15678 - Comet or break-up? The physical nature of Gault's dust trail

Cycle: 26, 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) GAULT	WFC3/UVIS	1	04-Mar-2019 13:00:15.0	yes
02	(1) GAULT	WFC3/UVIS	1	04-Mar-2019 13:00:16.0	yes
03	(1) GAULT	WFC3/UVIS	1	04-Mar-2019 13:00:17.0	yes

3 Total Orbits Used

ABSTRACT

The past two decades have shown that the main asteroid belt contains a number of asteroids exhibiting mass loss. Main-belt comets show regular activity due to the excavation of revealed subsurface ices, either through intra-asteroid collisions which result in the explosive ejection of a debris

cloud, or through rotational spin up due to thermal torques (the YORP effect) that can disrupt rubble-pile asteroids. As only some 20 such bodies have been detected so far, many physical aspects of their origin and subsequent evolution remain uncertain.

On 5 January 2019 we detected a dust tail / trail associated with the 5-10 km main belt asteroid (6478) Gault in images obtained by the ATLAS project; this is only the third discovery of a dust coma around a known main-belt asteroid. Archival data from ATLAS and Pan-STARRS show the Gault tail / trail already in early December 2018, but not in images taken between 2010 and January 2018. The tail / trail has significantly changed over one month; it is not clear whether this is due to pure dynamical evolution and changes in observing geometry, or because of continuous sublimation.

We propose a DD programme of WFPC3 imaging over four orbits. A two-orbit observation is requested as soon as possible to image the asteroid coma and near-asteroid dust structures at high angular resolution (about 40 km at the asteroid). The remaining two orbits would be used in February and March. Only HST will allow us to study the changing morphology of the dust structures and thus differentiate between continuous mass-loss and an impulsive event, and for the latter to decide between an impact and spin-up origin for this surprising discovery.

OBSERVING DESCRIPTION

Optical imaging observations to explore the dust surrounding asteroid Gault. We request a total time baseline for observations of approximately two months, with visits spaced roughly equally, to enable robust measurements of the evolution of the dust structure and of the velocity of any detected fragments.

While we would like to observe Gault as soon as possible, disruptive scheduling is not warranted.

Visit

Proposal 15678, Visit 1-WFC3/UVIS (01), completed Mon Mar 04 18:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 315D TO 328 D; BETWEEN 19-JAN-2019:00:00:00 AND 07-FEB-2019:00:00:00

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)

