



13469 - Tol 26 and the EGB 6 Class of Planetary-Nebula Nuclei: What Happens to a Companion Star when a PN is Ejected?

Cycle: 21, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

INVESTIGATORS

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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) TOL26	WFC3/IR WFC3/UVIS	1	19-Feb-2014 21:04:46.0	yes
02	(2) EGB6	WFC3/IR WFC3/UVIS	1	19-Feb-2014 21:05:17.0	yes
03	(3) TOL26-UPDATED	COS/FUV	1	19-Feb-2014 21:05:31.0	yes

3 Total Orbits Used

ABSTRACT

Tol 26 is a faint, compact, high-latitude planetary nebula (PN), little studied since its discovery in the 70's. Its nebular spectrum is unusual in having no [O II] or [N II], and strong [O III] 4363, indicating very high electron density. Tol 26 is unresolved from the ground. GALEX, BVRI, 2MASS, and WISE data reveal: a bright UV source, which we identify as the central star; optical flux consistent with a dK companion, and NIR and MIR excesses indicating the presence of warm dust with two distinct temperatures.

Tol 26 resembles the formerly unique EGB 6, a faint PN with a compact nucleus, also containing a hot white dwarf (WD) and dual-temperature dust. EGB 6 has a close dM companion; HST imaging shows that the compact nebula coincides with the dM star, not the WD. We speculate that a portion of the outflow during PN ejection created an accretion disk around the dM star, which has survived to the present time, and is ionized by the WD's UV flux.

We propose WFC3 imaging of Tol 26, using filters that will separately isolate the hot central star, nebular emission, and the optical and NIR fluxes. We will determine whether there is likewise a resolved companion star in this system, and if so whether the nebular emission comes from an accreted disk around the companion, as in EGB 6. We will also obtain a FUV spectrum of Tol 26, to determine the $T_{\text{eff}}/\log g$ of the central star and search for accreted metals. Our study will have wider implications for the spin-up of companion stars of PN nuclei, formation of barium stars, and the nature of 24-micron excesses discovered in several hot WDs and PN central stars. We will also obtain new images of EGB 6, last imaged by HST in 1995.

OBSERVING DESCRIPTION

We will obtain WFC3 images of two central stars of planetary nebulae, Tol 26 and EGB 6, with the main aim of determining the spatial locations of (a) the hot central star, (b) a cool companion star that is resolved from the hot star in EGB 6 and possibly in Tol 26, (c) compact ionized nebulae, possibly associated with the cool companions, and (d) warm dust. A range of WFC3 filters from the NUV, to the optical (including narrow-band filters), and the NIR will be used to sort out these components.

