (1)	60 Secs (240 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure