



16752 - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous emission

Cycle: 29, Proposal Category: GO

(UV Initiative)

(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) GAIA-DR2-2860923998433585664	COS/FUV COS/NUV	1	01-Feb-2022 17:01:30.0	yes
02	(2) LAMOST-J051002.11+231541.0	COS/FUV COS/NUV	1	01-Feb-2022 17:01:31.0	yes
03	(3) GAIA-DR2-5279484614703730944	COS/FUV COS/NUV	3	01-Feb-2022 17:01:31.0	yes

<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>
04	(4) SBSS-1622+587	COS/FUV COS/NUV	2	01-Feb-2022 17:01:32.0	yes
05	(1) GAIA-DR2-2860923998433585664	COS/FUV COS/NUV	1	01-Feb-2022 17:01:33.0	yes
06	(1) GAIA-DR2-2860923998433585664	COS/FUV COS/NUV	1	01-Feb-2022 17:01:33.0	yes
07	(3) GAIA-DR2-5279484614703730944	COS/FUV COS/NUV	2	01-Feb-2022 17:01:34.0	yes

11 Total Orbits Used

ABSTRACT

As we move into an epoch of rocky planet detection, white dwarfs that have accreted exoplanetary bodies are unique laboratories to directly study the bulk composition of exoplanetary material and deduce the geological processes in exoplanets. Gas and dust observed close to the white dwarfs trace the accretion of this planetary material into the atmosphere of the white dwarf. The recent three-fold increase in the number of known white dwarfs with gaseous emission (including emission features from O, Na, Mg, Si, Ca, Fe) provides a unique opportunity to study the composition of planetary material in two ways. Abundances can be derived from the gas exterior to the white dwarf, and they can then be compared to the abundances determined from the accreted material in the photosphere of the white dwarf. We propose to obtain abundances of the accreted exoplanetary material from FUV spectra of four recently discovered, heavily polluted white dwarfs with at least O, Ca, and Fe in circumstellar gaseous emission. By comparing the composition of the circumstellar gas with the composition of the material that has accreted onto the atmosphere of the white dwarf, we can probe whether volatiles are accreted simultaneously with refractories. This is crucial to using the observed abundances in the white dwarf photosphere to probe the volatile content of exoplanetary bodies, and to understand how planetary bodies lose (gain) volatiles.

OBSERVING DESCRIPTION

We propose to obtain HST/COS spectra of 4 recently identified heavily polluted white dwarfs with both circumstellar gas and dust to obtain photospheric abundances of: O, Fe, and C, so we can compare the composition of the circumstellar gas and the accreted material in the atmosphere of the white dwarfs.

Proposal 16752 (STScI Edit Number: 4, Created: Tuesday, February 1, 2022 at 5:01:34 PM Eastern Standard Time) - Overview

Technical Set-up: We propose to use the G130M grating in the FUV module with a central wavelength of 1291 Å to parallel the analysis by Jura et al. (2012) and Gaensicke et al. (2012). In accordance with the COS2025 policies, we will only use two FP-POS positions (3 and 4).

CVZ: One of our targets is located in the continuous viewing zone, but we do not require continuous uninterrupted observations. Using the visit planner tool, we find our target is schedulable.

Exposure Times: We scaled the Mg/H abundance determined from ground based optical observations to calculate model spectra for each white dwarf. This gives us expected abundances and line strengths for C, N, O, Si, S, Fe in the UV. For all 4 targets we will confidently detect C, O, and Fe using HST/COS. For each object, we input the model spectra into the COS ETC version 29.1.1 to determine the required on-target observing time. We aim to achieve a signal-to-noise ratio of 20 at 1320 Å, close to the wavelengths of the important C II lines. We use average sky background conditions, and include the overheads for target acquisition and instrumental set-up to determine the requested number of orbits.

Reduced gyro observations: our observations are not time critical, and can be scheduled any time, so reducing the possible observing windows will not affect this proposal. Using the visit planner tool, there are plenty of schedulable opportunities across the cycle for all 4 targets. Target acquisition is required for all of our targets in order to successfully complete the proposed observations.

