



18439 - Wind velocity variations as a clue to late stage binary evolution processes

Cycle: 34, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Julian M. Pittard (CoI) (ESA Member)	University of Leeds

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) HD-5980	STIS/CCD STIS/FUV-MAMA	2	07-Aug-2026 11:00:17.0	yes
02	(1) HD-5980	STIS/CCD STIS/FUV-MAMA	2	07-Aug-2026 11:00:18.0	yes
03	(1) HD-5980	STIS/CCD STIS/FUV-MAMA	2	07-Aug-2026 11:00:19.0	yes

6 Total Orbits Used

ABSTRACT

Recent observations of very high-redshift star forming regions highlight the need to use nearby proxies to improve our understanding of massive star binary evolution, particularly with respect to processes responsible for enhancing heavy chemical element yields and producing more massive black hole end products. HD5980 is the ideal proxy for these studies. It is located in the Small Magellanic Cloud and its two nitrogen-rich Wolf-Rayet components are so massive and luminous, they can only be the product of highly efficient internal mixing processes, as needed to produce large heavy element yields. In addition, the primary component was observed to undergo a major eruption in 1994, reminiscent of such mass-shedding events observed in distant galaxies a few decades prior to a supernova. It is an eclipsing binary, thus allowing for precise determination of the orbit and stellar parameters. However, ultraviolet monitoring has provided the varying wind speeds only during the eruptive phase. This proposal aims to obtain the wind velocities and UV fluxes now that the system has returned to the pre-eruption state.

The requested HST/STIS spectroscopic observations will provide the valuable information needed to identify the eruption triggering mechanism, as well as yield insights into the role of binary interactions (prior to mass-transfer events) in low-metallicity, star-forming environments. They will also benefit wind-wind collision and interstellar medium studies. Only HST can provide observations of the UV resonance and low-excitation P Cygni lines needed to precisely measure the wind velocities of the different stars in the HD5980 system.

OBSERVING DESCRIPTION

HD5980 will be observed during 3 visits each lasting 2 orbits, in the 1170--1730 Å spectral interval with STIS using the FUV MAMA detector, the E140M grating and the 0.2x0.2 slit. It will also be observed using the CCD detector and the G230LB and G430L gratings, which occupy only a small fraction of each visit and provide a uniformly flux-calibrated spectral energy distribution for comparison with the radiation transfer models.

Each visit corresponds to an orbital phase of the HD5980 eclipsing system. The orbital ephemeris has been updated recently by Schmutz et al. (2026, in preparation) based on the observed eclipse minima of Sterken & Breysacher (1997) and those extracted from the TESS archive: $P=19.266032$ days and $T_0=\text{HJD } 2450036.41$. Primary eclipse is at $\phi=0$ and secondary eclipse is at $\phi=0.36$. We are requesting observations at orbital phases 0.00 ± 0.02 , 0.36 ± 0.02 and 0.75 ± 0.05 .

