



## 15316 - Unveiling the mysterious nature of the cataclysmic variable SDSS

### J153817.35+5123238.0

Cycle: 25, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

#### INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
<b>Anna Francesca Pala (PI) (ESA Member) (Contact)</b>	<b>The University of Warwick</b>	<b>a.f.pala@warwick.ac.uk</b>
Prof. Boris T. Gaensicke (CoI) (ESA Member)	The University of Warwick	boris.gaensicke@warwick.ac.uk
Dr. Dean Townsley (CoI) (AdminUSPI)	University of Alabama	dean.m.townsley@ua.edu
Dr. Matthias R. Schreiber (CoI)	Universidad de Valparaiso	matthias@dfa.uv.cl
Dr. Alessandro Ederoclite (CoI) (ESA Member)	Centro de Estudios de Fisica del Cosmos de Aragon	aederocl@cefca.es
Mr. Javier Abril (CoI) (ESA Member)	Centro de Estudios de Fisica del Cosmos de Aragon	jabril@cefca.es

#### 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) SDSSJ1538+5123	COS/FUV	3	19-Mar-2018 20:00:39.0	yes
02	(1) SDSSJ1538+5123	S/C	1	19-Mar-2018 20:00:40.0	yes
03	(2) SDSSJ1538+5123-SAFE-TARGET	COS/FUV	3	19-Mar-2018 20:00:41.0	yes

7 Total Orbits Used

#### ABSTRACT

## Proposal 15316 (STScI Edit Number: 3, Created: Monday, March 19, 2018 7:00:42 PM EST) - Overview

Evolution of cataclysmic variables (CVs) is driven by angular momentum loss, which keeps mass loss from the donor star continually going, replenishing the disc with new higher-momentum material and maintaining, in this way, the accretion process. The angular momentum loss rate can be accurately constrained by measuring the white dwarf (WD) effective temperature ( $T_{\text{eff}}$ ), and provides one of the best available tests for the present model of the CV evolution. We conducted an HST/COS survey (ID 12870, PI Gaensicke) in which we measured  $T_{\text{eff}}$  for 31 CV WDs. Our results are in good agreement with the theoretical prediction with one exception: SDSS J153817.35+5123238.0, a short period (93.1 min) CV which contains an anomalously hot WD. We argue that the system is either a very young CV ( $\sim 20$  Myr), or has been recently re-heated to  $\sim 35000$  K. While the former hypothesis is statistically unlikely, the latter is most likely related to a nova eruption within the past few 1000 years or to additional mechanisms of angular momentum losses that are not accounted for by the present theory of CV evolution. To distinguish between these three scenarios, we need higher resolution UV observation to accurately measure the white dwarf mass, its effective temperature and photospheric abundances, along with a search for absorption features due to an ejected shell and their velocity. In this way we will constrain the WD age (from an improved mass measurement), its cooling rate (from this second temperature measurement) and we will also identify possible ashes and the expanding circumstellar gas shell expected in case of a recent nova explosion, shedding light on the mysterious nature of this system.

### **OBSERVING DESCRIPTION**

The aim of this program is to obtain high-resolution far-ultraviolet COS G130M spectroscopy of the cataclysmic variable white dwarf SDSS J1538. Our previous observations of this object on Cycle 20 with COS/G140L (dataset LC1V30010) demonstrated that the white dwarf is the dominant source of emission in the ultraviolet, with an effective temperature  $\sim 30\,000$  K. Given the white dwarf temperature, it is quite unlikely that SDSS J1538 can experience a dwarf nova outburst. Nonetheless, in order to insure the safety of the COS detectors, we will carry out an intense ground-based monitoring leading up to the HST observations.

We will perform the target acquisition in dispersed light using the G130M grating.