Solar System Targets

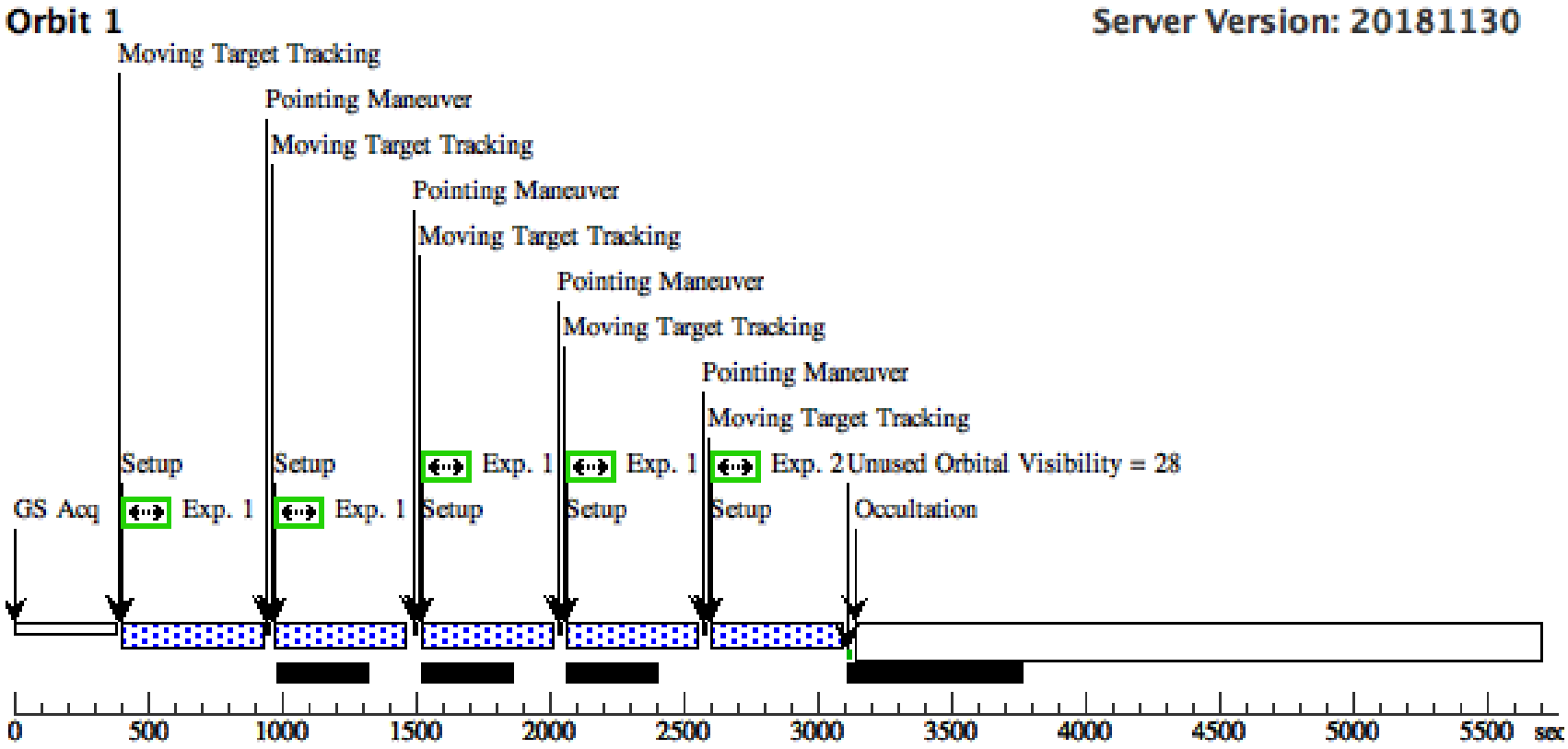
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	GAULT	TYPE=ASTEROID,A=2.305298349567425,E=0.1942278713804378,I=22.79993887779855,O=183.6161875622978,W=83.12121545138562,M=33.45120536282601,EQUINOX=J2000,EPOCH=30-APR-2013:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) GAULT	WFC3/UVIS, ACCUM, UVIS1	F350LP	CR-SPLIT=NO	POS TARG 65,0	Sequence 1-2 Non-Int in Visit 1-WFC3/UVIS (01)	380 Secs (1520 Secs)	
							Pattern 1, Exps 1-1 in Sequence 1-2 Non-Int in Visit 1-WFC3/UVIS (01) (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) GAULT	WFC3/UVIS, ACCUM, UVIS1	F350LP	CR-SPLIT=NO	POS TARG 65,0	Sequence 1-2 Non-Int in Visit 1-WFC3/UVIS (01)	380 Secs (380 Secs) *[==>]*	***[1]***

Orbit Structure



Visit

Proposal 15678, Visit 2-WFC3/UVIS (02), completed Mon Mar 04 18:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 2D TO 23 D; AFTER 01 BY 20 D TO 27 D; VISIBILITY INTERVAL 50 M

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)

