17789 - NUV observations of transiting exoplanetary debris in a 10-hr orbit around a white dwarf

Cycle: 32, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Joseph Alexander Guidry (PI) (Contact)	**Boston University**
Dr. JJ Hermes (CoI)	Boston University
Dr. Zachary Vanderbosch (CoI)	California Institute of Technology
Prof. Boris T. Gaensicke (CoI) (ESA Member)	University of Warwick

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(2) ZTFJ0328-1219	STIS/CCD STIS/NUV-MAMA	5	08-Nov-2024 18:00:16.0	yes

5 Total Orbits Used

ABSTRACT

The atmospheres of white dwarfs that are accreting a tidally disrupted planetesimal are powerful tools for deriving the bulk chemical composition of exoplanets. Ultraviolet (UV) spectroscopy is necessary to extract the most accurate abundances of these polluted white dwarfs, due to the high temperatures of most white dwarfs and the higher density of metal lines in the UV compared to the optical. Recent studies have discovered several metal-rich white dwarfs that show transits from tidally disrupted debris, but only two such systems have been extensively studied in the UV. We propose near-ultraviolet spectroscopy of ZTF J0328-1219, a newly discovered remnant planetary system that shows persistent transits from a

planetary debris disk that repeat every 10 hours. Our proposal is designed to obtain the near-UV (NUV) spectra required to most accurately derive the abundances of the disrupted rocky material in orbit around the white dwarf and create a time-tagged NUV light curve to constrain the possible wavelength dependence of the transit depths. Our observations will put ZTF J0328-1219 into the broader context of other transiting debris systems, marking a crucial step in understanding the relationship between the orbital periods and eccentricities and observed properties.

OBSERVING DESCRIPTION

The goal of this HST program is to obtain time-resolved STIS near-ultraviolet spectroscopy of the white dwarf ZTFJ0328-1219 to (1) detect the photospheric metal absorption lines in this wavelength range and (2) to probe for color-dependence of the transit depth. The orbital period of the debris is 9.94h.

The observations will be done using the G230L grating, TIME-TAG mode, and the 52x0.5 aperture.

The target acquisition will be performed via a CCD image taken with the FP28x50LP broad-band filter. We used a Teff=7630K blackbody scaled to SDSS g=16.7 for the acquisition ETC run.

For the ETC simulation of the STIS TIME-TAG spectrophotometry, we used a white dwarf model spectrum computed with the parameters from Table 6 of Vanderbosch et al. 2021 (ApJ 917, 41), i.e. Teff=7630K, log g=8.245, log(C/He)=-9.55, and we scaled all other elements to Bulk Earth abundances.

As per our Phase I proposal, the observations have to be carried in a single 5-orbit visit, which will cover nearly a full orbital cycle of the debris.

Visit

Proposal 17789, ZTFJ0328-1219 (01), implementation Fri Nov 08 23:00:17 GMT 2024

Diagnostic Status: No Diagnostics

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

Special Requirements: SCHED 100%; BETWEEN 01-SEP-2025:00:00:00 AND 28-DEC-2025:00:00:00

