11581 - Searching for Pulsations from a Helium White Dwarf Companion to a Millisecond Pulsar

Cycle: 17, Proposal Category: GO

(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) PSR-J1911-5958A	WFC3/UVIS	3	25-Jun-2008 21:09:05.0	yes

3 Total Orbits Used

ABSTRACT

The low mass white dwarf (WD) companion to the 3.26 ms pulsar PSR J1911-5958A offers an unprecedented opportunity for seismological study of the interior of a helium core WD. While much more massive carbon/oxygen core WDs are observed to pulsate in normal modes of oscillation called g-modes (known as ZZ Ceti stars), no helium core pulsator is known. By extrapolating the boundaries of the ZZ Ceti instability strip downward in surface gravity by a factor of 20 below any known pulsator, we find that the effective temperature of this WD makes it an excellent candidate to search for pulsation. Detection of g-mode pulsations in the lightcurve would have a transformative effect on the field of WD pulsations, as this would

allow the first seismological study of the interior of a helium core WD, and the low gravity strongly constrains theories for the driving and amplitudes of pulsations. We show that with 3 orbits of HST, we will detect photometric variations with amplitudes of 1%, lower than typically seen in other hydrogen-dominated ZZ Ceti stars. A set of measured mode periods would also constrain the thickness of the presumed stably hydrogen burning shell, and help us determine its age more securely.

OBSERVING DESCRIPTION

We require rapid and regular sampling to try to measure the oscillation modes of the white dwarf companion to PSR J1911-5958A. We have chosen WFC3 with the UVIS channel and the F200LP filter to maximize our throughput. We are using the UVIS1-C512A-SUB aperture so that we can cut down on the readout time and overhead. With 60-s exposures we have 55-s of overhead, making for a repetition time of 115s. This is fast enough to sample the expected oscillation modes (fastest is ~200 s). We are using CVZ observations to (1) get more exposure time per orbit and (2) get a much more continuous observing regiment without the gaps imposed by occultation that would harm our periodogram. With this strategy, we are using ~12 repetitions of each exposure for a total time of 1370s between exposure series. This is long enough that we will not affect detection of the longest expected periodicities (~600s). Each set of 12 exposures will be taken at the same position (not dithering) to preserve stability. Between each set of 12 we will dither, replicating the UVIS-DITHER-BOX pattern. In each orbit we have 4 sets of 12, and the dither positions will be shifted by (0.5,0.5) arcsec (orbit 2) and (-0.5, -0.5) arcsec (orbit 3) relative to orbit 1 to get better spatial sampling and average over flatfield errors.

Visit

Proposal 11581, Visit 01 Thu Jun 26 01:09:34 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: CVZ

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PSR-J1911-5958A	RA: 19 11 42.7600 (287.9281667d) Dec: -59 58 26.90 (-59.97414d) Equinox: J2000		V=22.13+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO			60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[1]***
2		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG .158,.070		60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[1]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
3		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG .099,.165		60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[1]***
4		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG -0.06,.095		60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[1]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
5		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG .5,.5		60 Secs X 13	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]*	***[2]***
6		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG .658,.57		60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[2]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
7		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG .599,.665		60 Secs X 13	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]*	***[2]***
8		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG .44,.595		60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[2]***

