



12435 - Investigating the Outburst of Asteroid 596 Scheila: Main Belt Comet vs Collisional Origin

Cycle: 18, Proposal Category: GO/DD

(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) MBC-596-SCHEILA	WFC3/UVIS	1	17-Dec-2010 21:03:57.0	yes
02	(1) MBC-596-SCHEILA	WFC3/UVIS	1	17-Dec-2010 21:04:07.0	yes

2 Total Orbits Used

ABSTRACT

On 2010 Dec 11 the Catalina Sky Survey discovered a coma around the 113km asteroid 596 Scheila. Mass loss from such a large, slowly rotating object (escape speed 50 m/s) is unprecedented. It can only be driven by impact or by drag forces from sublimated gas, as occurs in classical comets. We propose a 2-orbit Hubble investigation of 596 Scheila to decide between these alternatives and

to assess variability in the near-nucleus environment. Deep images will be used to examine fine-scale coma structures including jets and decameter-sized fragments, if present, and to measure the expansion velocities of the ejected material. With its high spatial resolution and point-spread-function stability, Hubble is uniquely suited to this investigation.

OBSERVING DESCRIPTION

We request HST imaging observations of 596 Scheila to establish the high resolution appearance of this object. The basic question is whether the morphology is more consistent with an impact origin, or with a sublimation origin. Impact, as observed in P/2010 A2, produces a distinctive, fine-structured morphology consisting of ribbons of large debris chunks ejected at a single time. The chunks then act as secondary sources of smaller (mm to cm) grains that populate the tail. Sublimation, as witnessed in the many classical comets observed by HST, produces a more amorphous inner coma in which may be seen fine radial jets associated with individual surface vents. We expect that HST images will immediately support one or the other of these two hypotheses for the origin of the activity.

Our observing strategy is to take both short and long exposures of Scheila using WFC3: the short exposure use F621M and the long ones use F606W.

During the next couple of weeks, the nucleus will have $V = 13.7$, and we will use an exposure time of 4 sec with F621M to obtain $S/N=200$ on the nucleus itself. And we will use long exposure times of ~ 400 s to provide the deepest search for debris in the environs of Scheila. We plan to take a sequence images at one location on the CCD and then repeat that sequence of images at a dithered location. A similar strategy was employed by our successful program on P/2010 A2, except there was no bright nucleus to contend with in that case (i.e., saturation wasn't an issue).

The appearance of Scheila may evolve rapidly, and we request two separate visits

to investigate temporal variability. It is important to obtain the first set of images as soon as possible because that will presumably provide the best information on what triggered the outburst. The timing of the second visit is probably not too critical, but observing sometime between 7 and 14 days after the first visit (i.e., in the next SMS) seems like a reasonable choice given the expected dynamical behavior of small grains (1 m grains might have outflow speeds of 100 m s⁻¹, which means they will traverse one-half of the WFC3 field-of-view in 13 days).

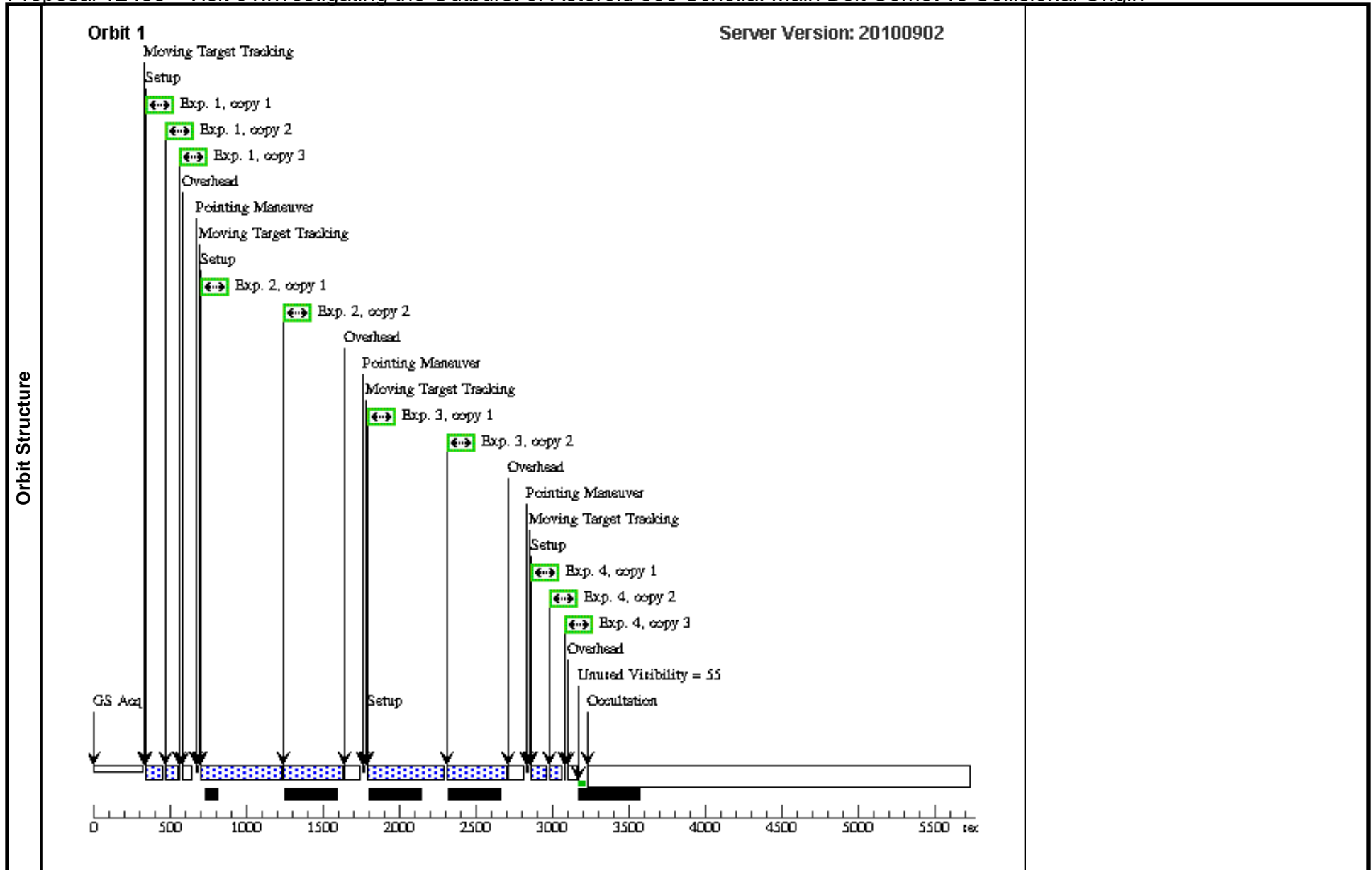
Scheila is well-placed for Hubble observations during the next couple of weeks with a solar elongation angle of 130 deg, a heliocentric distance of 3.1 AU, and a geocentric distance of 2.3 AU. The target's apparent rate of motion is currently 16"/hr, which is easily within Hubble's tracking capabilities. This rate of motion is also slow enough to keep a single pair of guide stars within the FGS pickles for an entire visibility window (54 min for this asteroid located near the ecliptic plane). Since Scheila is a well known asteroid, the ephemeris uncertainty is negligible (sub-arcsecond), compared to the WFC3 field-of-view of 162 × 162 and ephemeris issues are of no concern to this observation.