Fixed Targets

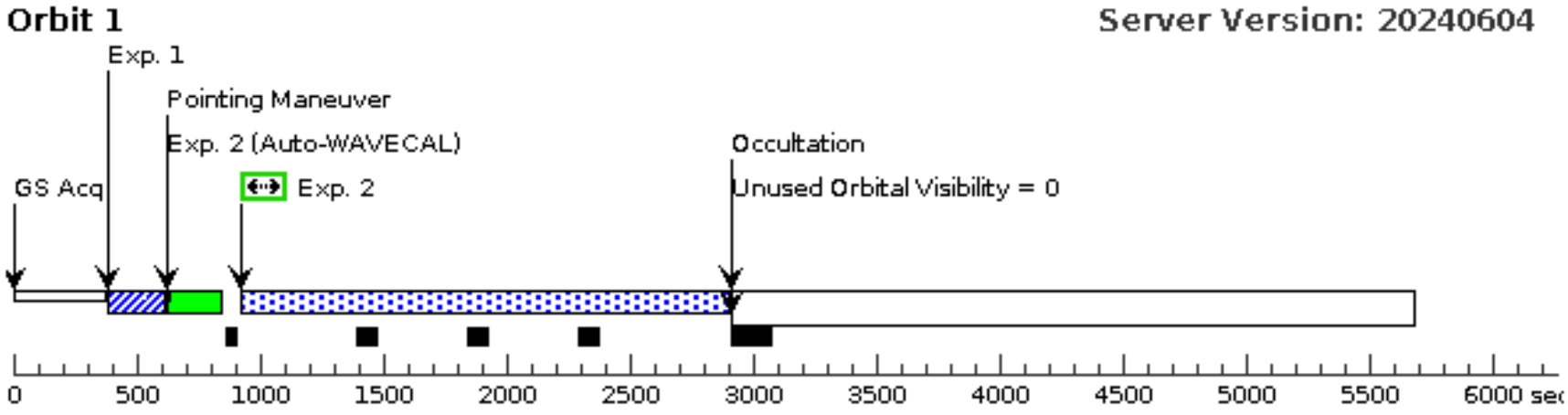
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	ZTFJ0328-1219	RA: 03 28 33.5150 (52.1396458d) Dec: -12 19 45.26 (-12.32924d) Equinox: J2000	Proper Motion RA: 110.73899999999999 mas/yr Proper Motion Dec: -14.392999969459197 mas/yr Parallax: 0.0230377" Epoch of Position: 2000	V=16.6 Gaia G=16.6, GALEX NUV=18.91, SDSS g=16.7	Reference Frame: ICRS

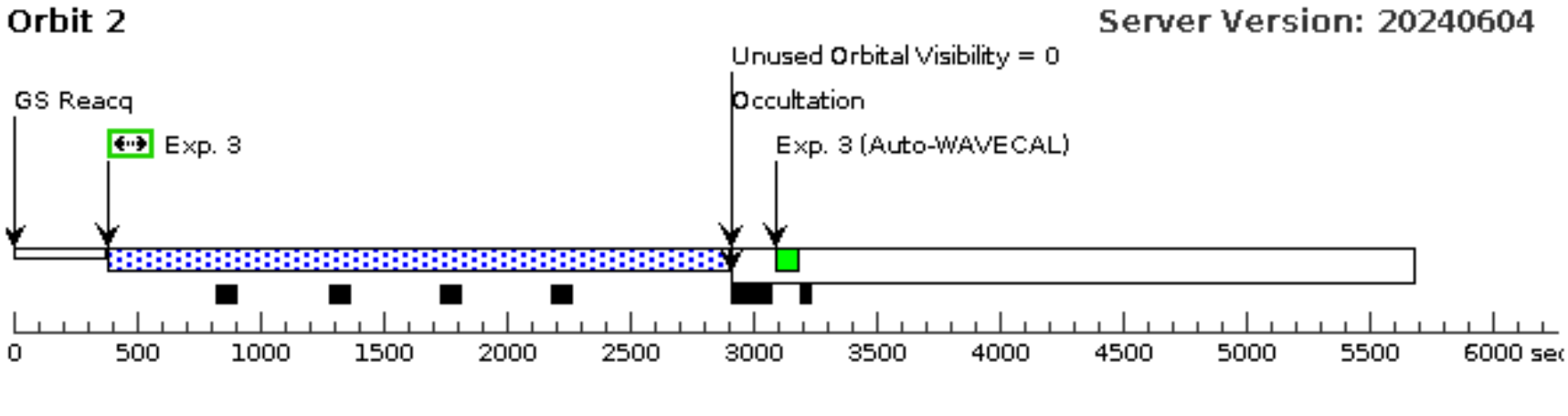
Comments:
Category=STAR
Description=[DC]
Extended=NO