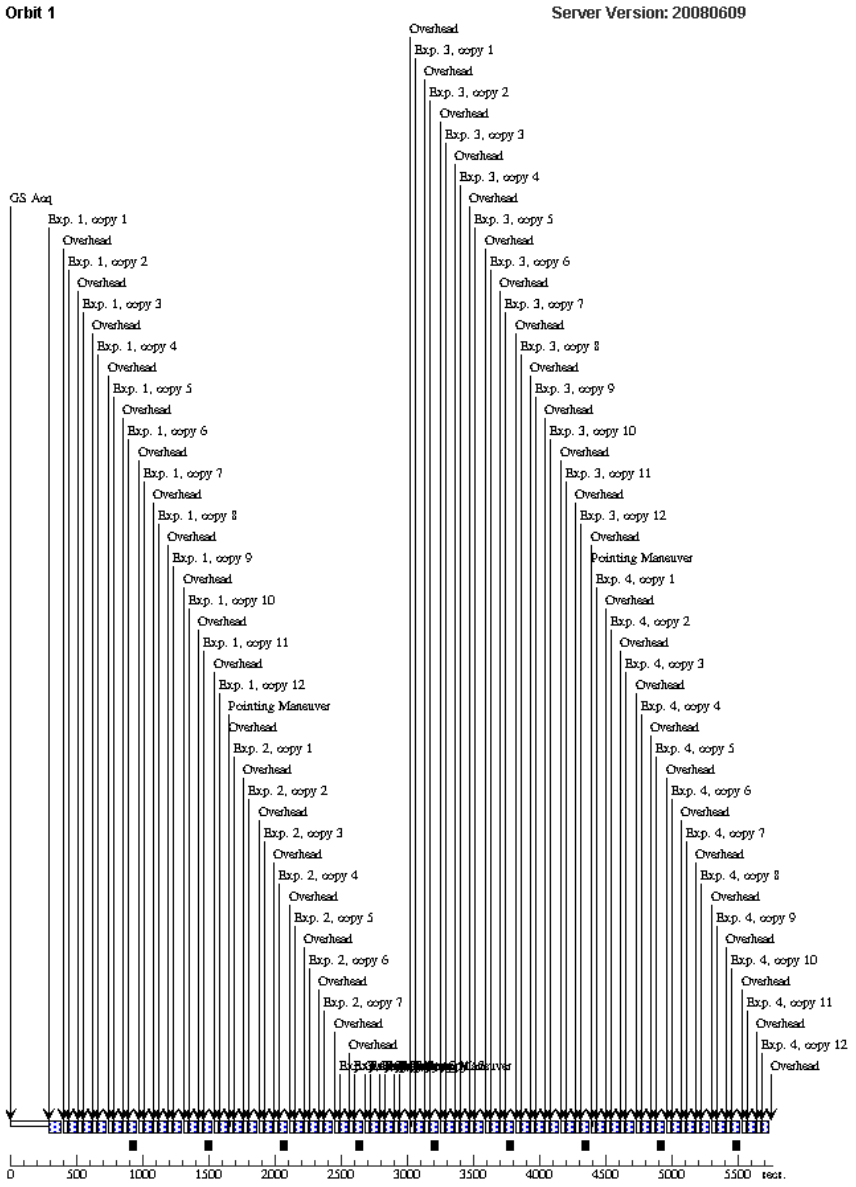
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
9		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG -0.5,-0.5		60 Secs X 12	
								[==>(Copy 1)]	***[2]***
								[==>(Copy 2)]	***[3]***
								[==>(Copy 3)]	
								[==>(Copy 4)]	
								[==>(Copy 5)]	
								[==>(Copy 6)]	
								[==>(Copy 7)]	
								[==>(Copy 8)]	
								[==>(Copy 9)]	
								[==>(Copy 10)]	
								[==>(Copy 11)]	
								[==>(Copy 12)]	
10		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG -0.342,-0.43		60 Secs X 12	
								[==>(Copy 1)]	***[3]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
								[==>(Copy 4)]	
								[==>(Copy 5)]	
								[==>(Copy 6)]	
								[==>(Copy 7)]	
								[==>(Copy 8)]	
								[==>(Copy 9)]	
								[==>(Copy 10)]	
								[==>(Copy 11)]	
								[==>(Copy 12)]	

