



16921 - Enabling a First in a Lifetime Multi-Wavelength Gas and Dust Coma Characterization of the Centaur 39P/Oterma

Cycle: 29, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) 39P	WFC3/UVIS	2	11-Jul-2022 09:00:14.0	yes

2 Total Orbits Used

ABSTRACT

Centaur's are the dynamical intermediary between the more distant and thermally pristine Trans-Neptunian Objects (TNOs) with the more processed and active Jupiter-Family Comets (JFCs). In the Centaur region between Neptune and Jupiter the thermal activation of many cosmogonically abundant volatile species occurs driving comae activity. Investigations of these distant comae provide salient data to test models of the solar system's formation. To date thorough Centaur gas comae characterizations are prohibitive due to instrumental sensitivity limitations, however the newly launched James Webb Space Telescope (JWST) will provide the sensitivities necessary to probe Centaur gas comae. Six Centaur's have been

approved for JWST Cycle 1 gas comae characterizations [McKay et al. 2021] with additional contemporaneously acquired dust comae observations from other observatories. Of the six JWST Centaur targets 39P/Oterma is predicted to be beyond suitable characterization through ground-based assets during the Cycle 1 NIRSpec observations. We request 2 HST orbits during Cycle 29 (Jul. - Aug. 2022) of WFC3-UVIS imaging to contemporaneously characterize the dust coma of the Centaur 39P/Oterma during scheduled Cycle 1 JWST NIRSpec gas coma characterization. The tight, stable, and well characterized WFC3 PSF in combination with HST's sensitivity to low surface brightness provide the only observational platform currently available to detect and isolate the flux from 39P's dust coma from its nucleus contribution. If a suitable ramp up of comae activity occurs before the scheduled JWST observations we will forgo the HST observations, instead utilizing ground-based assets.

OBSERVING DESCRIPTION

We will use two orbits of HST/WFC3 to observe the active Centaur 39P/Oterma's dust coma color and morphology to complement its Cycle 1 JWST NIRSpec IFU Prism gas coma characterization. Due to the variable nature of comae activities it is important to schedule the HST observations as close as possible to the JWST observations to ensure a direct comparison of the time variable coma environment. We will acquire imaging data in WFC3-UVIS in the F475W (SDSS g), F625W (SDSS r), and F775W (SDSS i) filters in order to compare to ensemble studies of comes and Centaurs that commonly use the SDSS gri or BVRI systems. The ephemeris uncertainty of 39P is low (approximately 1 arcsecond) so we choose to use the UVIS-M1K1C-SUB subarray (40 arcsecond FOV) to allow more images to be acquired before buffer dumps.

The coma surface brightness during the JWST and HST observations is not known a priori so we base out exposure times to achieve a S/N of > 50 for each of the filters. A total integration of g (20 minutes), r (15 minutes) and i (23 minutes) is planned to achieve the desired S/N. The telescope will be dithered between individual exposures to mitigate effects of bad pixels and for the removal of cosmic rays. The detector pixels will not be binned retaining the native 0.04 arcseconds per pixel resolution.

Proposal 16921 - 39P images (01) - Enabling a First in a Lifetime Multi-Wavelength Gas and Dust Coma Characterization of the Centa...

Mon Jul 11 13:00:14 GMT 2022

Visit	Proposal 16921, 39P images (01), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 08-JUL-2022:00:00:00 AND 28-JUL-2022:00:00:00; BETWEEN 29-JUL-2022:00:00:00 AND 22-AUG-2022:00:00:00 Comments: This should include two orbits to acquire images in the three filters.									
	#	Primary Pattern	Secondary Pattern	Exposures						
Patterns	(1)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1), (4)						
	(2)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(2)						
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(1)	39P	TYPE=COMET,Q=5.7022203108955 06,E=0.2293325146529492,I=1.47035 9413259978 ,O=304.5833580651899,W=88.700512 88508857,T=03-APR- 2023:21:44:02,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=10-SEP- 2014:00:00:00,EpochTimeScale=TDB				EARTH			
Comments: Description=Comet and Active Centaur 39P/Oterma Extended=YES Acquisition Uncertainty: 1.0 Arcsec										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	g images	(1) 39P	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=12		Pattern 1, Exps 1-1 in 39P images (01) (1)	400 Secs (1128 Secs) [==>376.0 Secs (Pattern 1)] [==>376.0 Secs (Pattern 2)] [==>376.0 Secs (Pattern 3)]	[1]
	2	r images	(1) 39P	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=12		Pattern 2, Exps 2-2 in 39P images (01) (2)	300 Secs (590 Secs) [==>295.0 Secs (Pattern 1)] [==>295.0 Secs (Pattern 2)]	[1]
	3	First r images	(1) 39P	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=12	POS TARG 0.135,0.135		300 Secs (358 Secs) [==>358.0 Secs]	[2]
4	First i image	(1) 39P	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F775W	FLASH=12		Pattern 1, Exps 4-4 in 39P images (01) (1)	450 Secs (1524 Secs) [==>508.0 Secs (Pattern 1)] [==>508.0 Secs (Pattern 2)] [==>508.0 Secs (Pattern 3)]	[2]	