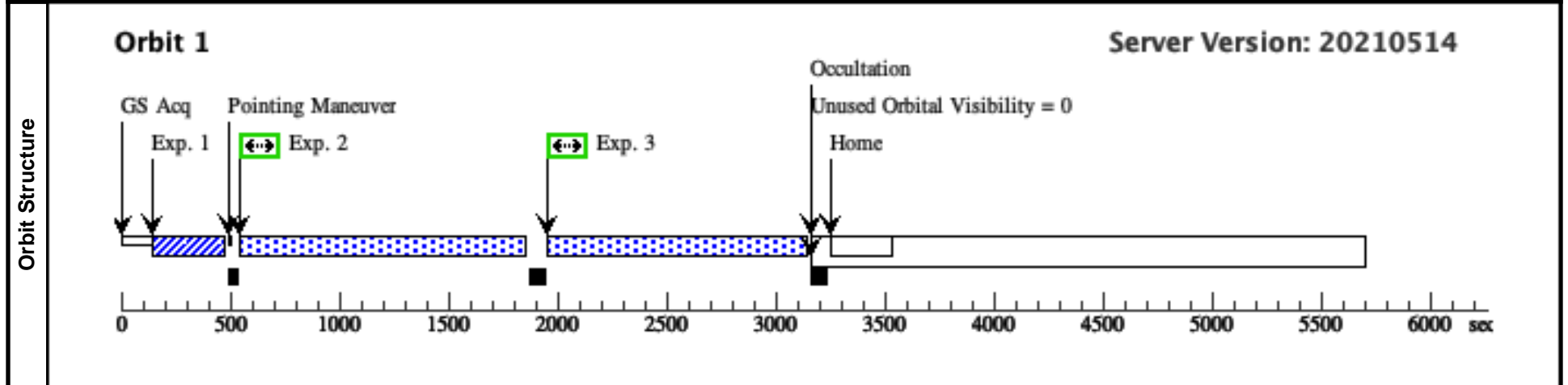
Proposal 16752 - Visit 01 - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous emission

Tue Feb 01 22:01:34 GMT 2022

Visit	Proposal 16752, Visit 01, failed				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: COS/FUV, COS/NUV				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	GAIA-DR2-2860923998433585664	RA: 00 06 34.7129 (1.6446371d) Dec: +28 58 46.54 (28.97959d) Equinox: J2000	Proper Motion RA: 26.5137 mas/yr Proper Motion Dec: 13.295 mas/yr Parallax: 0.0063887" Epoch of Position: 2000.0	V=16.4 Galex FUV = 15.8	Reference Frame: ICRS
	<i>Comments: Target information from Simbad (Gaia DR2). Category=STAR Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO</i>					

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.152 5494)	(1) GAIA-DR2-2860923998433585664	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				12 Secs (12 Secs) [==>]	[1]
	2	(COS.sp.152 5500)	(1) GAIA-DR2-2860923998433585664	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=17 80; FP-POS=3			1141 Secs (1141 Secs) [==>]	[1]
	3	(COS.sp.152 5500)	(1) GAIA-DR2-2860923998433585664	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=17 80; FP-POS=4			1141 Secs (1141 Secs) [==>]	[1]



