16172 - The disappearing LBV in the low metallicity galaxy PHL293B: Collapse to a black hole?

Cycle: 28, 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) PHL293B-LBV	WFC3/UVIS	2	09-Nov-2020 16:00:26.0	yes
02	(1) PHL293B-LBV	WFC3/IR	1	09-Nov-2020 16:00:27.0	yes

3 Total Orbits Used

ABSTRACT

The metal-poor dwarf galaxy PHL293B (23 Mpc) contained a luminous blue variable (LBV) candidate that was identified based on its spectrum. This source was detected at roughly constant luminosity during 2001-2009, modeled as a massive LBV with log(L/Lsun)=6.4-6.7. This is similar to eta Carinae, and notably, similar to the progenitors of SN2009ip and SN2015bh. In more recent data, the source has faded beyond ground-based

limits, and spectral signatures of the LBV are now gone. A massive LBV-like star at roughly 0.1 Z solar provides important clues for understanding the role of eruptive mass loss at low metallcity, and the star's recent disappearance may hold critical clues about the fate of such stars. The sudden fading in the last decade could be the result of either the end of a giant LBV eruption, or it could be the death of a very massive star when it collapsed to a black hole with no bright supernova. To rule out the second hypothesis, we would need to detect the surviving star, but ground-based data cannot do this because the source is too faint and lost in galaxy light. There are two plausible scenarios for a surviving star: (1) When the LBV eruption ended, the star faded in the optical because it got hotter, shifting its energy distribution into the UV, or (2) it faded at visual wavelengths because it formed dust, in which case the star should still be detectable in the near-IR. We propose deep imaging with WFC3 UVIS and IR to either detect the surviving star in the UV/optical/IR, or to confirm that it has vanished to deep limits. If it is gone, this would be the first secure case of a very massive star that vanished to a black hole.

OBSERVING DESCRIPTION

The goal of these observations is to obtain post-event optical and near-IR magnitudes or deep upper limits of the source at the position of an LBV star that has faded beyond detectability in ground-based data (perhaps largely due to spatial resolution, as it is now indistinguishable from surropunding galaxy light from the goround). We also aim to obtain photometry of all nearby bright sources to help constrain the host environments age and/or star formation history. The UVIS observations are all set up in one visit of two orbits, but these orbits can be separated if neeeded. There are no special orients needed, although we would prefer both orbits taken at the same orient if they need to separated into separate visits because we are combining two exposures of F438W including one from each oribit. We are using full frame instead of sub-array because we need the whole nearby stellar population.

Visit

Proposal 16172, Visit 01, implementation Mon Nov 09 21:00:28 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-2 in Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 2 (Pattern 1, Exps 1-2 in Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 3 (Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 4 (Pattern 1, Exps 4-5 in Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 5 (Pattern 1, Exps 4-5 in Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 6 (Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (4-5)

Fixed Targets

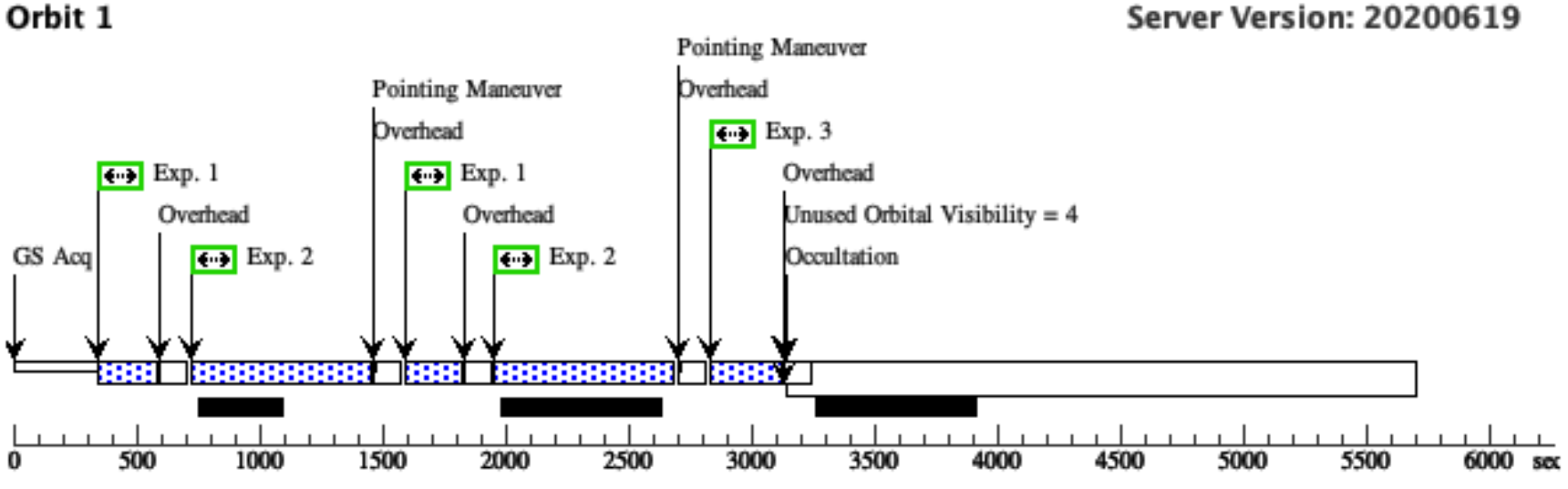
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PHL293B-LBV	RA: 22 30 36.7960 (337.6533167d) Dec: -00 06 36.89 (-.11025d) Equinox: J2000		V=22+/-1	Reference Frame: ICRS