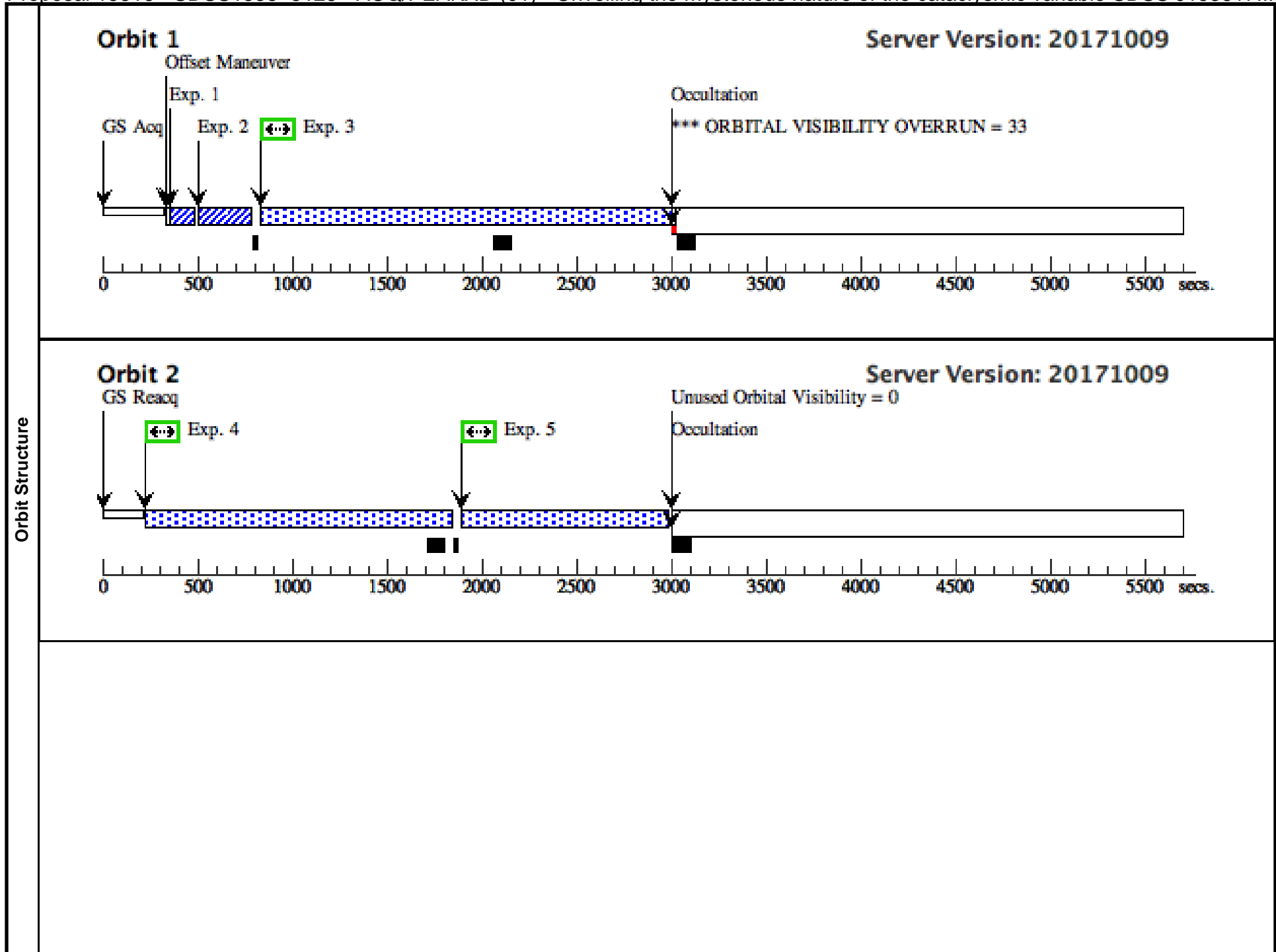
The coordinates and proper motions are drawn from the PPMXL catalogue, which has proven to be reliable and accurate to fractions of an arcsec, hence we do not precede the observations with a search pattern. We will make use of the 2 FP-POS positions available for G130M at the central wavelength 1291 Å.

