16286 - The First Double Helium White Dwarf LISA Verification Source

Cycle: 28, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) J2322+0509	STIS/CCD STIS/FUV-MAMA	4	10-Jun-2020 11:00:19.0	yes

4 Total Orbits Used

ABSTRACT

We propose to obtain low resolution ultraviolet spectroscopy of the newly identified 1201 s orbital period detached binary J2322+0509. This is the third shortest-period detached binary known, and it contains two He-core white dwarfs at a ~27 degree inclination. The low-inclination results in no visible photometric effects (e.g., eclipses, ellipsoidal variations), but makes this one of the strongest sources of gravitational waves in the mHz frequency range. Located 760 pc from the Sun, this binary has an estimated LISA 4-yr signal-to-noise ratio of 40. J2322+0509 is the first He+He white dwarf LISA verification binary, a source class that is predicted to account for one-third of all LISA ultra-compact binary detections. Here we request HST STIS observations in the far-ultraviolet to constrain the physical parameters of this binary precisely. The optical data on this system reveals about 15% contribution from the cooler secondary white dwarf, limiting the precision of our model atmosphere analysis on the primary white dwarf. The primary star is hot, and it dominates in the far-ultraviolet. Our STIS data will enable us to constrain the temperature and mass of the

primary precisely, which in turn will constrain the radius and mass of the secondary star, and the inclination of the system. Well-measured white dwarf binaries will be among the best electromagnetic + gravitational wave laboratories for understanding the formation of compact objects, dynamical interactions and tides in binaries. J2322+0509 is one of the best such systems.

OBSERVING DESCRIPTION

Our goal is to obtain low-resolution STIS spectroscopy of J2322+0509 in the TIME-TAG mode. Since our target has GALEX FUV=18.52 mag, we will obtain low resolution observations with the G140L grating.

A S/N =20 STIS spectrum will enable us to constrain the mass of the primary white dwarf in this system precisely. Given the relatively low-amplitude of the radial velocity variations and the broad Lyman alpha line, orbital smearing will have no effect on our analysis of the STIS data.

Visit

Proposal 16286, Visit 01 Wed Jun 10 15:00:19 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

Fixed Targets

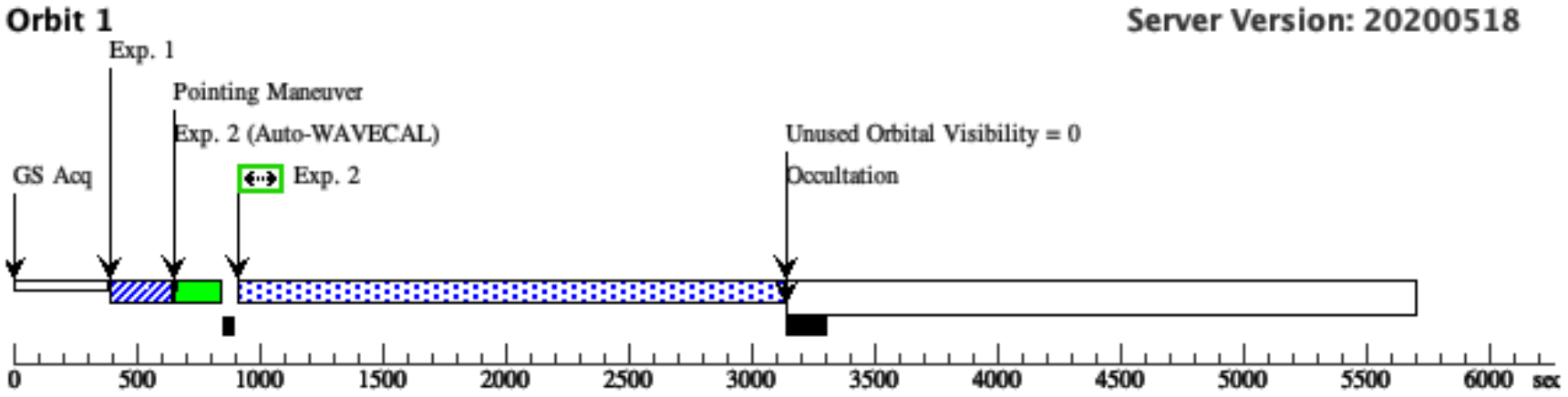
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J2322+0509	RA: 23 22 30.2030 (350.6258458d) Dec: +05 09 42.06 (5.16168d) Equinox: J2000		V=18.6 GALEX FUV = 18.52	Reference Frame: ICRS

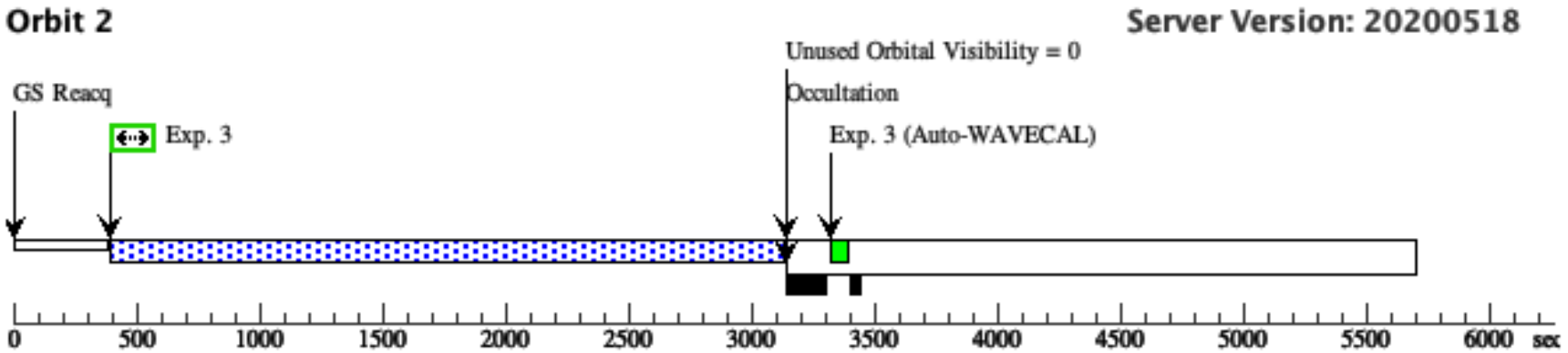
Comments:
Category=STAR
Description=[DA]
Extended=NO