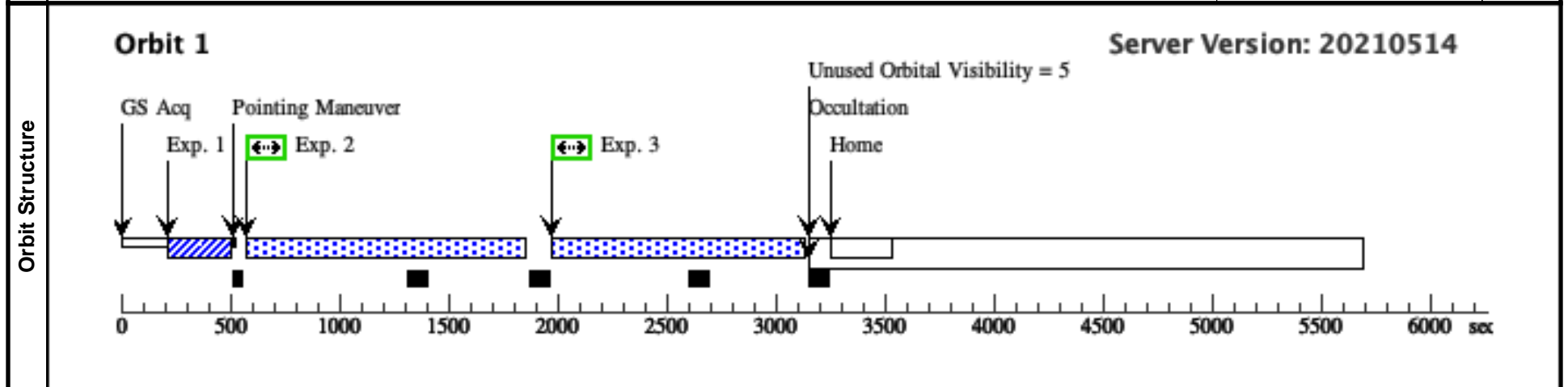
Proposal 16752 - Visit 02 - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous emission

Tue Feb 01 22:01:34 GMT 2022

Visit	Proposal 16752, Visit 02, completed				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: COS/FUV, COS/NUV				
	Special Requirements: (none)				

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	LAMOST-J051002.11+231541.0 Alt Name1: GAIA-DR2-3415788525598117248	RA: 05 10 2.1464 (77.5089433d) Dec: +23 15 41.42 (23.26151d) Equinox: J2000	Proper Motion RA: -48.3002 mas/yr Proper Motion Dec: -38.229 mas/yr Parallax: 0.0153341" Epoch of Position: 2000.0	V=15.1 Galax FUV = 14.1	Reference Frame: ICRS
