15072 - The classical nova hibernation scenario: a definitive confirmation

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?*
01	(1) LL-ERI	COS/FUV COS/NUV	5	08-Mar-2018 16:01:00.0	yes

5 Total Orbits Used

ABSTRACT

The detached white dwarf plus M-dwarf binary LL Eri exhibits truly unique behaviour within this class of compact binaries. As part of a COS snapshot survey, we detected large-amplitude variability in the ultraviolet flux of the white dwarf, confirmed by extensive ground-based blue-band photometry. The three independent frequencies detected in the light curves clearly identify this variability as non-radial pulsations of the white dwarf.

However, with a hydrogen atmosphere and Teff=17200K, this white dwarf is nearly 5000K hotter than the canonical instability strip.

The COS spectrum, albeit noisy, reveals that the metal lines typically detected in this class of stars, arising from material captured from the M-dwarf wind, are very broad. If interpreted as rotationally broadened, they imply a spin of only a few minutes. Such a short period could be explained by a past phase of intense accretion of mass and angular momentum. It has been postulated for over thirty years that classical nova eruptions on the white dwarf could cause such switching from a semi-detached to a detached binary configuration, during which the system "hibernates" - yet, to date no hibernating nova has been identified.

However, the broad lines could also be due to pulsation-driven surface velocity fields, in which case the nature and past evolution of LL Eri would not be easily linked to any exisiting scenario for compact binary evolution.

We propose to obtain a deeper COS observations to unambiguosly determine whether the cause of the observed line broadening is due to rapid rotation, which would unequivocally confirm the hibernation scenario.

OBSERVING DESCRIPTION

This is a white dwarf + M-dwarf binary post common envelope binary (PCEB). The white dwarf parameters are Teff=17200K, log g=8.25, and the spectral type of the companion is M2.5V.

The white dwarf was observed in the UV with COS as part of a snapshot program in Cycle 19 (LBOVNN010), and the metal lines in the white dwarf photoshpere are significantly broader than in any other PCEB, and the time-tag data reveals short-period non-radial pulsations of the white dwarf. The goal of this program is to obtain high S/N data of the metal lines to determine whether they are broadened due to rapid rotation of the white dwarf, or due to the surface motion of the non-radial pulsations.

The Cycle 25 observations are very similar to those carried out in Cycle 19: target acquisition using ACQ/IMAGE (coordinates and proper motions are good), using MIRRORB. The major difference is that we will use the new 1223A setting, which will provide coverage of the red wing of Ly beta as well (which will help to probe for temperature modulations as a function of pulsation phase), and at the same time covers the strongest lines (Si II 1260/65A, C II 1335A, CIII1175A).

2018-Mar-08: changed the target acq. to BOA/MirrorA to pass the M-dwarf clearing procedure.

Visit

Proposal 15072, Visit 01, implementation Thu Mar 08 21:01:02 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 01) Warning (Form): If the target coordinates are not known to 0.4" (or better), an ACQ/SEARCH should precede the ACQ/IMAGE.

(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

Fixed Targets

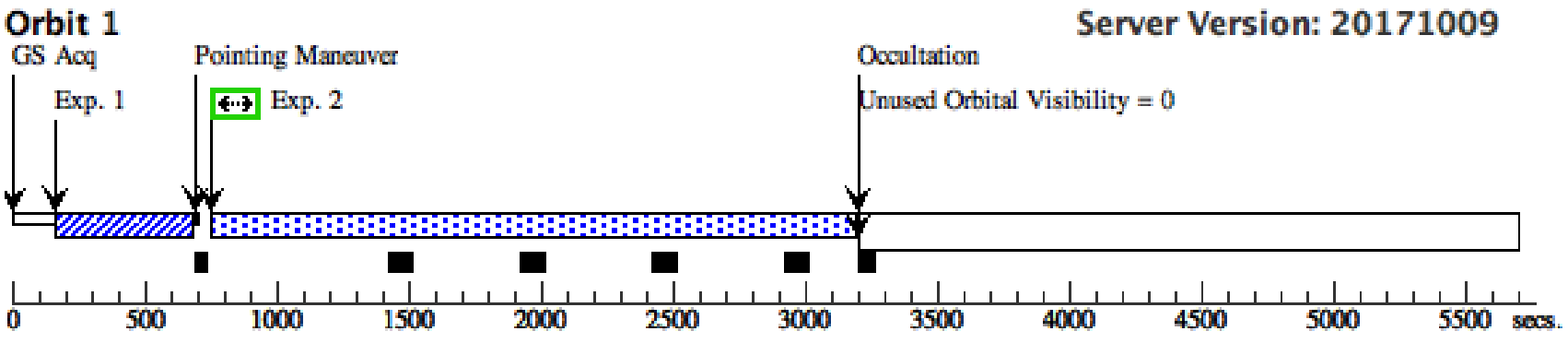
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LL-ERI	RA: 03 32 43.4600 (53.1810833d) Dec: -08 55 39.30 (-8.92758d) Equinox: J2000	Proper Motion RA: 130.5 mas/yr Proper Motion Dec: -105.5 mas/yr Epoch of Position: 2000	V=14.60+/-0.1 GALEX FUV=5655microJy GALEX NUV=4519microJy	Reference Frame: ICRS