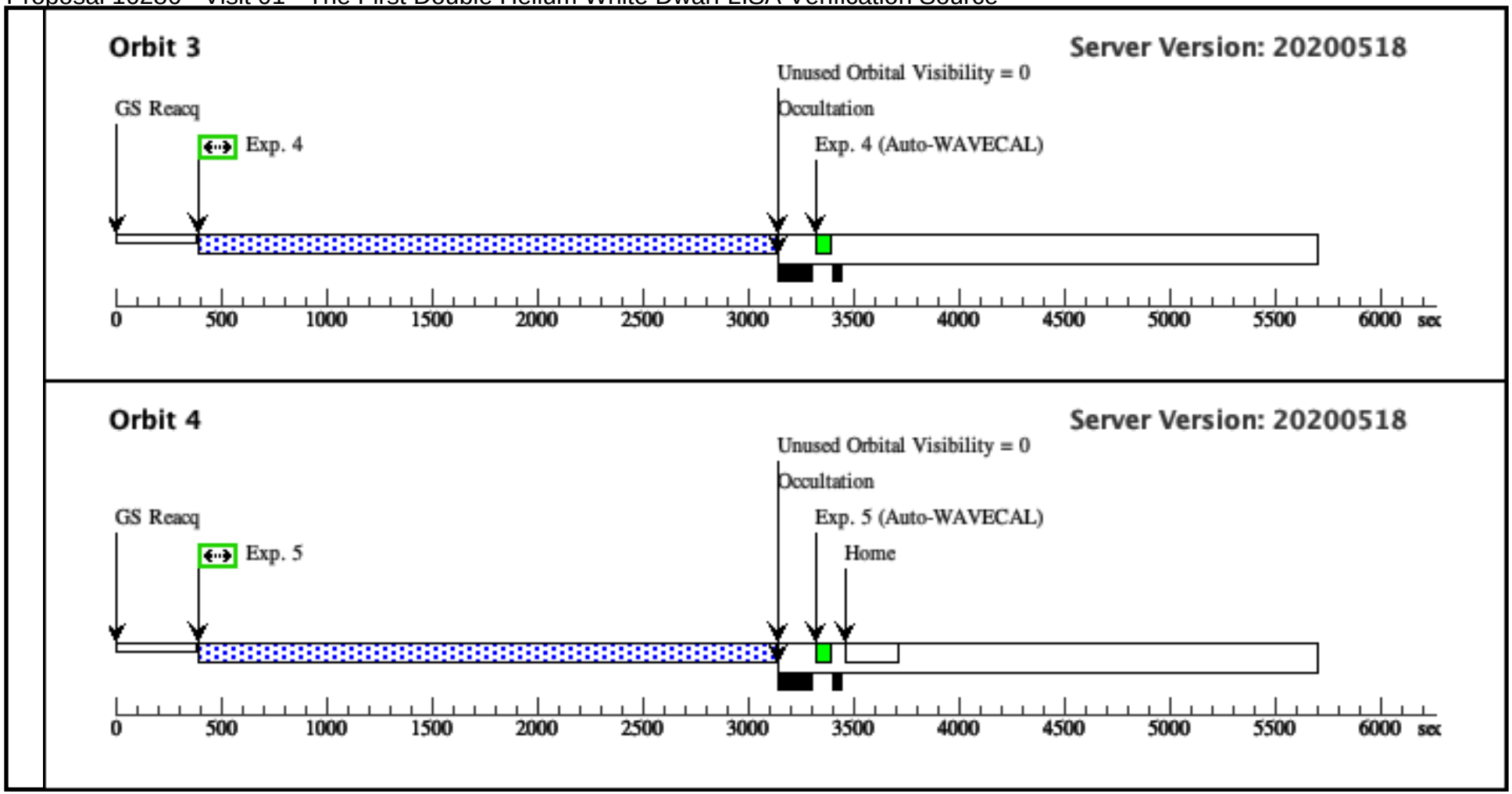
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1445750)	(1) J2322+0509	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			5 Secs (5 Secs)	
								[==>]	***[1]***
2	(1411129)	(1) J2322+0509	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=5170			2205 Secs (2205 Secs)	
								[==>]	***[1]***
3	(1411129)	(1) J2322+0509	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=5170			2725 Secs (2725 Secs)	
								[==>]	***[2]***
4	(1411129)	(1) J2322+0509	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=5170			2725 Secs (2725 Secs)	
								[==>]	***[3]***
5	(1411129)	(1) J2322+0509	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=5170			2725 Secs (2725 Secs)	
								[==>]	***[4]***

Orbit Structure



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Exp. 4 (Auto-WAVECAL)
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1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec
Orbit 4
Server Version: 20200518
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 5
Exp. 5 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec