15474 - Water Delivery in Extrasolar Systems: Accretion of Water-Rich Debris onto a Spectacularly Polluted White Dwarf

Cycle: 25, Proposal Category: GO

(UV Initiative)

(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?*
02	(1) APASSJ204713.82-125909.5	COS/FUV	5	21-Aug-2018 11:00:56.0	yes

5 Total Orbits Used

ABSTRACT

Kuiper belt objects are the best candidate source of water and volatile elements delivered to terrestrial planets early in the solar system. Determining the prevalence of this architecture in the galaxy is fundamental to modelling the frequency of habitable planets. We propose to examine a system

showing remarkable water content, and discover the origin of its water-bearing rocky material. White dwarf APASS J2047-1259 exhibits absorption features of both rock-forming and volatile elements. COS Snapshot observations have detected a large oxygen excess, while optical spectra show the extraordinary hydrogen fraction (5% by mass) of the helium atmosphere, beyond explanation by continuous evolution. That the star has undergone accretion is beyond question, but the history of the pollutant material is yet to be determined. A detection of nitrogen would indicate cometary origin, providing firm evidence of hydrogen pollution of white dwarfs from objects formed well beyond the snow line.

We apply for five HST orbits in order to be sensitive to relevant abundances of volatiles that would classify the accreted material. We will also gain a precise measurement of the abundance of oxygen and other elements, allowing a confident determination of the composition and oxygen excess of the accreted material, and thus constraining the mass of water accreted by this star. The results will not only impact understandings of white dwarf atmospheric evolution, but will further our knowledge of the ubiquity and history of water in planetary systems around Sun-like stars.

OBSERVING DESCRIPTION

The purpose of these COS observations are to obtain a high signal-to-noise ratio of the white dwarf APASS2047, which is accreting volatile rich planetary debris. Key lines for this study are N I 1200A, O I 1150A, and multiple lines of S and P. To maximise the S/N, we use two FP-POS settings @ 1291A, and three @ 1222A. The 1222A observations will extend the wavelength coverage into the red wing of Ly beta, which will provide additional constraints on the effective temperature, and allow to probe for the presence / absence of the quasi-molecular Ly beta line near 1175A.

Changes:

21 August 2018: As discussed with Nick, we now split the @ 1222A observations across all four FP-POS settings, double-checked the ETC simulations, modified the buffer times accordingly.

Visit

Proposal 15474, APASSJ204713.82-125909.5 (02), implementation Tue Aug 21 15:00:57 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV

Special Requirements: (none)

Diagnostics

(APASSJ204713.82-125909.5 (02)) 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.

Fixed Targets

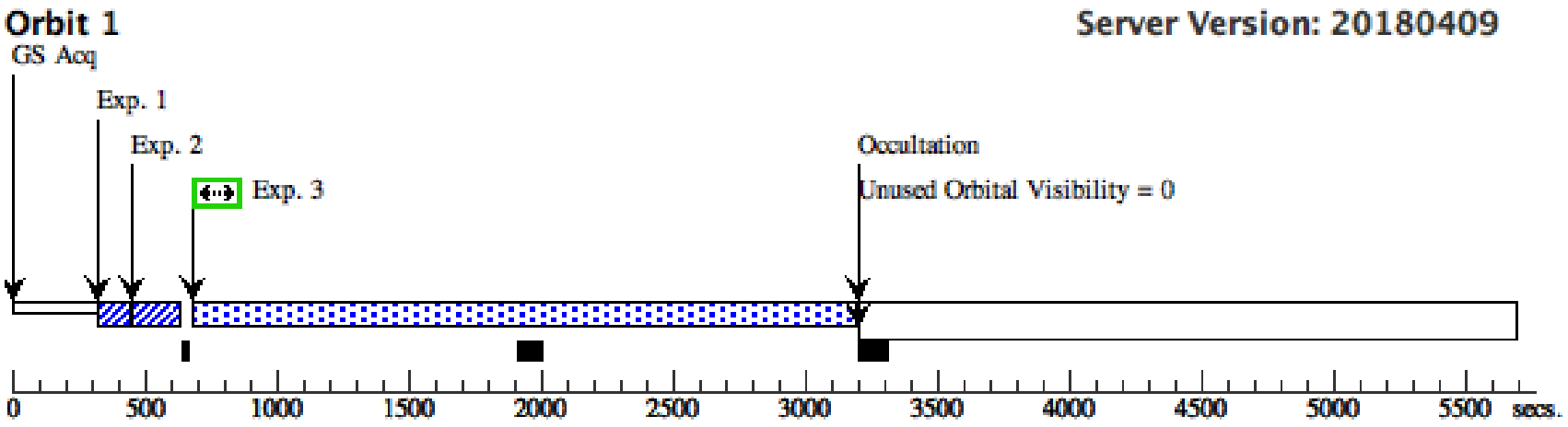
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	APASSJ204713.82-125909.5	RA: 20 47 13.8208 (311.8075867d) Dec: -12 59 8.65 (-12.98574d) Equinox: J2000	Proper Motion RA: 60.693 mas/yr Proper Motion Dec: 19.074 mas/yr Epoch of Position: 2015.5	V=15.85+/-0.1 GALEX FUV=15.59, observed with COS (LDNU0R010), F(1300A)=3e-14erg/cm2/s/A	Reference Frame: ICRS