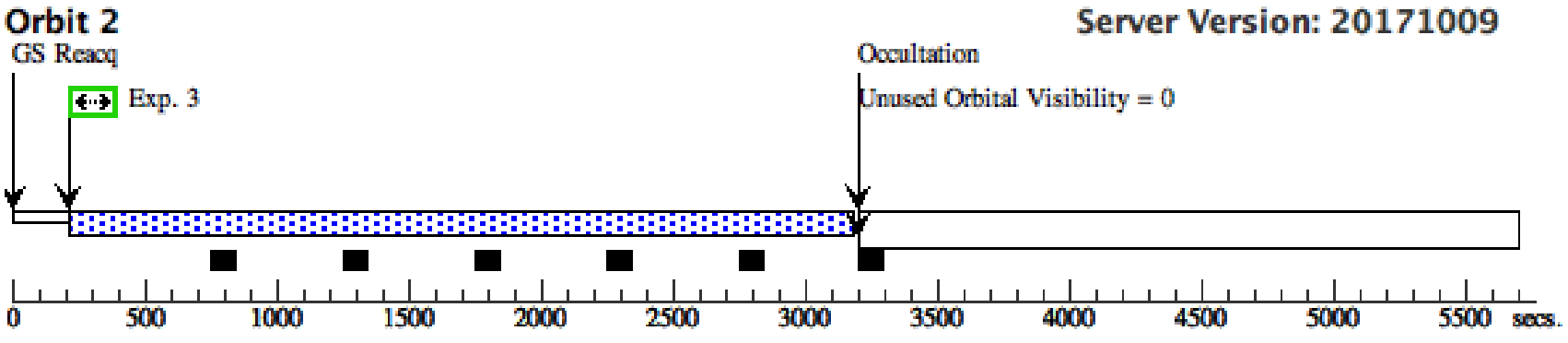
Comments:
Category=STAR
Description=[DA]
Extended=NO

