16496 - 323P/SOHO: The First Short Period Near-Sun Object Observed to Disintegrate

Cycle: 28, Proposal Category: GO/DD

(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) 323P	WFC3/UVIS	1	12-Mar-2021 15:00:25.0	yes
02	(1) 323P	WFC3/UVIS	1	12-Mar-2021 15:00:25.0	yes
03	(1) 323P	WFC3/UVIS	1	12-Mar-2021 15:00:26.0	yes
04	(1) 323P	WFC3/UVIS	1	12-Mar-2021 15:00:27.0	yes

4 Total Orbits Used

ABSTRACT

323P/SOHO is a near-Sun comet with perihelion activity driven by mass-loss mechanism most likely completely different from that of typical comets, and thus is possibly unique in the comet population of the solar system. Postperihelion observations from CFHT in early February 2021

showed that the comet has morphology consistent with ongoing disintegration in rapid evolution, in stark contrast to the preperihelion morphology, which was simply asteroidal in Subaru data from late December 2020. Thus, 323P becomes the first short period near-Sun object that has disintegrated. The ongoing event is offering us an unprecedented opportunity to study a near-Sun object in great detail, and to constrain properties of the interior as well as the disintegration process. We hereby request four DD orbits, taking advantage of HST/WFC3's ultra-high resolution, sensitivity, and photometric stability to monitor and characterize the disintegration event at 323P.

OBSERVING DESCRIPTION

We request four orbits to observe disintegrating near-Sun comet 323P/SOHO using HST's WFC3 through the F350LP filter. The four orbits are split as two pairs, with each pair of the visits separated by a day or two in order to cross-link debris and measure their motions between visits, and the two pairs should be a week or so apart, in order to detect any nongravitational effects that the debris are subject to, and to monitor changes in the morphology of the comet from different observing geometries. In each orbit, we request that consecutive exposures of 405 s on the comet should be taken, with image dithering performed in the middle to mitigate CCD defects including bad pixels and the gap between the two WFC3 gaps after stacking the images. During each entire visibility window, five such consecutive exposures can be obtained. According to the WFC3 Exposure Time Calculator, a point source with a solar-type color at mV = 27.4 will reach signal-to-noise ratio (SNR) ~3 in a single F350LP image. Combining five such images will help removal of cosmic ray hits effectively, and the SNR can be improved by a factor of ~2.2. Using the viewing geometry of 323P on 2021 March 15 (heliocentric distance 1.48 au, cometocentric distance 1.18 au, phase angle 42 deg) as an example, the HST observations will be able to reveal debris from the disintegration event down to ~30 m in radius (comet-like geometric albedo 0.04 assumed) in a combined image from a single visit. This clearly manifests the supreme sensitivity of HST that is unparalleled by any other facilities. The nonsidereal apparent motion of 323P will be <4 arcmin/hr, well within the tracking capacity of HST. The current 3-sigma ephemeris uncertainty during the observable window is at the subarcsec level, much smaller than the field of view (FOV) of WFC3, and so will not be a concern to telescope pointing. In order to follow up the disintegration process in rapid evolution seen in our CFHT data from early February 2021, we request disruptive scheduling for the first two visits of observations. The other pair of orbits should be executed roughly a week after the first pair of visits. The comet is currently swiftly receding from both the Sun and Earth. Observations from much later epochs will have sensitivity way lower than what should have been achieved in earlier epochs, and the disintegration may have faded to a degree where the morphology may have been altered considerably as the rapid evolution of the disintegration continues, making investigation of the initial disintegration mechanism difficult, and co-moving remnants may have dispersed beyond WFC3's FOV. In addition, the comet will enter HST's Sun exclusion zone (solar elongation <50 deg) starting from mid May 2021. Therefore, we must observe 323P and complete the program in March 2021, the earlier the better. We understand that the HST roll angle is not within our control, although ideally the extension of the debris cloud should be placed along the diagonal of WFC3's FOV.

Visit

Proposal 16496, Visit 01, completed Fri Mar 12 20:00:27 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Comments: Schedule this visit as soon as possible.