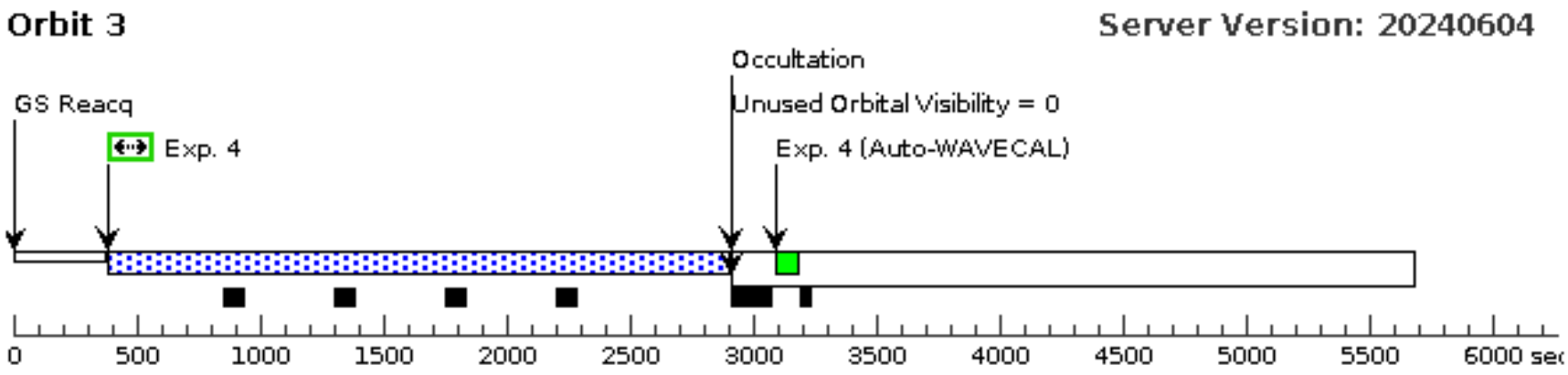
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1930791)	(2) ZTFJ0328-1219	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs)	
								[==>]	***[1]***
Comments: We used a T=7630K blackbody scaled to SDSS g=16.7 for the acquisition ETC run.									
2	(STIS.sp.1930810)	(2) ZTFJ0328-1219	STIS/NUV-MAMA, TIME-TAG, 52X0.5	G230L 2376 A	BUFFER-TIME=450			2042 Secs (1940 Secs)	
								[==>1940.0 Secs]	***[1]***
Comments: We computed a white dwarf model spectrum with the parameters in Table 6 of Vanderbosch et al. 2021 (ApJ 917, 41) as input for the ETC calculation.									
3	(STIS.sp.1930810)	(2) ZTFJ0328-1219	STIS/NUV-MAMA, TIME-TAG, 52X0.5	G230L 2376 A	BUFFER-TIME=450			2584 Secs (2505 Secs)	
								[==>2505.0 Secs]	***[2]***
4	(STIS.sp.1930810)	(2) ZTFJ0328-1219	STIS/NUV-MAMA, TIME-TAG, 52X0.5	G230L 2376 A	BUFFER-TIME=450			2584 Secs (2482 Secs)	
								[==>2482.0 Secs]	***[3]***
5	(STIS.sp.1930810)	(2) ZTFJ0328-1219	STIS/NUV-MAMA, TIME-TAG, 52X0.5	G230L 2376 A	BUFFER-TIME=450			2584 Secs (2482 Secs)	
								[==>2482.0 Secs]	***[4]***
6	(STIS.sp.1930810)	(2) ZTFJ0328-1219	STIS/NUV-MAMA, TIME-TAG, 52X0.5	G230L 2376 A	BUFFER-TIME=450			2584 Secs (2482 Secs)	
								[==>2482.0 Secs]	***[5]***