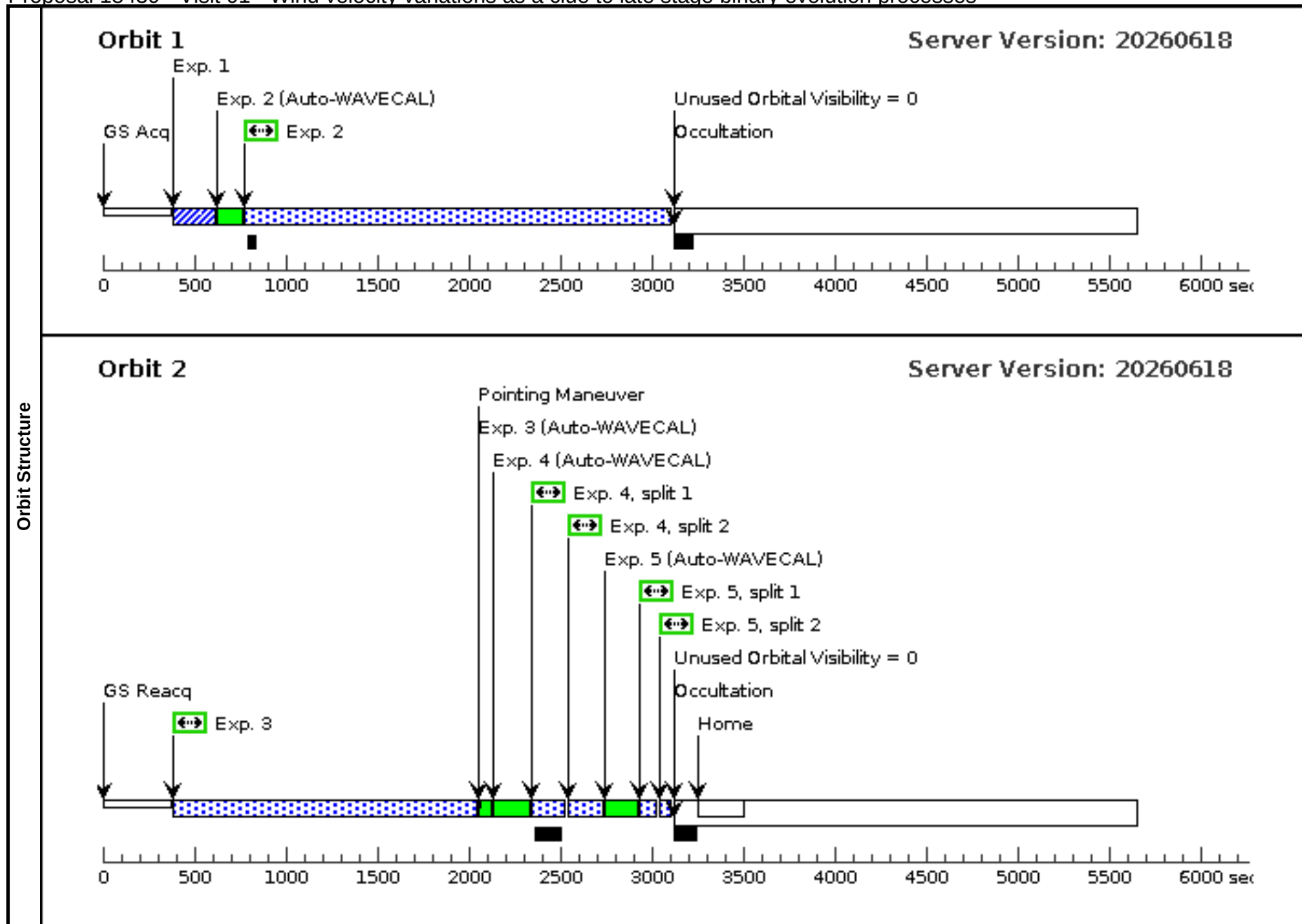
For the FUV MAMA observations, the ETC indicates exposure times of 3800 sec in order to reach at least $S/N=35$ per resolution element at 1480 Å, and adopting $E(B-V)=0.06$. These S/N will provide sufficient signal in the P Cyg absorptions for analysis.

The CCD G230LB observations will require an exposure time of at least 200 sec to provide $S/N \sim 30$ at the N IV 1718 Å line. The sufficient exposure times for grating G430L is 50 sec. The total exposure time+overheads for the CCD spectra is approximately 20 min, assuming a 5 min

overhead per CCD exposure. Adopting for the average visibility 53 minutes per orbit, each visit can be fit into 2 orbits. The first orbit will contain the target acquisition and part of the FUV-MAMA exposure. The second orbit will contain the second part of the FUV-MAMA exposure and the CCD spectra. The mixture of MAMA and CCD observations in the same orbit is justified by the short exposure time required for the CCD spectra.