Solar System Targets

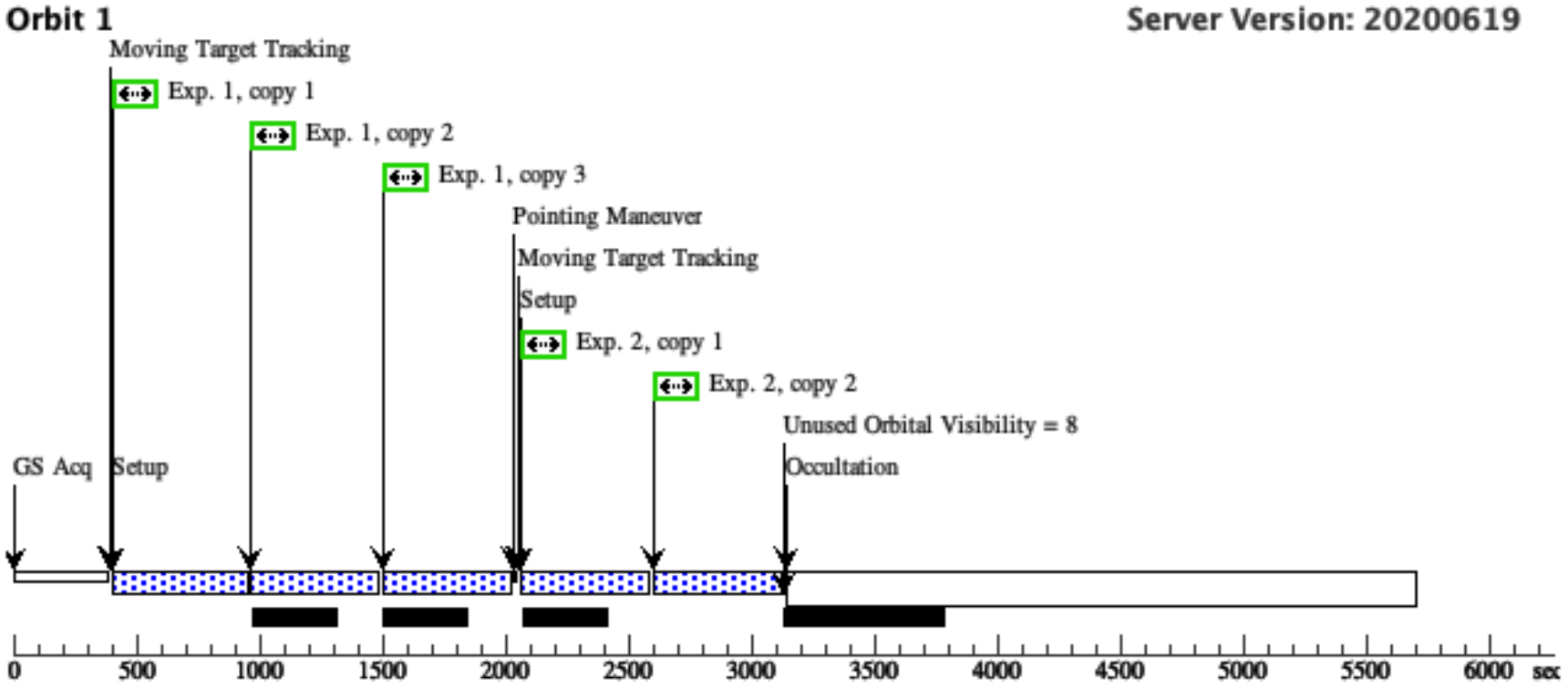
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	323P	TYPE=COMET,Q=0.0392071121041, E=0.9848146391461,I=5.3699316736616,O=324.2293902822781,W=353.1741243642062,T=17-JAN-2021:15:09:08,TTimeScale=TDT,EQUINOX=J2000,EPOCH=17-FEB-2021:00:00:00,EpochTimeScale=TDT				EARTH

Comments: Description=Disintegrating comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40,0	Sequence 1-2 Non-Int in Visit 01	405 Secs X 3 (1215 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40.2,2.5	Sequence 1-2 Non-Int in Visit 01	405 Secs X 2 (810 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	

Orbit Structure



Visit

Proposal 16496, Visit 02, completed Fri Mar 12 20:00:27 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 01 BY 20.3 H TO 2 D

Comments: Schedule this visit as soon as possible.