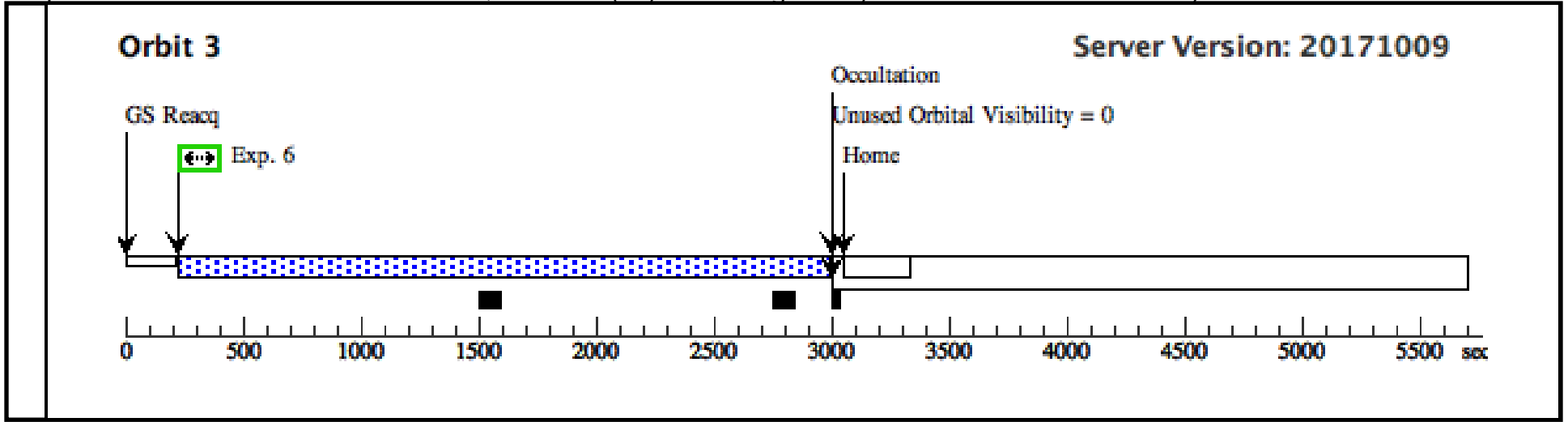
Proposal 15316 - SDSS1538+5128 - ACQ/PEAKXD (01) - Unveiling the mysterious nature of the cataclysmic variable SDSS J153817....

<b>Visit</b>	<b>Proposal 15316, SDSS1538+5128 - ACQ/PEAKXD (01), scheduling</b> <span style="float: right;">Tue Mar 20 00:00:42 GMT 2018</span> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV Special Requirements: SCHED 100%; ORIENT 81.0D TO 7.0 D; AFTER 02 BY 3 D TO 5 D; BETWEEN 02-APR-2018:00:00:00 AND 09-APR-2018:00:00:00 <i>Comments: This visit should be scheduled in the day or evening-local time. Flags need to be cleared during the work day.</i>																
	<b>Diagnosics</b> (SDSS1538+5128 - ACQ/PEAKXD (01)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details. (SDSS1538+5128 - ACQ/PEAKXD (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN																
<b>Fixed Targets</b>	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>SDSSJ1538+5123</td> <td>RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000</td> <td>Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0</td> <td>V=18.6+/-0.3</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	SDSSJ1538+5123	RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000	Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0	V=18.6+/-0.3	Reference Frame: ICRS
	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous											
(1)	SDSSJ1538+5123	RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000	Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0	V=18.6+/-0.3	Reference Frame: ICRS												
<i>Comments:</i> Category=STAR Description=[DWARF NOVA] Extended=NO																	

Proposal 15316 - SDSS1538+5128 - ACQ/PEAKXD (01) - Unveiling the mysterious nature of the cataclysmic variable SDSS J153817....

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	SDSS1538+5128 ACQ/P 3 (COS.sa.101 2232)	(1) SDSSJ1538+512 COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	LIFETIME-POS=LP 4	USE OFFSET V01S AF		10.5 Secs (10.5 Secs) [==>]	[1]
	2	SDSS1538+5128 ACQ/P 3 (COS.sa.416 266)	(1) SDSSJ1538+512 COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	STEP-SIZE=0.9; NUM-POS=5; CENTER=DEF; LIFETIME-POS=L P4	USE OFFSET V01S AF		25 Secs (25 Secs) [==>]	[1]
	3	SDSS1538+5128 FP-3 3 (COS.sp.101 2300)	(1) SDSSJ1538+512 COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=12 00; FP-POS=3; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4	USE OFFSET V01S AF		2140 Secs (2140 Secs) [==>]	[1]
	4	SDSS1538+5128 FP-3 3 (COS.sp.101 2301)	(1) SDSSJ1538+512 COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=14 59; FP-POS=3; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4	USE OFFSET V01S AF		1569 Secs (1569 Secs) [==>]	[2]
	5	SDSS1538+5128 FP-4 3 (COS.sp.101 2297)	(1) SDSSJ1538+512 COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 42; FP-POS=4; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4	USE OFFSET V01S AF		1042 Secs (1042 Secs) [==>]	[2]
	6	SDSS1538+5128 FP-4 3 (COS.sp.101 2298)	(1) SDSSJ1538+512 COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=12 50; FP-POS=4; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4	USE OFFSET V01S AF		2716 Secs (2716 Secs) [==>]	[3]