<i>Comments: Target information from Simbad (Gaia DR2).</i>					
<i>Category=STAR Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO</i>					

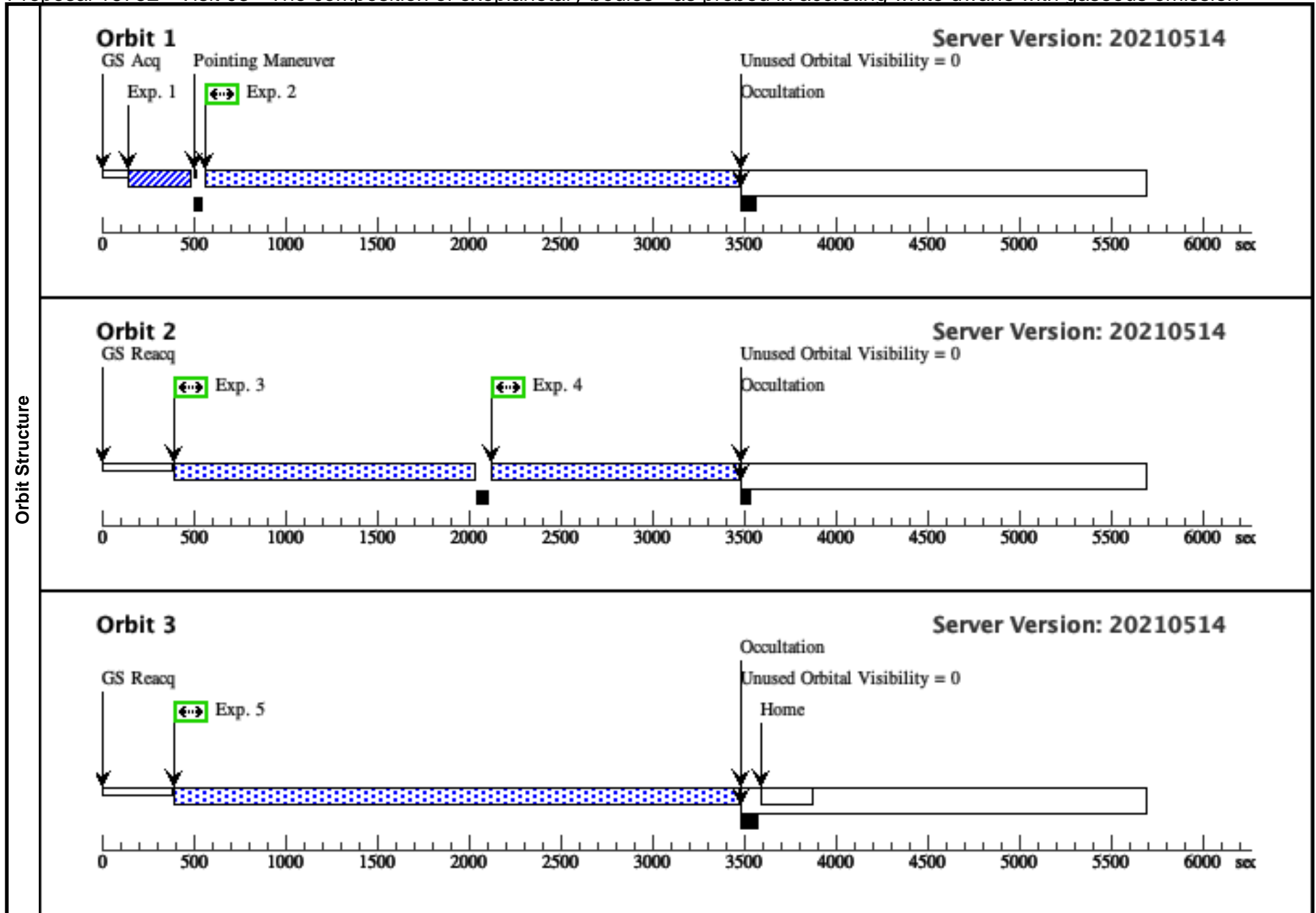
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.152 5499)	(2) LAMOST-J0510 02.11+231541.0	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				25 Secs (25 Secs) [==>]	[1]
2	(COS.sp.152 5509)	(2) LAMOST-J0510 02.11+231541.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=59 0			1114 Secs (1114 Secs) [==>]	[1]
3	(COS.sp.152 5509)	(2) LAMOST-J0510 02.11+231541.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=59 0; FP-POS=4			1110 Secs (1110 Secs) [==>]	[1]