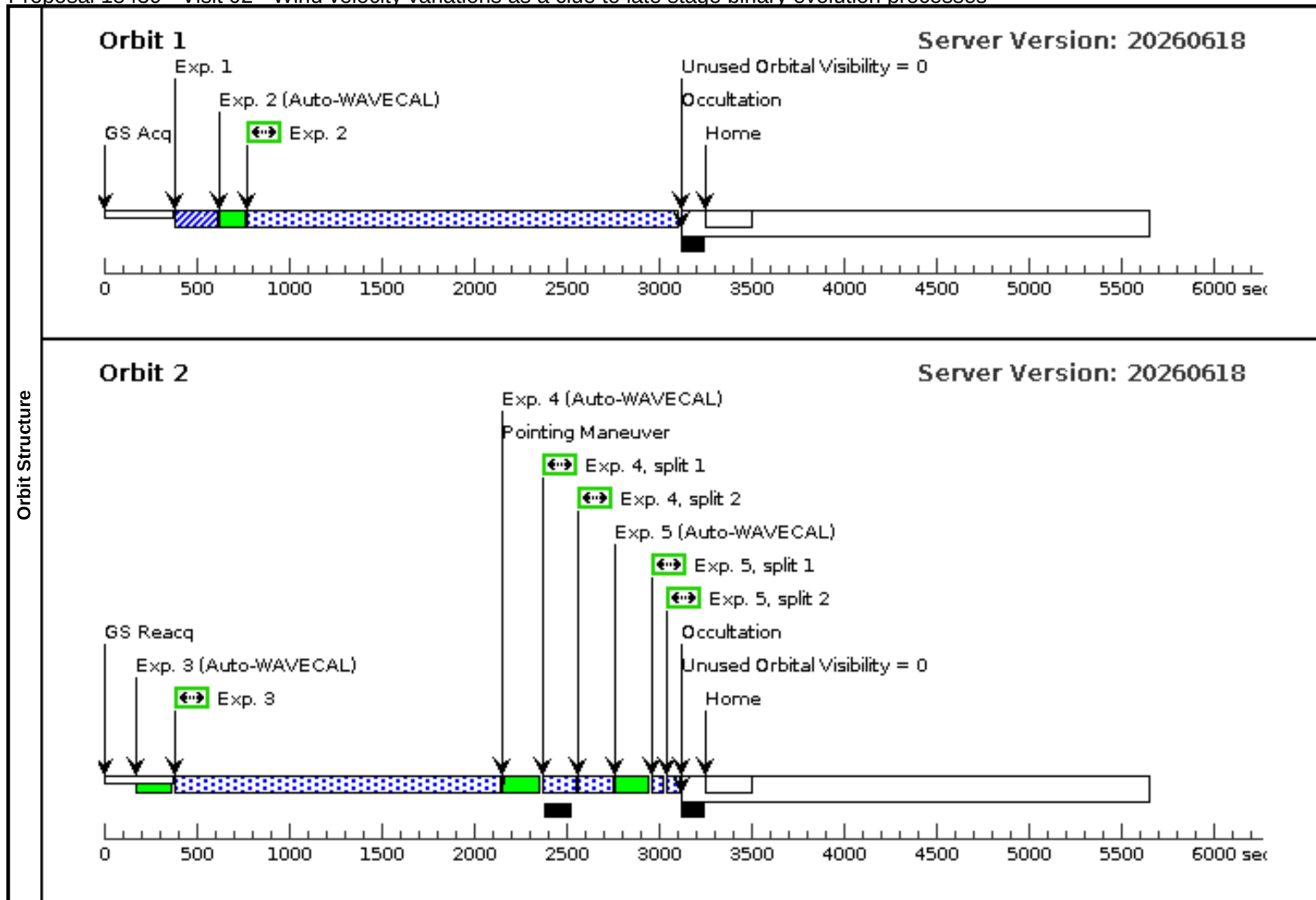
Proposal 18439 - Visit 01 - Wind velocity variations as a clue to late stage binary evolution processes

Visit	Proposal 18439, Visit 01								Fri Aug 07 15:00:19 GMT 2026	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: Period 19.266032 D AND ZERO-PHASE HJD2450036.41									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HD-5980	RA: 00 59 26.5839 (14.8607662d)	Proper Motion RA: 0.903 mas/yr	V=11.31+/-0.1	Reference Frame: ICRS				
		Alt Name1: HD5980	Dec: -72 09 53.93 (-72.16498d)	Proper Motion Dec: -1.3379999700191547 mas/yr						
			Equinox: J2000	Parallax: 6.08E-5"	Epoch of Position: 2000					
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.									
	Category=EXT-STAR									
	Description=[WOLF RAYET - WN]									
	Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) HD-5980	STIS/CCD, ACQ, F28X50LP	MIRROR		PHASE 0.98 TO 0.0 2		0.5 Secs (0.5 Secs)	
									[==>]	[1]
	2	(2363596)	(1) HD-5980	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				2316 Secs (2316 Secs)	
									[==>]	[1]
	3	(2363596)	(1) HD-5980	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				1642 Secs (1642 Secs)	
									[==>]	[2]
	4		(1) HD-5980	STIS/CCD, ACCUM, 52X0.2	G230LB 2375 A				300 Secs (300 Secs)	
									[==>(Split 1)]	[2]
									[==>(Split 2)]	
5		(1) HD-5980	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A				50 Secs (60 Secs)		
								[==>60.0 Secs (Split 1)]	[2]	
								[==>0 Secs (Split 2)]		