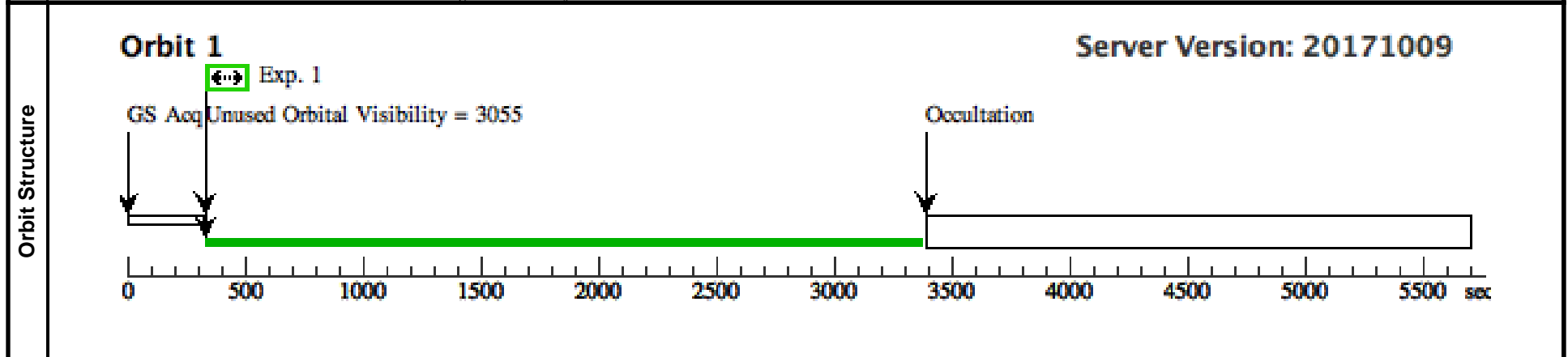
Proposal 15316 - Safe Offset setup (02) - Unveiling the mysterious nature of the cataclysmic variable SDSS J153817.35+5123238.0

Tue Mar 20 00:00:43 GMT 2018

<b>Visit</b>	<b>Proposal 15316, Safe Offset setup (02), scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: S/C Special Requirements: ORIENT 81.0D TO 7.0 D <i>Comments: This visit allocates and sets up the safe position offset slot for visit 01 which will use that slot. This S/C visit should go earlier in the week while visit 01 will be at least 3 days later. This S/C visit will contain only 1 exposure. Note: weekends are to be avoided since the CS must clear the target within 24 hours of HST execution.</i>				

<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>
	(1)	SDSSJ1538+5123	RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000	Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0	V=18.6+/-0.3	Reference Frame: ICRS
<i>Comments: Category=STAR Description=[DWARF NOVA] Extended=NO</i>						

<b>Exposures</b>	<b>#</b>	<b>Label</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>	<b>Orbit</b>
	1		(1) SDSSJ1538+5123 3	S/C, POINTING, V1			POS TARG 229.132 80,-241.05750; SAVE OFFSET V01 SAF; SPEC COM INSTR ECSLOTSET; QESIPARM ANGLE 230.5; QESIPARM DIST 9.043		5 Secs (5 Secs) [==>]	[1]
<i>Comments: This visit allocates and sets up the safe position offset slot for visit 1531601, which will use that slot. This S/C visit, 1531602, should go earlier in the week while 1531601 will be at least 3 days later. Note: weekends are to be avoided since the CS must clear the target 24 hours before HST execution.</i>										



Proposal 15316 - SDSS1538+5128 - BOP ONLY (03) - Unveiling the mysterious nature of the cataclysmic variable SDSS J153817.35...