Proposal 16752 - Visit 03 - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous emission

Tue Feb 01 22:01:34 GMT 2022

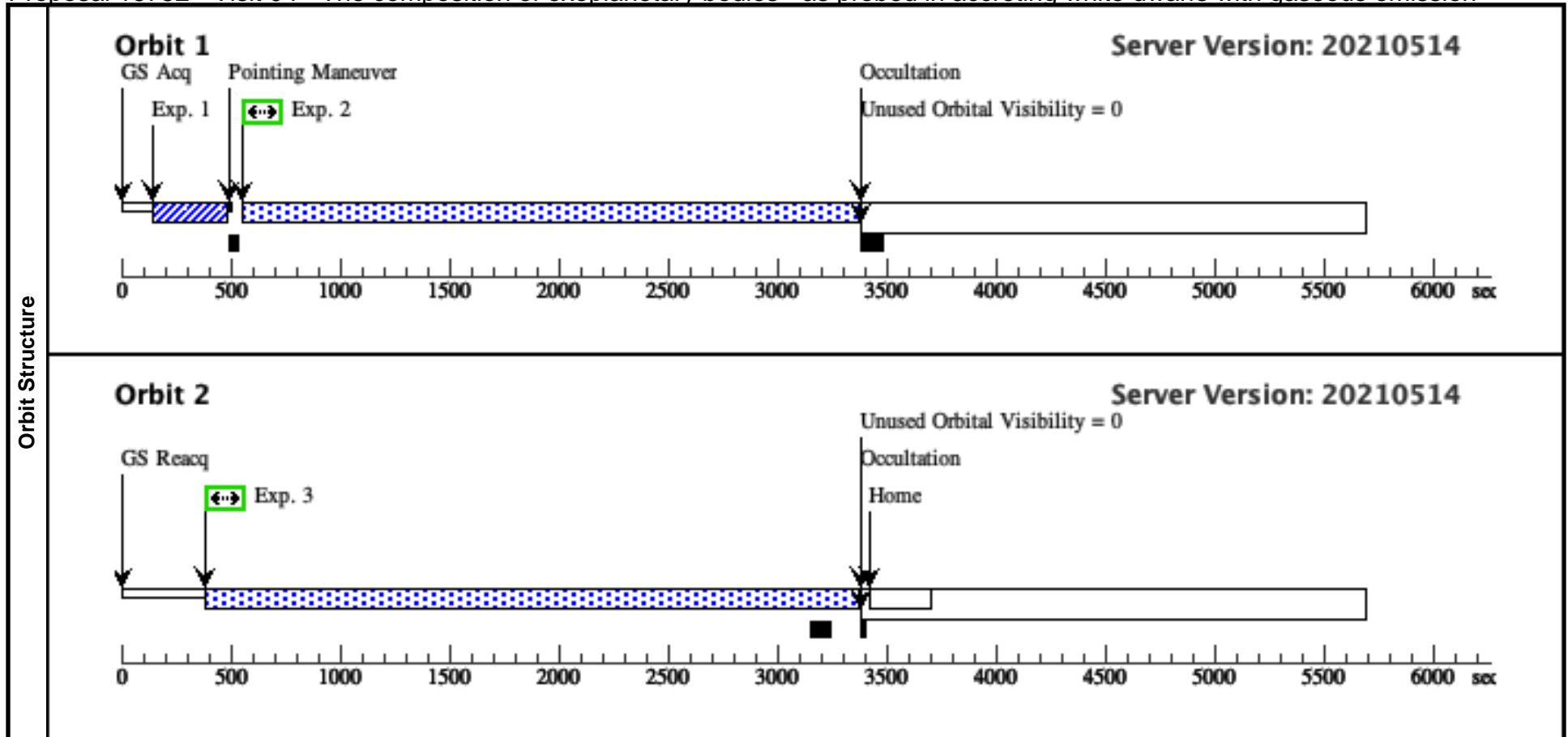
Visit	Proposal 16752, Visit 03, failed Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(3)	GAIA-DR2-5279484614703730944	RA: 06 11 31.6991 (92.8820796d) Dec: -69 31 2.15 (-69.51726d) Equinox: J2000	Proper Motion RA: 64.761 mas/yr Proper Motion Dec: 100.373 mas/yr Parallax: 0.0069923" Epoch of Position: 2000.0	V=16.8 Gaia FUV= 16.6	Reference Frame: ICRS			
	<i>Comments: Target information from Simbad (Gaia DR2).</i> Category=STAR Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.152 5515)	(3) GAIA-DR2-5279 484614703730944	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				19 Secs (19 Secs) [==>]	[1]
	2	(COS.sp.152 5518)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=3			2742 Secs (2742 Secs) [==>]	[1]
	3	(COS.sp.152 9150)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=3			1590 Secs (1590 Secs) [==>]	[2]
	4	(COS.sp.152 9150)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=4			1297 Secs (1297 Secs) [==>]	[2]
	5	(COS.sp.152 9152)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=4			3030 Secs (3030 Secs) [==>]	[3]



Proposal 16752 - Visit 04 - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous emission

Tue Feb 01 22:01:35 GMT 2022

Visit	Proposal 16752, Visit 04, completed Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(4)	SBSS-1622+587 Alt Name1: GAIA-DR2-1623866184737702912 Alt Name2: WD-1622+587	RA: 16 22 59.6453 (245.7485221d) Dec: +58 40 30.90 (58.67525d) Equinox: J2000	Proper Motion RA: 83.1204 mas/yr Proper Motion Dec: -128.692 mas/yr Parallax: 0.0054589 " Epoch of Position: 2000.0	V=16.9 Galax FUV = 16.26	Reference Frame: ICRS			
	<i>Comments: Target information from Simbad (Gaia DR2).</i> Category=STAR Description=[ACCRETION DISK, DB, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.152 5525)	(4) SBSS-1622+587	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				15 Secs (15 Secs)	
									[==>]	[1]
	2	(COS.sp.152 5527)	(4) SBSS-1622+587	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=27 31; FP-POS=3			2653 Secs (2653 Secs)	
								[==>]	[1]	
3	(COS.sp.152 5527)	(4) SBSS-1622+587	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=27 31			2933 Secs (2933 Secs)		
								[==>]	[2]	