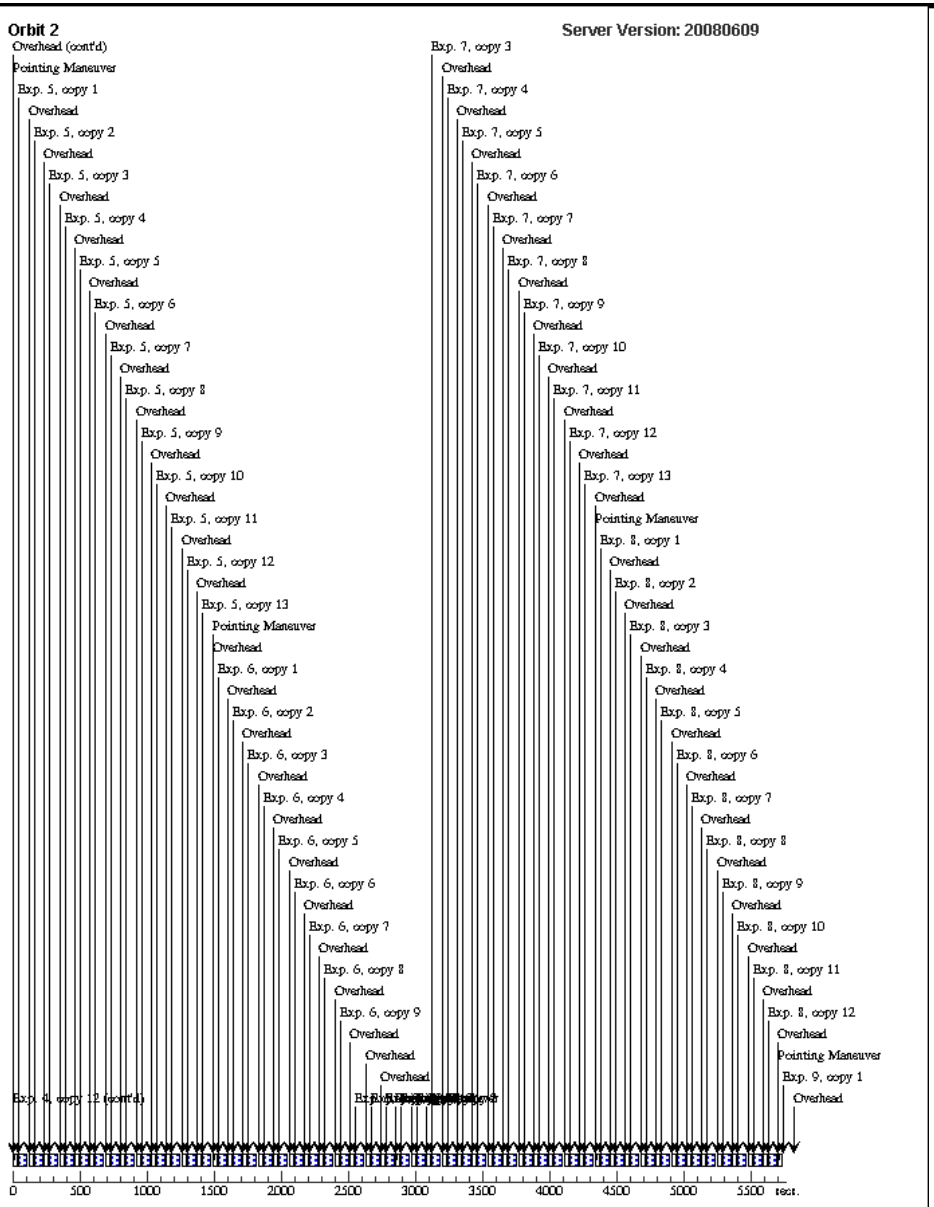
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
11		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG -0.401,-.335		60 Secs X 12	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]*	***[3]***
12		(1) PSR-J1911-5958 A	WFC3/UVIS, ACCUM, UVIS1-C512A-SUB	F200LP	CR-SPLIT=NO	POS TARG -0.56,-0.405		60 Secs X 9	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]*	***[3]***

Orbit Structure



Orbit Structure (continued)



Orbit Structure (continued)