



17182 - The hot remnant core of the mass donor in a unique Be star binary HD 92406 - two stellar eclipses and two disk occultations per orbit

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Jonathan M Labadie-Bartz (PI) (Contact)	University of Oklahoma Norman Campus
Dr. Alex Carciofi (CoI)	Universidade de Sao Paulo
Mr. Tajan Henrique de Amorim Sr. (CoI)	Universidade de Sao Paulo

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) HD92406	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	22-Nov-2023 13:01:17.0	yes
02	(1) HD92406	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	1	22-Nov-2023 13:01:18.0	yes

2 Total Orbits Used

ABSTRACT

About 20% of the B-type stars are rotating very rapidly. Among these are the classical Be stars, which eject material and build up gaseous circumstellar 'decretion' disks. Rotation plays a significant role in the structure and evolution of massive stars, yet in many aspects is poorly

Proposal 17182 (STScI Edit Number: 1, Created: Wednesday, November 22, 2023 at 1:01:18 PM Eastern Standard Time) - Overview understood. One viable evolutionary pathway to acquire near-critical rotation is through binary interaction - namely mass and angular momentum transfer. The remaining core of the mass donor is now a hot stripped star. Some models suggest the binary channel is dominant in creating rapid rotators. Yet, only about 15 rapidly rotating Be + stripped star binaries are known, virtually all of which were detected and characterized with UV spectroscopy. This proposal aims to characterize a new Be + stripped star binary, HD 92406, using HST UV spectroscopy. HD 92406 is exceptionally valuable as there are two stellar eclipses and two disk occultations per binary orbit - this is the only known eclipsing binary that hosts a Be star. HD 92406 is the first putative late-type Be + stripped star binary, occupying a unique niche in the rapidly rotating binary population. UV spectroscopy taken at two specific orbital phases (one when the sdO is hidden behind the Be star) offers the unique opportunity to measure directly the spectrum of an sdO star for the first time. With that, the parameters of the stripped star in HD 92406 can be determined with sufficient precision to reveal its evolutionary tracks via comparison with binary evolution models. A full analysis promises to make this a benchmark system, with properties determined with far higher precision than what is typically possible.

OBSERVING DESCRIPTION

This is an EB, with the primary (brighter in the UV) being a small stripped star (about B0), and a main-sequence late-B type star (about B9). We are planning two visits - one during the primary (total) eclipse (so the observed flux will be that from the MS B9 star), and one near quadrature. Besides the eclipses, there is low-amplitude pulsation (at about the <1% level) in optical photometry.

For both visits (each 1 orbit) we intend to use the same instrument configuration:

STIS/FUV-MAMA, E140M, 0.2x0.2, central wavelength = 1425. 1 exposure of 1100 s.

STIS/NUV-MAMA, E230M, 0.2x0.2, central wavelength = 2124. 1 exposure of 424 s, to immediately follow the above FUV exposure.

Based on our analysis of optical data for the system, we have a two-stellar-component model spectrum that we are using to estimate the expected UV flux. This model, with the extinction that we have calculated [$E(B-V) = 0.065$] matches very well with archival IUE data that cover the FUV + NUV. We have used this spectral model in the ETC, where for the in-eclipse visit the input model spectrum is only from the MS B9 star, and in the at-quadrature visit the model spectrum includes both stars (and so is brighter).

REDUCED GYRO MODE:

This should not have a significant impact on our proposal. As far as we can tell, our target is still in a good place on the sky even in reduced-gyro mode, and the additional two minutes of overhead is not significant. If, however, reduced-gyro mode limits our ability to schedule the single in-

Proposal 17182 (STScI Edit Number: 1, Created: Wednesday, November 22, 2023 at 1:01:18 PM Eastern Standard Time) - Overview
eclipse visit, we can modify the observing strategy to be less constrained.