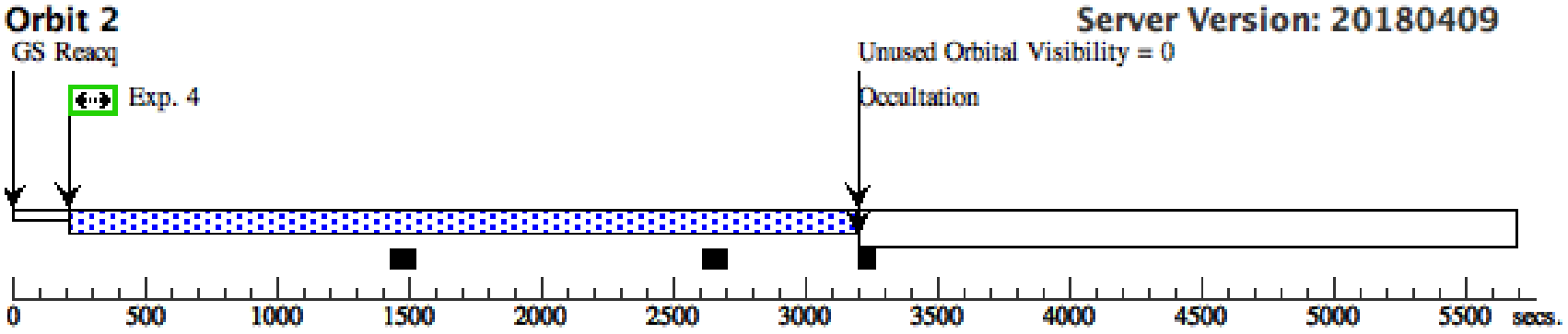
Comments:
Category=STAR
Description=[DA]
Extended=NO

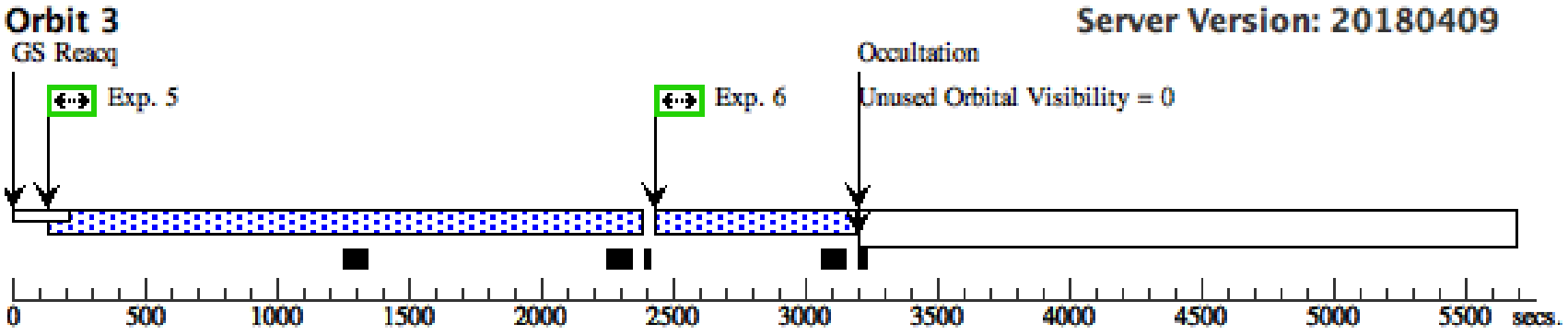
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/PEAKXD (COS.sa.1013029)	(1) APASSJ204713.82-125909.5	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A				5 Secs (5 Secs) *[==>]*	*[1]*
2	ACQ/PEAKD (COS.sa.1013029)	(1) APASSJ204713.82-125909.5	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	STEP-SIZE=0.9; NUM-POS=5; CENTER=DEF			5 Secs (5 Secs) *[==>]*	*[1]*
3	1291/FP-POS3 (COS.sp.1285553)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1200; FLASH=YES; FP-POS=3			2464 Secs (2464 Secs) *[==>]*	*[1]*
4	1291/FP-POS4 (COS.sp.1285553)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1177; FLASH=YES; FP-POS=4			2923 Secs (2923 Secs) *[==>]*	*[2]*
5	1222/FP-POS1 (COS.sp.1285552)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1000; FLASH=YES; FP-POS=1			2111 Secs (2111 Secs) *[==>]*	*[3]*
6	1222/FP-POS2a (COS.sp.1285552)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=597; FLASH=YES; FP-POS=2			707 Secs (707 Secs) *[==>]*	*[3]*
7	1222/FP-POS2b (COS.sp.1285552)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1294; FLASH=YES; FP-POS=2			1404 Secs (1404 Secs) *[==>]*	*[4]*
8	1222/FP-POS3a (COS.sp.1285552)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1304; FLASH=YES; FP-POS=3			1414 Secs (1414 Secs) *[==>]*	*[4]*
9	1222/FP-POS3b (COS.sp.1285552)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=587; FLASH=YES; FP-POS=3			697 Secs (697 Secs) *[==>]*	*[5]*
10	1222/FP-POS4 (COS.sp.1285552)	(1) APASSJ204713.82-125909.5	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1000; FLASH=YES; FP-POS=4			2111 Secs (2111 Secs) *[==>]*	*[5]*