Solar System Targets

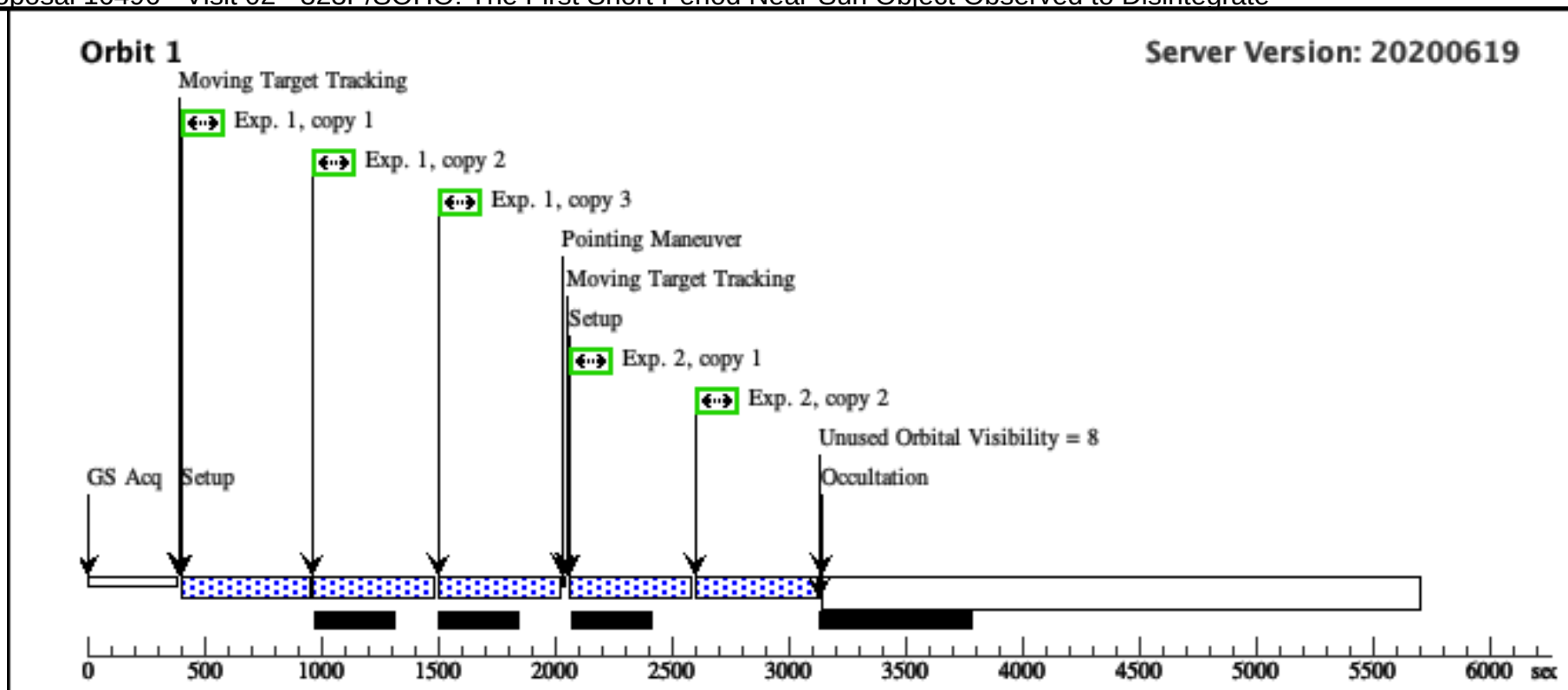
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	323P	TYPE=COMET,Q=0.0392071121041, E=0.9848146391461,I=5.3699316736616,O=324.2293902822781,W=353.1741243642062,T=17-JAN-2021:15:09:08,TTimeScale=TDT,EQUINOX=J2000,EPOCH=17-FEB-2021:00:00:00,EpochTimeScale=TDT				EARTH

Comments: Description=Disintegrating comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40,0	Sequence 1-2 Non-Int in Visit 02	405 Secs X 3 (1215 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40.2,2.5	Sequence 1-2 Non-Int in Visit 02	405 Secs X 2 (810 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	

Orbit Structure



Visit

Proposal 16496, Visit 03, implementation

Fri Mar 12 20:00:27 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Solar System Targets