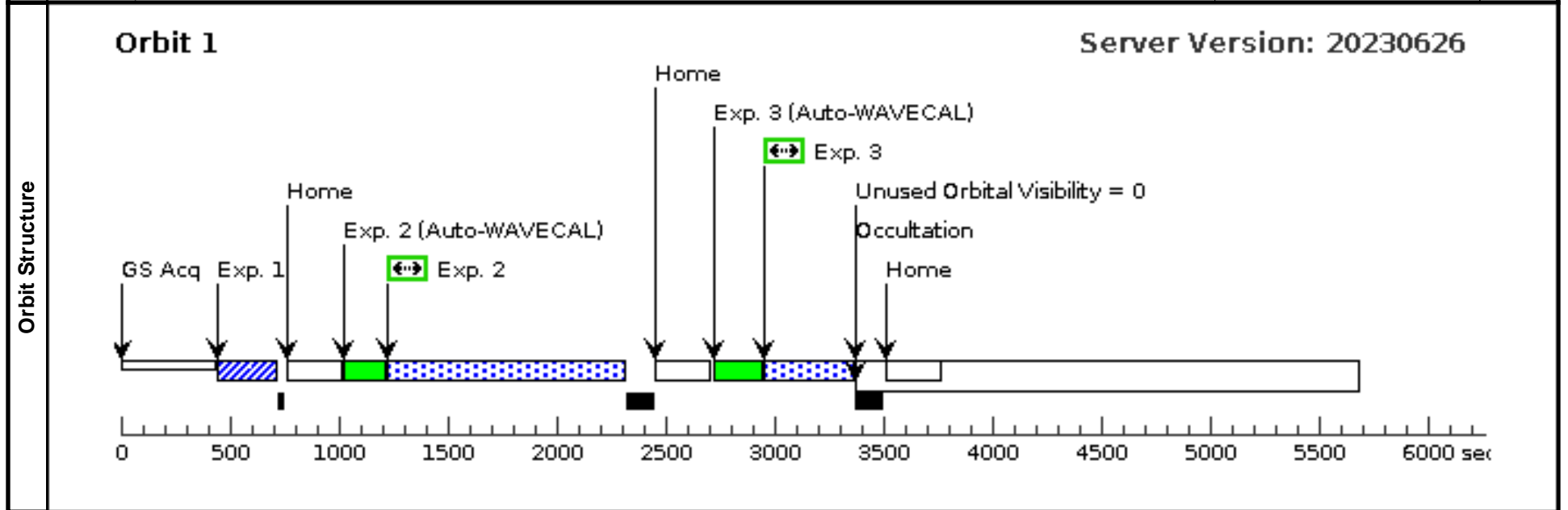
Proposal 17182 - in eclipse (01) - The hot remnant core of the mass donor in a unique Be star binary HD 92406 - two stellar eclipses a...

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Visit	Proposal 17182, in eclipse (01), implementation				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA				
	Special Requirements: Period 32.1854 D AND ZERO-PHASE HJD2459545.3533				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	HD92406	RA: 10 38 47.2587 (159.6969112d)	Proper Motion RA: -0.007846 arcsec/yr	V=9.15	Reference Frame: ICRS
		Alt Name1: V658-CAR	Dec: -58 43 32.36 (-58.72566d)	Proper Motion Dec: -0.001012 arcsec/yr		
			Equinox: J2000	Epoch of Position: 2016.0		
			<i>Comments: Coordinates and PM from Gaia DR3.</i>			
		<i>Category=STAR</i>				
		<i>Description=[B6-B9.5 V-IV, BE, EMISSION LINE STAR, SDB]</i>				
		<i>Extended=NO</i>				

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	acq (STIS.ta.181 3894)	(1) HD92406	STIS/CCD, ACQ, F28X500II	MIRROR				2 Secs (2 Secs)	
									[==>]	[1]
	2	FUV (STIS.sp.18 13690)	(1) HD92406	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A		PHASE 0.20 TO 0.2 8		1100 Secs (1070 Secs)	
									[==>1070.0 Secs]	[1]
	3	NUV (STIS.sp.18 13691)	(1) HD92406	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2124 A		PHASE 0.20 TO 0.2 8		424 Secs (394 Secs)	
									[==>394.0 Secs]	[1]



Proposal 17182 - at quadrature (02) - The hot remnant core of the mass donor in a unique Be star binary HD 92406 - two stellar eclips...

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Visit	Proposal 17182, at quadrature (02), completed Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA Special Requirements: Period 32.1854 D AND ZERO-PHASE HJD2459545.3533
	(at quadrature (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (at quadrature (02)) Warning (Orbit Planner): UNSCHEDULABLE PHASE SPECIAL REQUIREMENTS

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Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>HD92406</td> <td>RA: 10 38 47.2587 (159.6969112d)</td> <td>Proper Motion RA: -0.007846 arcsec/yr</td> <td>V=9.15</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td></td> <td>Alt Name1: V658-CAR</td> <td>Dec: -58 43 32.36 (-58.72566d)</td> <td>Proper Motion Dec: -0.001012 arcsec/yr</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>Equinox: J2000</td> <td>Epoch of Position: 2016.0</td> <td></td> <td></td> </tr> </tbody> </table> <p><i>Comments: Coordinates and PM from Gaia DR3. Category=STAR Description=[B6-B9.5 V-IV, BE, EMISSION LINE STAR, SDB] Extended=NO</i></p>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	HD92406	RA: 10 38 47.2587 (159.6969112d)	Proper Motion RA: -0.007846 arcsec/yr	V=9.15	Reference Frame: ICRS		Alt Name1: V658-CAR	Dec: -58 43 32.36 (-58.72566d)	Proper Motion Dec: -0.001012 arcsec/yr					Equinox: J2000	Epoch of Position: 2016.0		
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	1	acq (STIS.ta.181 3896)	(1) HD92406	STIS/CCD, ACQ, F28X500II	MIRROR					2 Secs (2 Secs) [==>]
2	FUV (STIS.sp.18 13694)	(1) HD92406	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A		PHASE 0.76 TO 0.8 4			1100 Secs (1100 Secs) [==>]	[1]
3	NUV (STIS.sp.18 13695)	(1) HD92406	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2124 A		PHASE 0.76 TO 0.8 4			424 Secs (424 Secs) [==>]	[1]