Orbit Structure



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Occultation
GS Reacq
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Exp. 4 (Auto-WAVECAL)
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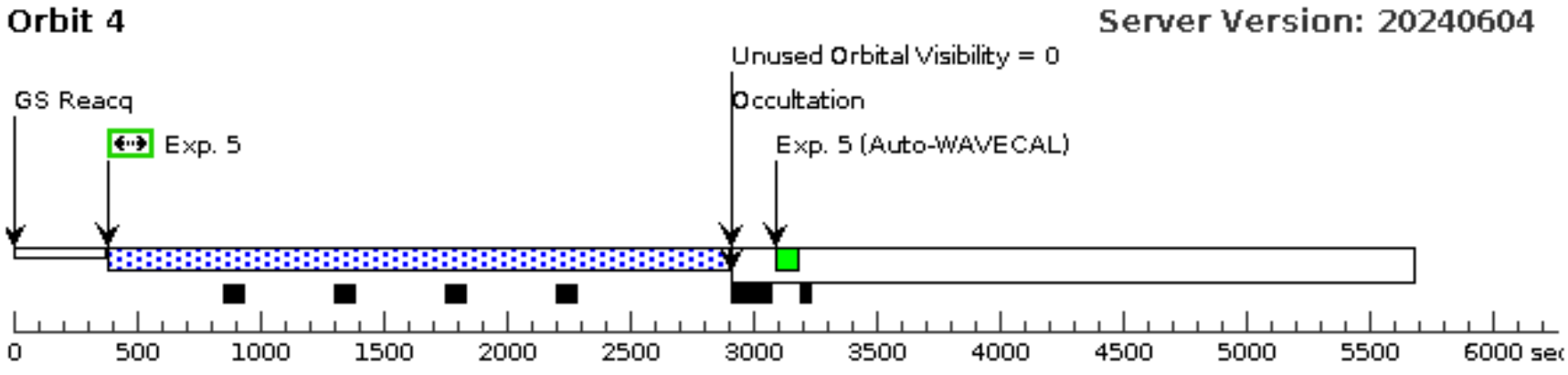
6000 sec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Server Version: 20240604
Unused Orbital Visibility = 0
GS Reacq
Occultation
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Exp. 5 (Auto-WAVECAL)
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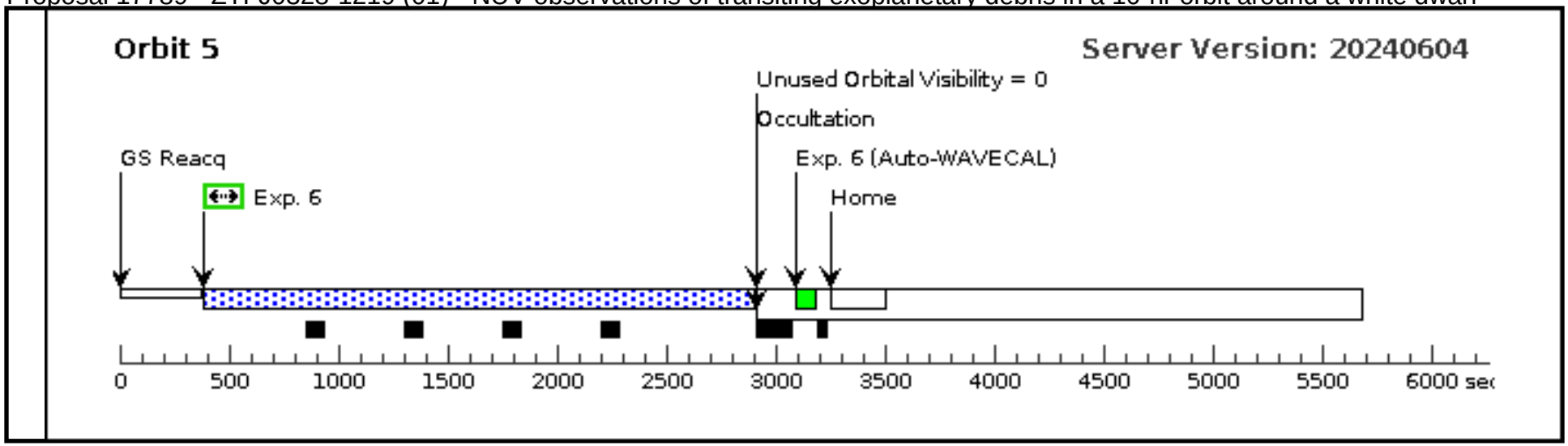
6000 sec


Orbit 5
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Occultation
GS Reacq
Exp. 6
Exp. 6 (Auto-WAVECAL)
Home
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3500
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5000
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6000 sec