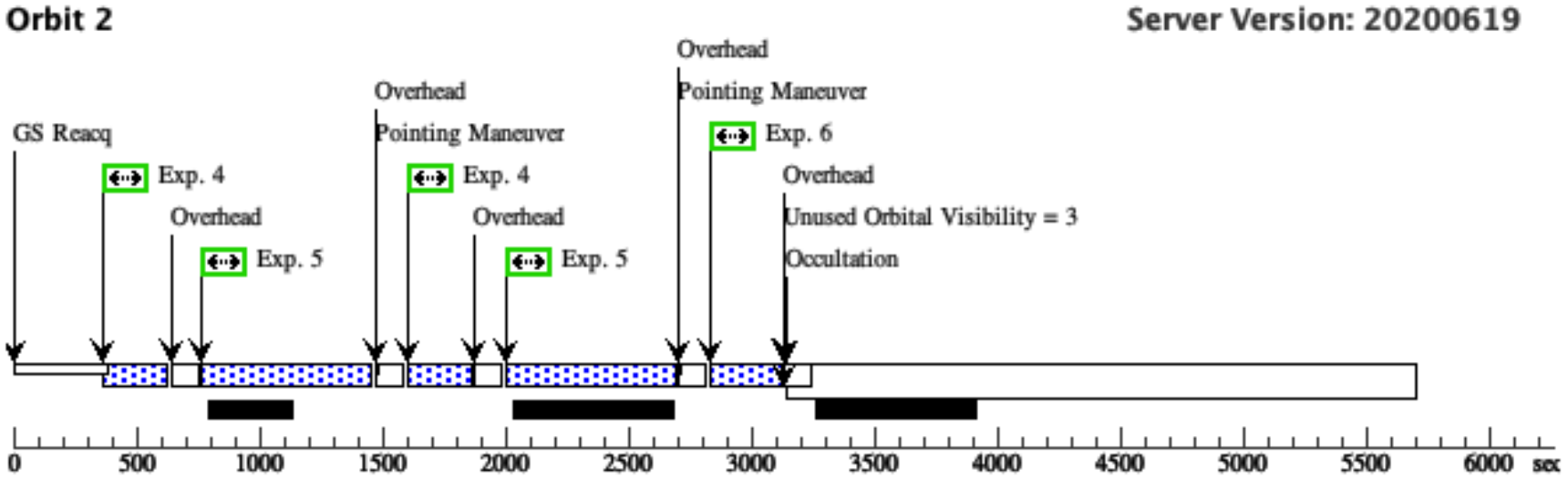
Comments:
Category=EXT-STAR
Description=[BLUE STRAGGLER, ETA CARINAE STAR, LUMINOUS BLUE VARIABLE]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PHL293B-LBV	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12		Pattern 1, Exps 1-2 in Visit 01 (1)	216 Secs (414 Secs) *[==>207.0 Secs (Pattern 1)]* *[==>207.0 Secs (Pattern 2)]*	***[1]***
2		(1) PHL293B-LBV	WFC3/UVIS, ACCUM, UVIS2	F225W	FLASH=18		Pattern 1, Exps 1-2 in Visit 01 (1)	720 Secs (1422 Secs) *[==>711.0 Secs (Pattern 1)]* *[==>711.0 Secs (Pattern 2)]*	***[1]***
3		(1) PHL293B-LBV	WFC3/UVIS, ACCUM, UVIS2	F438W	FLASH=18			280 Secs (270 Secs) *[==>270.0 Secs]*	***[1]***
4		(1) PHL293B-LBV	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=15		Pattern 1, Exps 4-5 in Visit 01 (1)	252 Secs (484 Secs) *[==>242.0 Secs (Pattern 1)]* *[==>242.0 Secs (Pattern 2)]*	***[2]***
5		(1) PHL293B-LBV	WFC3/UVIS, ACCUM, UVIS2	F336W	FLASH=18		Pattern 1, Exps 4-5 in Visit 01 (1)	680 Secs (1340 Secs) *[==>670.0 Secs (Pattern 1)]* *[==>670.0 Secs (Pattern 2)]*	***[2]***
6		(1) PHL293B-LBV	WFC3/UVIS, ACCUM, UVIS2	F438W	FLASH=18	POS TARG -3.4088166189286015E-4,-1.425343380764952		280 Secs (270 Secs) *[==>270.0 Secs]*	***[2]***

Orbit Structure





Visit

Proposal 16172, Visit 02, implementation Mon Nov 09 21:00:28 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1-2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PHL293B-LBV	RA: 22 30 36.7960 (337.6533167d) Dec: -00 06 36.89 (-.11025d) Equinox: J2000		V=22+/-1	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[BLUE STRAGGLER, ETA CARINAE STAR, LUMINOUS BLUE VARIABLE]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PHL293B-LBV	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 2, Exps 1-2 in Visit 02 (2)	599.232292 Secs (1198.465 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*
2		(1) PHL293B-LBV	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=STEP100		Pattern 2, Exps 1-2 in Visit 02 (2)	699.232615 Secs (1398.465 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*

Orbit Structure