Proposal 18439 - Visit 02 - Wind velocity variations as a clue to late stage binary evolution processes

Visit	Proposal 18439, Visit 02							Fri Aug 07 15:00:20 GMT 2026		
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: Period 19.266032 D AND ZERO-PHASE HJD2450036.441									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HD-5980	RA: 00 59 26.5839 (14.8607662d)	Proper Motion RA: 0.903 mas/yr	V=11.31+/-0.1	Reference Frame: ICRS				
		Alt Name1: HD5980	Dec: -72 09 53.93 (-72.16498d)	Proper Motion Dec: -1.3379999700191547 mas/yr						
			Equinox: J2000	Parallax: 6.08E-5"						
	Epoch of Position: 2000									
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database.									
	Category=EXT-STAR									
	Description=[WOLF RAYET - WN]									
	Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) HD-5980	STIS/CCD, ACQ, F28X50LP	MIRROR		PHASE 0.34 TO 0.3 8		0.5 Secs (0.5 Secs)	
									[==>]	[1]
	2	(2363600)	(1) HD-5980	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				2316 Secs (2316 Secs)	
									[==>]	[1]
	3	(2363600)	(1) HD-5980	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A		PHASE 0.34 TO 0.3 8		1748 Secs (1748 Secs)	
									[==>]	[2]
	4		(1) HD-5980	STIS/CCD, ACCUM, 52X0.2	G230LB 2375 A				300 Secs (300 Secs)	
									[==>(Split 1)]	
									[==>(Split 2)]	[2]
5		(1) HD-5980	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A				60 Secs (60 Secs)		
								[==>(Split 1)]		
								[==>(Split 2)]	[2]	



Proposal 18439 - Visit 03 - Wind velocity variations as a clue to late stage binary evolution processes

Visit	Proposal 18439, Visit 03										Fri Aug 07 15:00:20 GMT 2026
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA										
	Special Requirements: Period 19.266032 D AND ZERO-PHASE HJD2450036.441										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections			Fluxes	Miscellaneous			
	(1)	HD-5980	RA: 00 59 26.5839 (14.8607662d)	Proper Motion RA: 0.903 mas/yr			V=11.31+/-0.1	Reference Frame: ICRS			
		Alt Name1: HD5980	Dec: -72 09 53.93 (-72.16498d)	Proper Motion Dec: -1.3379999700191547 mas/yr							
			Equinox: J2000	Parallax: 6.08E-5"							
	Epoch of Position: 2000										
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.										
	Category=EXT-STAR										
	Description=[WOLF RAYET - WN]										
	Extended=NO										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1		(1) HD-5980	STIS/CCD, ACQ, F28X50LP	MIRROR		PHASE 0.7 TO 0.8		0.5 Secs (0.5 Secs)		
									[==>]	[1]	
	2	(2363600)	(1) HD-5980	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M				2316 Secs (2316 Secs)		
					1425 A				[==>]	[1]	
	3	(2363600)	(1) HD-5980	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M				1642 Secs (1642 Secs)		
					1425 A				[==>]	[2]	
	4		(1) HD-5980	STIS/CCD, ACCUM, 52X0.2	G230LB				300 Secs (300 Secs)		
					2375 A				[==>(Split 1)]	[2]	
									[==>(Split 2)]		
5		(1) HD-5980	STIS/CCD, ACCUM, 52X0.2	G430L				50 Secs (60 Secs)			
				4300 A				[==>60.0 Secs (Split 1)]	[2]		
								[==>0 Secs (Split 2)]			