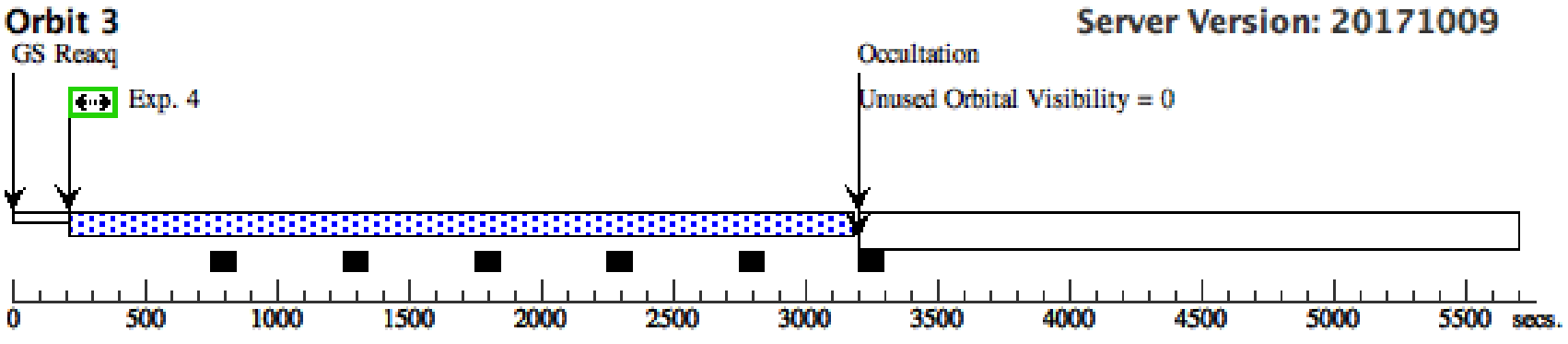
Exposures

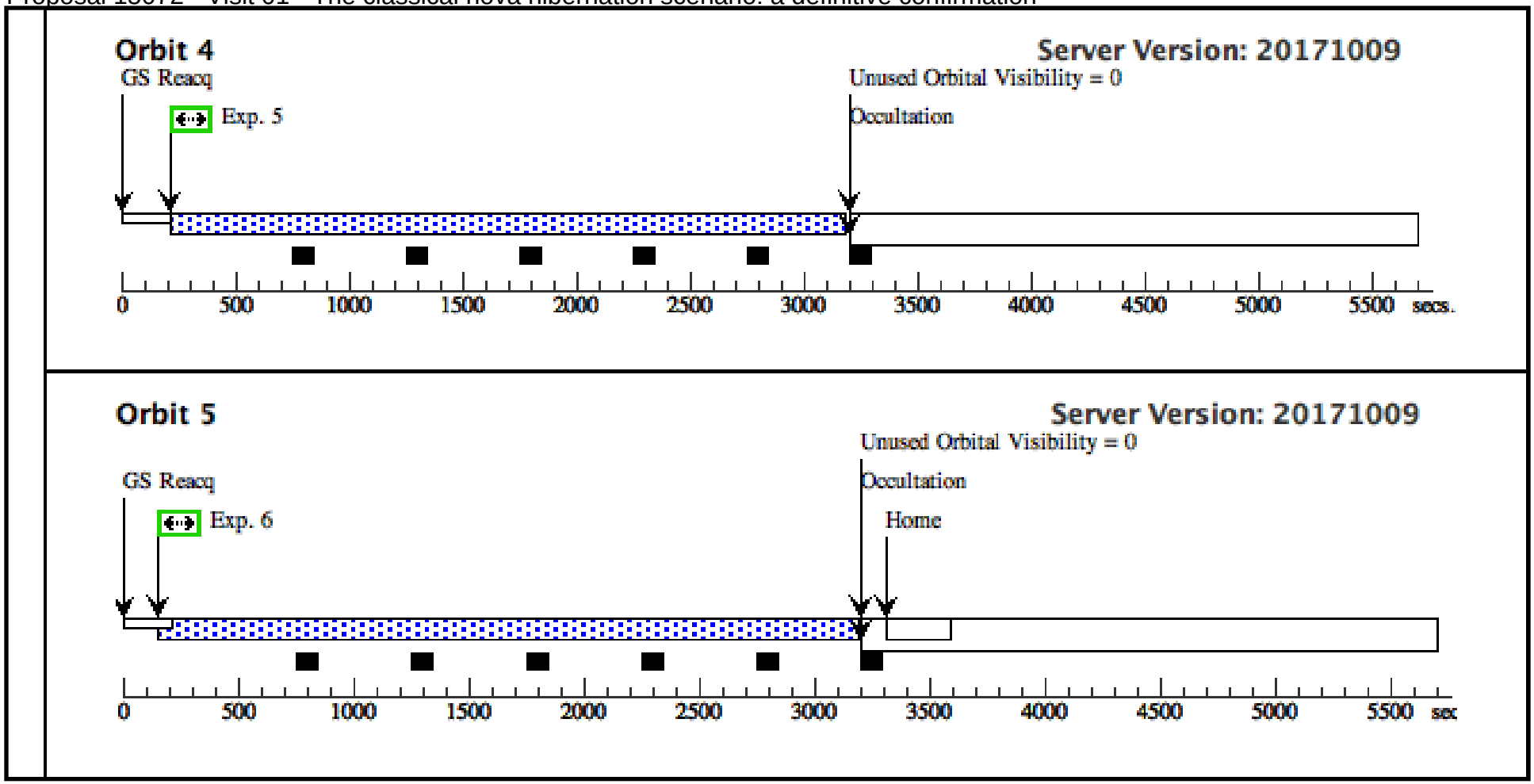
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/Image (COS.ta.1152098)	(1) LL-ERI	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				145 Secs (145 Secs) *[==>]*	***[1]***
2	FP-POS 1 (COS.sp.1013349)	(1) LL-ERI	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=500; FLASH=YES; FP-POS=1			2247 Secs (2247 Secs) *[==>]*	***[1]***
3	FP-POS 2 (COS.sp.1013349)	(1) LL-ERI	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=500; FLASH=YES; FP-POS=2			2919 Secs (2919 Secs) *[==>]*	***[2]***
4	FP-POS 3 (COS.sp.1013349)	(1) LL-ERI	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=500; FLASH=YES; FP-POS=3			2919 Secs (2919 Secs) *[==>]*	***[3]***
5	FP-POS 4 (COS.sp.1013349)	(1) LL-ERI	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=500; FLASH=YES; FP-POS=4			2919 Secs (2919 Secs) *[==>]*	***[4]***
6	FP-POS 1 (COS.sp.1013349)	(1) LL-ERI	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=500; FLASH=YES; FP-POS=1			2919 Secs (2919 Secs) *[==>]*	***[5]***

Orbit Structure





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Orbit 5
Server Version: 20171009
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