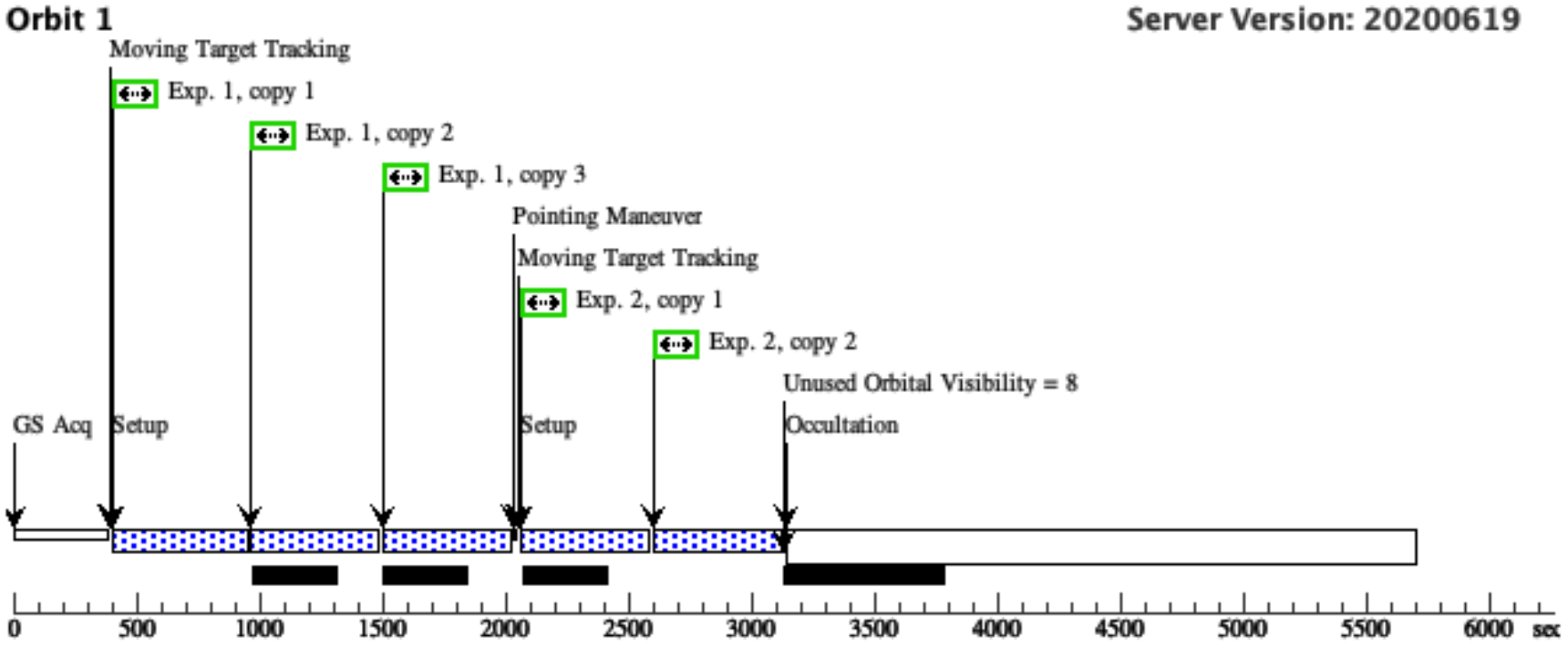
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	323P	TYPE=COMET,Q=0.0392071121041, E=0.9848146391461,I=5.3699316736616,O=324.2293902822781,W=353.1741243642062,T=17-JAN-2021:15:09:08,TTimeScale=TDT,EQUINOX=J2000,EPOCH=17-FEB-2021:00:00:00,EpochTimeScale=TDT				EARTH

Comments: Description=Disintegrating comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40,0	Sequence 1-2 Non-Int in Visit 03	405 Secs X 3 (1215 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40.2,2.5	Sequence 1-2 Non-Int in Visit 03	405 Secs X 2 (810 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	

Orbit Structure



Visit

Proposal 16496, Visit 04, implementation Fri Mar 12 20:00:27 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_03 BY 3 D TO 7 D

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	323P	TYPE=COMET,Q=0.0392071121041, E=0.9848146391461,I=5.3699316736616,O=324.2293902822781,W=353.1741243642062,T=17-JAN-2021:15:09:08,TTimeScale=TDT,EQUINOX=J2000,EPOCH=17-FEB-2021:00:00:00,EpochTimeScale=TDT				EARTH

Comments: Description=Disintegrating comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40,0	Sequence 1-2 Non-Int in Visit 04	405 Secs X 3 (1215 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) 323P	WFC3/UVIS, ACCUM, UVIS1-FIX	F350LP	CR-SPLIT=NO	POS TARG 40.2,2.5	Sequence 1-2 Non-Int in Visit 04	405 Secs X 2 (810 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	

Orbit Structure