Tue Mar 20 00:00:43 GMT 2018

<b>Visit</b>	<p><b>Proposal 15316, SDSS1538+5128 - BOP ONLY (03), withdrawn</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV</p> <p>Special Requirements: SCHED 100%; ORIENT 81.0D TO 7.0 D; BETWEEN 02-APR-2018:00:00:00 AND 09-APR-2018:00:00:00</p> <p><i>Comments: This visit is for BOP checking the safe target pointing only and should not execute onboard HST.</i></p>																																		
	<p><b>Diagnosics</b></p> <p>(SDSS1538+5128 - BOP ONLY (03)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details.</p>																																		
<b>Fixed Targets</b>	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>SDSSJ1538+5123</td> <td>RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000</td> <td>Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0</td> <td>V=18.6+/-0.3</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td colspan="6"> <p><i>Comments: Category=STAR Description=[DWARF NOVA] Extended=NO</i></p> </td> </tr> <tr> <td>(2)</td> <td>SDSSJ1538+5123-SAFE-TARGET</td> <td>Offset from SDSSJ1538+5123 RA Offset: -0.74 Secs Dec Offset: -5.78 Arcsec</td> <td></td> <td>V=18.6+/-0.3</td> <td>Offset Position (SDSSJ1538+5123-SAFE-TARGET)</td> </tr> <tr> <td colspan="6"> <p><i>Comments: This target is a blank piece of sky which is the bright object safe pointing and is 9.043 arcseconds away at PA (U3) 230.3 degrees from SDSSJ1538+5123. Category=UNIDENTIFIED Description=[BLANK FIELD] Extended=NO</i></p> </td> </tr> </tbody> </table>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	SDSSJ1538+5123	RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000	Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0	V=18.6+/-0.3	Reference Frame: ICRS	<p><i>Comments: Category=STAR Description=[DWARF NOVA] Extended=NO</i></p>						(2)	SDSSJ1538+5123-SAFE-TARGET	Offset from SDSSJ1538+5123 RA Offset: -0.74 Secs Dec Offset: -5.78 Arcsec		V=18.6+/-0.3	Offset Position (SDSSJ1538+5123-SAFE-TARGET)	<p><i>Comments: This target is a blank piece of sky which is the bright object safe pointing and is 9.043 arcseconds away at PA (U3) 230.3 degrees from SDSSJ1538+5123. Category=UNIDENTIFIED Description=[BLANK FIELD] Extended=NO</i></p>					
	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous																													
(1)	SDSSJ1538+5123	RA: 15 38 17.3100 (234.5721250d) Dec: +51 23 38.00 (51.39389d) Equinox: J2000	Proper Motion RA: 4.0 mas/yr Proper Motion Dec: -1.0 mas/yr Epoch of Position: 2000.0	V=18.6+/-0.3	Reference Frame: ICRS																														
<p><i>Comments: Category=STAR Description=[DWARF NOVA] Extended=NO</i></p>																																			
(2)	SDSSJ1538+5123-SAFE-TARGET	Offset from SDSSJ1538+5123 RA Offset: -0.74 Secs Dec Offset: -5.78 Arcsec		V=18.6+/-0.3	Offset Position (SDSSJ1538+5123-SAFE-TARGET)																														
<p><i>Comments: This target is a blank piece of sky which is the bright object safe pointing and is 9.043 arcseconds away at PA (U3) 230.3 degrees from SDSSJ1538+5123. Category=UNIDENTIFIED Description=[BLANK FIELD] Extended=NO</i></p>																																			

Proposal 15316 - SDSS1538+5128 - BOP ONLY (03) - Unveiling the mysterious nature of the cataclysmic variable SDSS J153817.35...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	SDSS1538+5128 ACQ/P EAKXD (COS.sa.101 2232)	(2) SDSSJ1538+5128 3-SAFE-TARGET	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	LIFETIME-POS=LP 4		10.5 Secs (10.5 Secs) [==>]	[1]
	2	SDSS1538+5128 ACQ/P EAKD (COS.sa.416 266)	(2) SDSSJ1538+5128 3-SAFE-TARGET	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	STEP-SIZE=0.9; NUM-POS=5; CENTER=DEF; LIFETIME-POS=L P4		25 Secs (25 Secs) [==>]	[1]
	3	SDSS1538+5128 FP-3 (COS.sp.101 2300)	(2) SDSSJ1538+5128 3-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=12 00; FP-POS=3; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4		2140 Secs (2140 Secs) [==>]	[1]
	4	SDSS1538+5128 FP-3 (COS.sp.101 2301)	(2) SDSSJ1538+5128 3-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=14 59; FP-POS=3; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4		1569 Secs (1569 Secs) [==>]	[2]
	5	SDSS1538+5128 FP-4 (COS.sp.101 2297)	(2) SDSSJ1538+5128 3-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 42; FP-POS=4; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4		1042 Secs (1042 Secs) [==>]	[2]
	6	SDSS1538+5128 FP-4 (COS.sp.101 2298)	(2) SDSSJ1538+5128 3-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=12 50; FP-POS=4; FLASH=YES; SEGMENT=BOTH; LIFETIME-POS=L P4		2716 Secs (2716 Secs) [==>]	[3]