Orbit Structure



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Exp. 6
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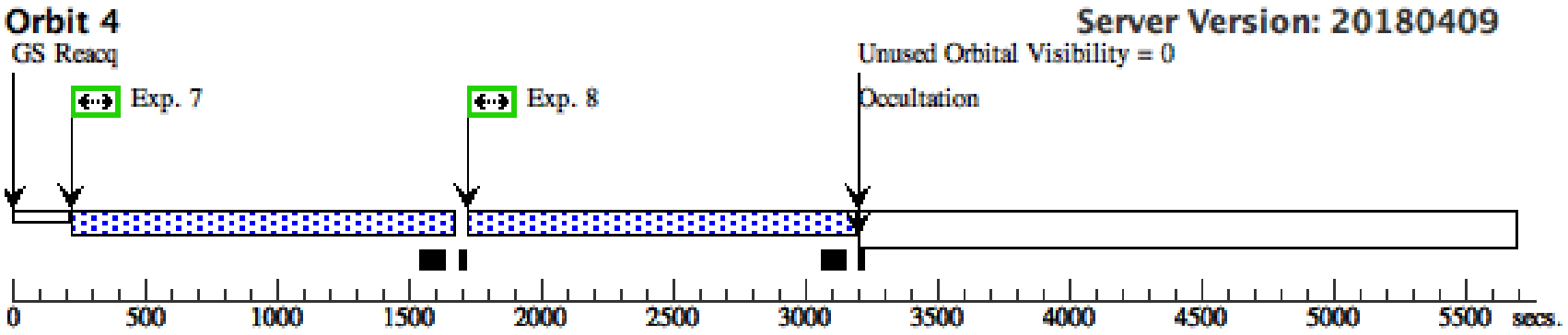
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Exp. 8
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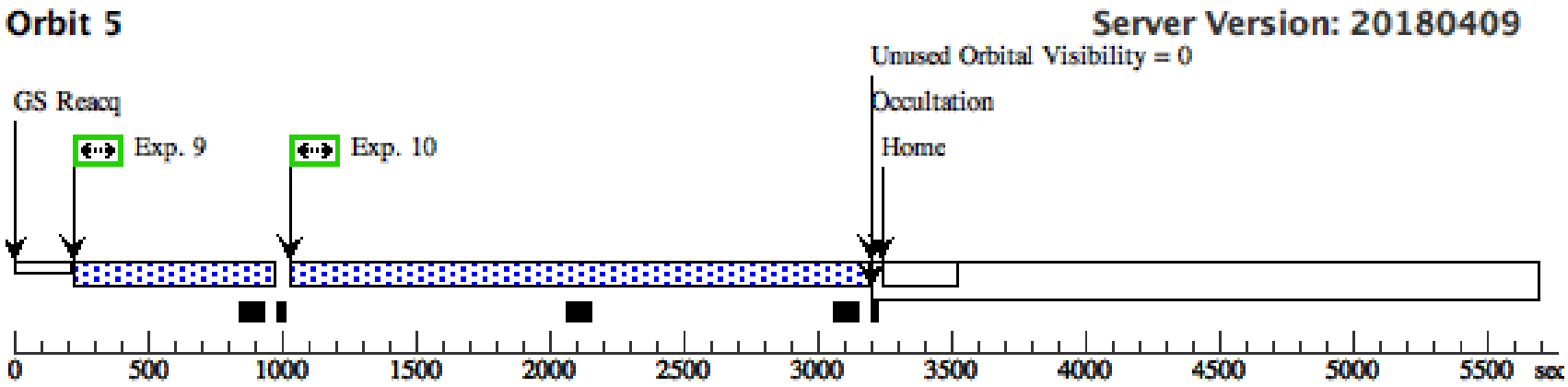
secs.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GS Reacq
Occultation
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Exp. 10
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sec