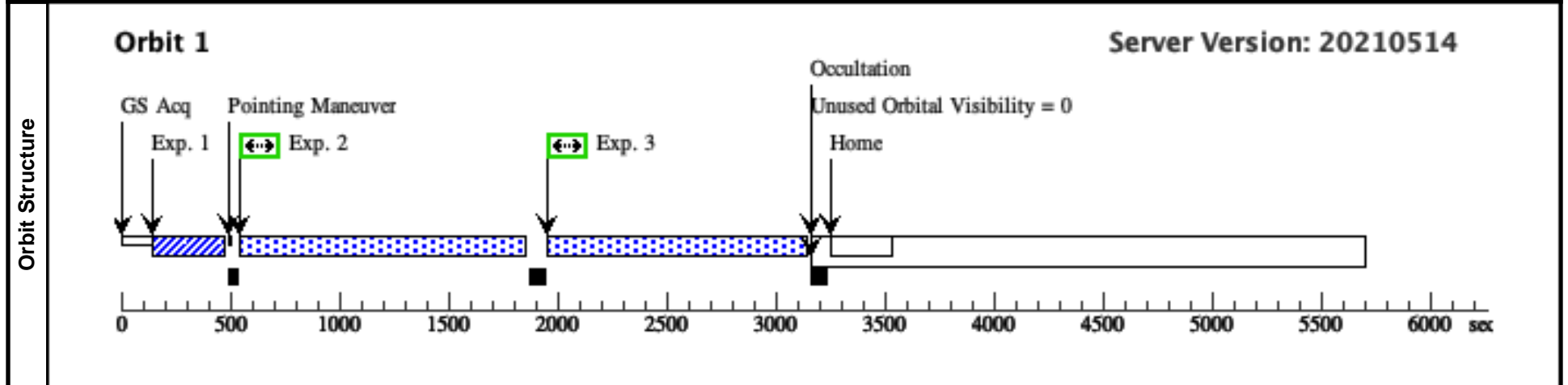
Proposal 16752 - Visit 01 Repeat (05) - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous e...

Tue Feb 01 22:01:35 GMT 2022

Visit	Proposal 16752, Visit 01 Repeat (05), failed				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: COS/FUV, COS/NUV				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	GAIA-DR2-2860923998433585664	RA: 00 06 34.7129 (1.6446371d) Dec: +28 58 46.54 (28.97959d) Equinox: J2000	Proper Motion RA: 26.5137 mas/yr Proper Motion Dec: 13.295 mas/yr Parallax: 0.0063887" Epoch of Position: 2000.0	V=16.4 Galex FUV = 15.8	Reference Frame: ICRS
	<i>Comments: Target information from Simbad (Gaia DR2).</i>					
	Category=STAR Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO					

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.152 5494)	(1) GAIA-DR2-2860923998433585664	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				12 Secs (12 Secs) [==>]	[1]
	2	(COS.sp.152 5500)	(1) GAIA-DR2-2860923998433585664	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1780; FP-POS=3			1141 Secs (1141 Secs) [==>]	[1]
	3	(COS.sp.152 5500)	(1) GAIA-DR2-2860923998433585664	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1780; FP-POS=4			1141 Secs (1141 Secs) [==>]	[1]