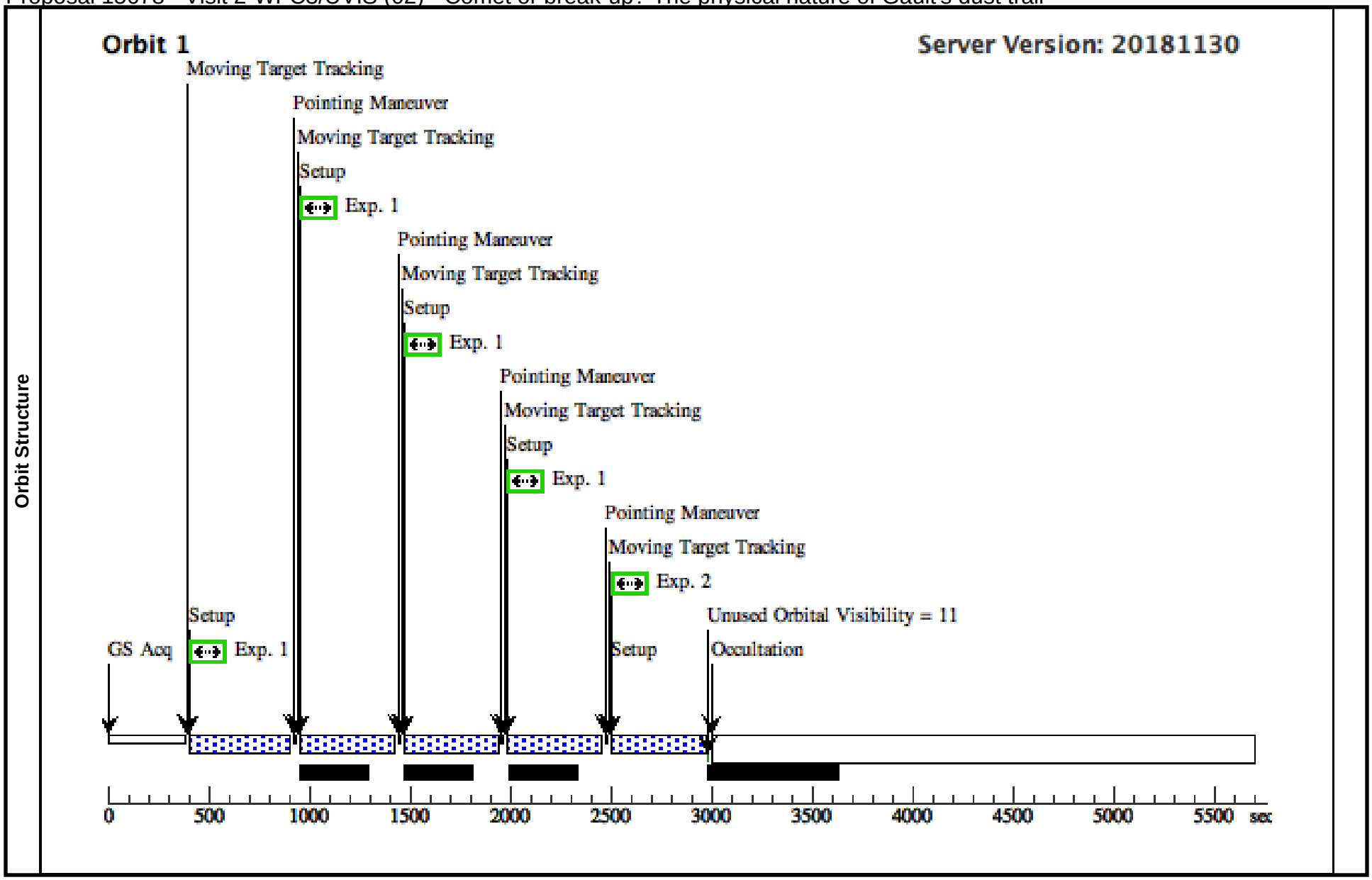
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	GAULT	TYPE=ASTEROID,A=2.305298349567425,E=0.1942278713804378,I=22.79993887779855,O=183.6161875622978,W=83.12121545138562,M=33.45120536282601,EQUINOX=J2000,EPOCH=30-APR-2013:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) GAULT	WFC3/UVIS, ACCUM, UVIS1	F350LP	CR-SPLIT=NO	POS TARG 60,-5	Sequence 1-2 Non-Int in Visit 2-WFC3/UVIS (02)	355 Secs (1420 Secs)	
							Pattern 1, Exps 1-1 in Sequence 1-2 Non-Int in Visit 2-WFC3/UVIS (02) (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) GAULT	WFC3/UVIS, ACCUM, UVIS1	F350LP	CR-SPLIT=NO	POS TARG 60,-5	Sequence 1-2 Non-Int in Visit 2-WFC3/UVIS (02)	355 Secs (355 Secs) *[==>]*	***[1]***


Orbit 1
Server Version: 20181130
Orbit Structure
Moving Target Tracking
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 1
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 1
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 1
Pointing Maneuver
Moving Target Tracking
Exp. 2
Setup
Unused Orbital Visibility = 11
GS Acq
Setup
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15678, Visit 3-WFC3/UVIS (03), pi Mon Mar 04 18:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 65D TO 80 D; AFTER_02 BY 20 D TO 27 D

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)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	GAULT	TYPE=ASTEROID,A=2.305298349567425,E=0.1942278713804378,I=22.79993887779855,O=183.6161875622978,W=83.12121545138562,M=33.45120536282601,EQUINOX=J2000,EPOCH=30-APR-2013:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) GAULT	WFC3/UVIS, ACCUM, UVIS2	F350LP	CR-SPLIT=NO	POS TARG 55,-10	Sequence 1-2 Non-Int in Visit 3-WFC3/UVIS (03)	378 Secs (1512 Secs)	
							Pattern 1, Exps 1-1 in Sequence 1-2 Non-Int in Visit 3-WFC3/UVIS (03) (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) GAULT	WFC3/UVIS, ACCUM, UVIS2	F350LP	CR-SPLIT=NO	POS TARG 55,-10	Sequence 1-2 Non-Int in Visit 3-WFC3/UVIS (03)	378 Secs (378 Secs)	
								[==>]	***[1]***

Orbit Structure