



18007 - Spectroscopy of the complex core of VY Canis Majoris

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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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) V-VY-CMA	STIS/CCD	1	15-Aug-2025 13:01:00.0	yes

1 Total Orbits Used

ABSTRACT

VY Canis Majoris (VY CMa) is the most luminous, largest, and presumably the initially most massive red supergiant (RSG) known. It is surrounded by a spectacular asymmetric nebula that was imaged by HST over 20 years ago, and shows a complex array of knots, arcs, and large-scale axisymmetric structure. It is a key object for understanding the extreme mass loss of the most massive RSGs and a benchmark for progenitors of SNe that interact with dense circumstellar material. Spectra reveal a range of outflow velocities in these structures that are faster than typical RSG winds, suggesting blasts of uneven mass-loss episodes over the past 1000 yr. The origin of this instability is not known, but it is usually attributed to either magnetic/convective instability near the Eddington limit, or to binary interaction with an unseen companion star. Although the central source in the nebula appeared unresolved in the earlier HST/WFPC2 imaging, a recent ground-based extreme-AO image has revealed that the central core of the nebula is not a point source. Instead, the core seems to be bisected by a dark obscuring lane (a disk?), and a fainter point source (a companion star?) is resolved at about 120 mas from the core. These features would have been just at the edge of the resolution limit in dithered WFPC2 images.

Proposal 18007 (STScI Edit Number: 0, Created: Friday, August 15, 2025, 12:01:00PM Eastern Standard Time) - Overview

We propose to obtain STIS spectra of the core of VY CMa in order to (1) record the spectrum of the fainter companion candidate, to see if it is reflected RSG light or a companion star, and (2) obtain the spectrum across the central obscuring lane to determine if it is molecular/dust obscuration and estimate its column density.

OBSERVING DESCRIPTION

This program will use STIS with a 0.1 arcsec slit width to obtain spectra of the central star in VY CMa, as well as a candidate companion star located about 120mas from the star. Both will be observed in low and medium resolution settings (G750L and G750M).

Proposal 18007 - Objects A and B (01) - Spectroscopy of the complex core of VY Canis Majoris

Fri Aug 15 17:01:00 GMT 2025

Visit	Proposal 18007, Objects A and B (01) Diagnostic Status: Warning Scientific Instruments: STIS/CCD Special Requirements: ORIENT 313D TO 317 D <i>Comments: First obtain spectrum of central star (Object A; shorter exposures) with STIS slit oriented roughly east-west, and then offset 0.12 arcsec to north to obtain spectrum of Object B (longer exposures).</i>						
	Diagnostics	(Objects A and B (01)) Warning (Orbit Planner): MISSING FRINGE FLAT CALIBRATION (Objects A and B (01)) Warning (Orbit Planner): MISSING FRINGE FLAT CALIBRATION (Objects A and B (01)) Warning (Orbit Planner): MISSING FRINGE FLAT CALIBRATION (Objects A and B (01)) Warning (Orbit Planner): MISSING FRINGE FLAT CALIBRATION (Objects A and B (01)) Warning (Orbit Planner): PATTERN POSITION OUTSIDE APERTURE (Objects A and B (01)) Warning (Orbit Planner): PATTERN POSITION OUTSIDE APERTURE (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL (Objects A and B (01)) Warning (Orbit Planner): STIS SCIENCE TOO FAR FROM WAVECAL					
Patterns		#	Primary Pattern	Secondary Pattern			
		(1)	Pattern Type=STIS-ALONG-SLIT Coordinate Frame=POS-TARG Purpose=DITHER Pattern Orientation=90.0 Number Of Points=2 Angle Between Sides= Point Spacing=0.2 Center Pattern=false Line Spacing=				
Exposures		(2), (3), (4), (5)					
Fixed Targets		#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
		(1)	V-VY-CMA	RA: 07 22 58.3231 (110.7430129d) Dec: -25 46 3.16 (-25.76754d) Equinox: J2000	Proper Motion RA: -1.9580296888911729E-4 sec of time/yr Proper Motion Dec: 0.002232 arcsec/yr Epoch of Position: 2015.5	V=8.691	Reference Frame: ICRS
<i>Comments: V magnitude is variable. 8.9 is the magnitude of the star plus scattered light in the iner nebula. Central star is actually fainter than this.</i> Category=EXT-STAR Description=[M V-IV] Extended=YES							

Proposal 18007 - Objects A and B (01) - Spectroscopy of the complex core of VY Canis Majoris

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	Acquisition	(1) V-VY-CMA	STIS/CCD, ACQ, F25ND3	MIRROR					0.2 Secs (0.2 Secs)	
										[==>]	[1]
	2	star (Object A) lowres	(1) V-VY-CMA	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A	WAVECAL=NO; CR-SPLIT=NO			Pattern 1, Exps 2-2 in Objects A and B (01) (1)	30 Secs (60 Secs)	
										[==>(Pattern 1)]	[1]
										[==>(Pattern 2)]	
3	Object B lowres	(1) V-VY-CMA	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A	WAVECAL=NO; CR-SPLIT=NO	POS TARG 0.13,null		Pattern 1, Exps 3-3 in Objects A and B (01) (1)	120 Secs (240 Secs)		
									[==>(Pattern 1)]	[1]	
									[==>(Pattern 2)]		
4	star (Object A) midres	(1) V-VY-CMA	STIS/CCD, ACCUM, 52X0.1	G750M 7795 A	WAVECAL=NO; CR-SPLIT=NO			Pattern 1, Exps 4-4 in Objects A and B (01) (1)	120 Secs (240 Secs)		
									[==>(Pattern 1)]	[1]	
									[==>(Pattern 2)]		
5	Object B midres	(1) V-VY-CMA	STIS/CCD, ACCUM, 52X0.1	G750M 7795 A	WAVECAL=NO; CR-SPLIT=NO	POS TARG 0.13,null		Pattern 1, Exps 5-5 in Objects A and B (01) (1)	479 Secs (958 Secs)		
									[==>(Pattern 1)]	[1]	
									[==>(Pattern 2)]		