We understand that we will have essentially no control over the spacecraft roll angle, which means we won't be able to optimize the orientation of the dust tail on the CCD (i.e., to orient the tail along the longest dimension of the detector). However, the field-of-view of the camera is large enough that we should obtain excellent data on a portion of the tail, no matter what spacecraft roll angle is used.

Proposal 12435 - Visit 01 Investigating the Outburst of Asteroid 596 Scheila: Main Belt Comet vs Collisional Origin

Sat Dec 18 02:04:14 GMT 2010

Visit	Proposal 12435, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(1)	MBC-596-SCHEILA	TYPE=ASTEROID,A=2.927227779,E=0.165149571,I=14.6610064,O=70.7150558,W=175.8937669,M=259.3829672,EQUINOX=J2000,EPOCH=25-DEC-2010:00:00:00					EARTH		
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F621M	CR-SPLIT=NO			4 Secs X 3	
									[==>(Copy 1)]	[1]
									[==>(Copy 2)]	
									[==>(Copy 3)]	
2		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W	CR-SPLIT=NO	POS TARG -0.5,20			390 Secs X 2	
								[==>(Copy 1)]	[1]	
								[==>(Copy 2)]		
3		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W	CR-SPLIT=NO	POS TARG -1,22			390 Secs X 2	
								[==>(Copy 1)]	[1]	
								[==>(Copy 2)]		
4		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F621M	CR-SPLIT=NO	POS TARG -0.5,0.5			4 Secs X 3	
								[==>(Copy 1)]	[1]	
								[==>(Copy 2)]		
								[==>(Copy 3)]		



Proposal 12435 - Visit 02 Investigating the Outburst of Asteroid 596 Scheila: Main Belt Comet vs Collisional Origin

Sat Dec 18 02:04:16 GMT 2010

Visit	Proposal 12435, Visit 02 Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: AFTER 01 BY 7 D TO 13 D									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(1)	MBC-596-SCHEILA	TYPE=ASTEROID,A=2.927227779,E=0.165149571,I=14.6610064,O=70.7150558,W=175.8937669,M=259.3829672,EQUINOX=J2000,EPOCH=25-DEC-2010:00:00:00					EARTH		
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F621M	CR-SPLIT=NO			4 Secs X 3	
									[==>(Copy 1)]	[1]
									[==>(Copy 2)]	
									[==>(Copy 3)]	
2		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W	CR-SPLIT=NO	POS TARG -0.5,20			390 Secs X 2	
								[==>(Copy 1)]	[1]	
								[==>(Copy 2)]		
3		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W	CR-SPLIT=NO	POS TARG -1,22			390 Secs X 2	
								[==>(Copy 1)]	[1]	
								[==>(Copy 2)]		
4		(1) MBC-596-SCHEILA	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F621M	CR-SPLIT=NO	POS TARG -0.5,0.5			4 Secs X 3	
								[==>(Copy 1)]	[1]	
								[==>(Copy 2)]		
								[==>(Copy 3)]		