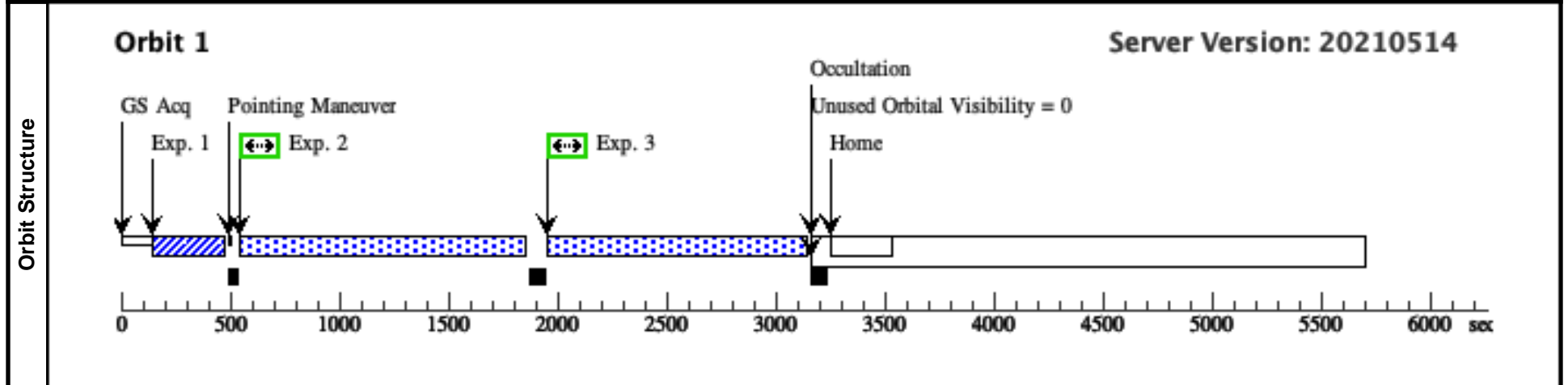


Proposal 16752 - Visit 05 Repeat (06) - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous e...

Visit	Proposal 16752, Visit 05 Repeat (06), completed					Tue Feb 01 22:01:35 GMT 2022
	Diagnostic Status: No Diagnostics					
	Scientific Instruments: COS/FUV, COS/NUV					
	Special Requirements: (none)					

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	GAIA-DR2-2860923998433585664	RA: 00 06 34.7129 (1.6446371d) Dec: +28 58 46.54 (28.97959d) Equinox: J2000	Proper Motion RA: 26.5137 mas/yr Proper Motion Dec: 13.295 mas/yr Parallax: 0.0063887" Epoch of Position: 2000.0	V=16.4 Galex FUV = 15.8	Reference Frame: ICRS
	<i>Comments: Target information from Simbad (Gaia DR2).</i>					
	Category=STAR Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO					

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.152 5494)	(1) GAIA-DR2-2860923998433585664	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				12 Secs (12 Secs) [==>]	[1]
	2	(COS.sp.152 5500)	(1) GAIA-DR2-2860923998433585664	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=17 80; FP-POS=3			1141 Secs (1141 Secs) [==>]	[1]
	3	(COS.sp.152 5500)	(1) GAIA-DR2-2860923998433585664	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=17 80; FP-POS=4			1141 Secs (1141 Secs) [==>]	[1]



Proposal 16752 - Visit 03 Repeat (07) - The composition of exoplanetary bodies - as probed in accreting white dwarfs with gaseous e...

Tue Feb 01 22:01:35 GMT 2022

Visit	Proposal 16752, Visit 03 Repeat (07), scheduling Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(3)	GAIA-DR2-5279484614703730944	RA: 06 11 31.6991 (92.8820796d) Dec: -69 31 2.15 (-69.51726d) Equinox: J2000	Proper Motion RA: 64.761 mas/yr Proper Motion Dec: 100.373 mas/yr Parallax: 0.0069923" Epoch of Position: 2000.0	V=16.8 Gaia FUV= 16.6	Reference Frame: ICRS			
	<i>Comments: Target information from Simbad (Gaia DR2).</i> Category=STAR Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.152 5515)	(3) GAIA-DR2-5279 484614703730944	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				19 Secs (19 Secs)	
									[==>]	[1]
	2	(COS.sp.152 5518)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=3			2742 Secs (2742 Secs)	
									[==>]	[1]
3	(COS.sp.152 9150)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=3			1590 Secs (1590 Secs)		
								[==>]	[2]	
4	(COS.sp.152 9150)	(3) GAIA-DR2-5279 484614703730944	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=35 76; FP-POS=4			1297 Secs (1297 Secs)		
								[==>]	[2]	