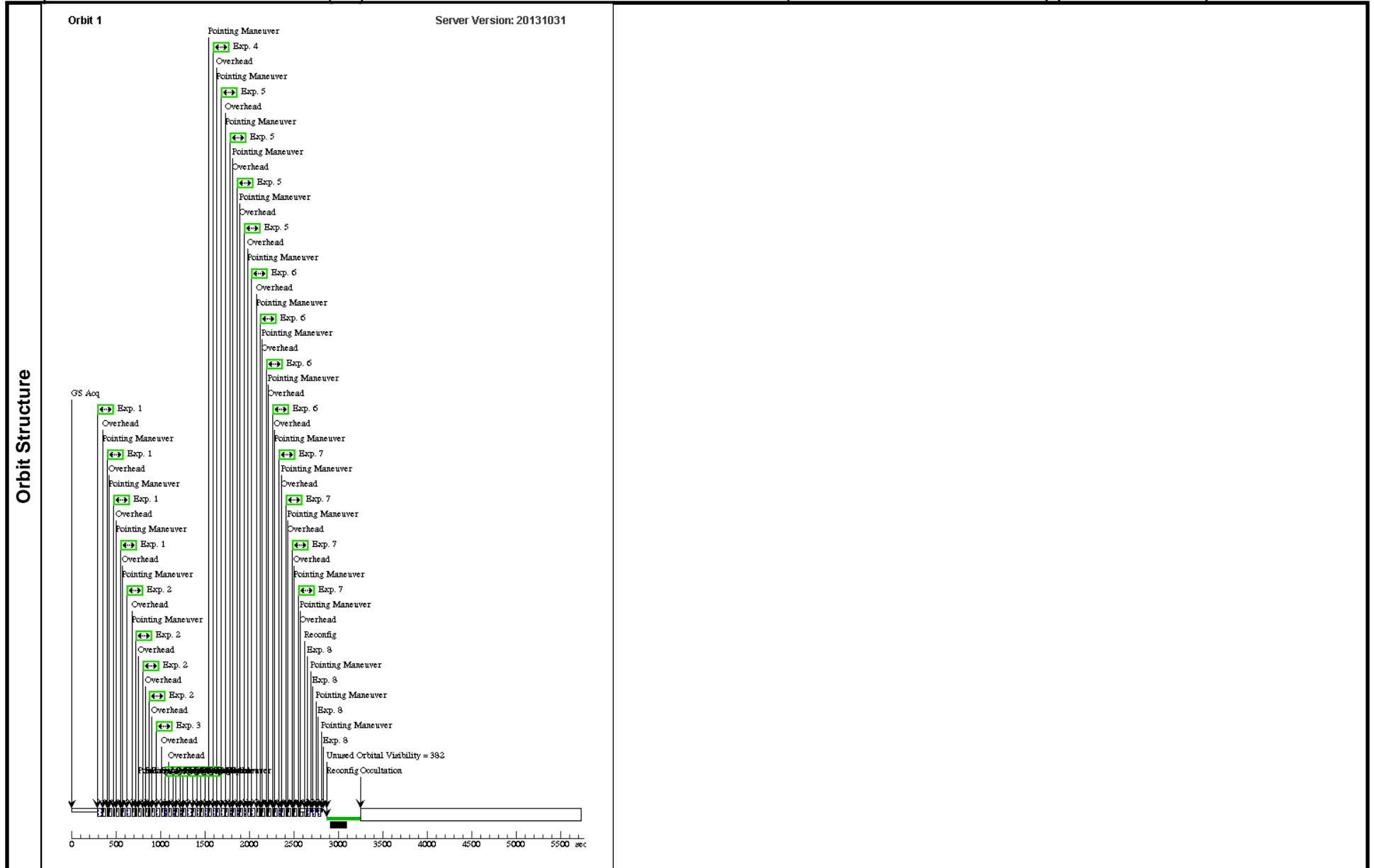
We will also obtain a COS FUV spectrum of Tol 26, for the purpose of determining atmospheric parameters of the hot stellar component.

Proposal 13469 - Tol 26 WFC3 (01) - Tol 26 and the EGB 6 Class of Planetary-Nebula Nuclei: What Happens to a Companion Star w...

Visit	<p>Proposal 13469, Tol 26 WFC3 (01), completed Thu Feb 20 02:05:40 GMT 2014 Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: ORIENT 283D TO 353 D; ORIENT 13D TO 38 D; ORIENT 58D TO 83 D; ORIENT 103D TO 173 D <i>Comments: ORIENT requirements are included because there is a bright star 25" away from the target. These requirements avoid either the charge bleeding columns or the diffraction spikes from the bright star interfering with the target.</i></p>					
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
(1)		Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=true		(1), (2), (3), (4), (5), (6), (7)	
(2)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=true		(8)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	TOL26 Alt Name1: TOL1230-275 Alt Name2: PNG298.0+34.8	RA: 12 33 12.9800 (188.3040833d) Dec: -27 48 53.40 (-27.81483d) Equinox: J2000		V=15.5	Reference Frame: ICRS
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>						

Proposal 13469 - Tol 26 WFC3 (01) - Tol 26 and the EGB 6 Class of Planetary-Nebula Nuclei: What Happens to a Companion Star w...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 1-1 i n Tol 26 WFC3 (01) (1)	12 Secs (48 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F275W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 2-2 i n Tol 26 WFC3 (01) (1)	15 Secs (60 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	3	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F336W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 3-3 i n Tol 26 WFC3 (01) (1)	20 Secs (80 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	4	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F502N	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 4-4 i n Tol 26 WFC3 (01) (1)	30 Secs (120 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	5	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F656N	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 5-5 i n Tol 26 WFC3 (01) (1)	20 Secs (80 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	6	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F555W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 6-6 i n Tol 26 WFC3 (01) (1)	5 Secs (20 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	7	(1) TOL26		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F814W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 7-7 i n Tol 26 WFC3 (01) (1)	5 Secs (20 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	8	(1) TOL26		WFC3/IR, MULTIACCUM, IRSUB128	F160W	NSAMP=9; SAMP-SEQ=RAPID		Pattern 2, Exps 8-8 i n Tol 26 WFC3 (01) (2)	1.014345 Secs (4.057 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]



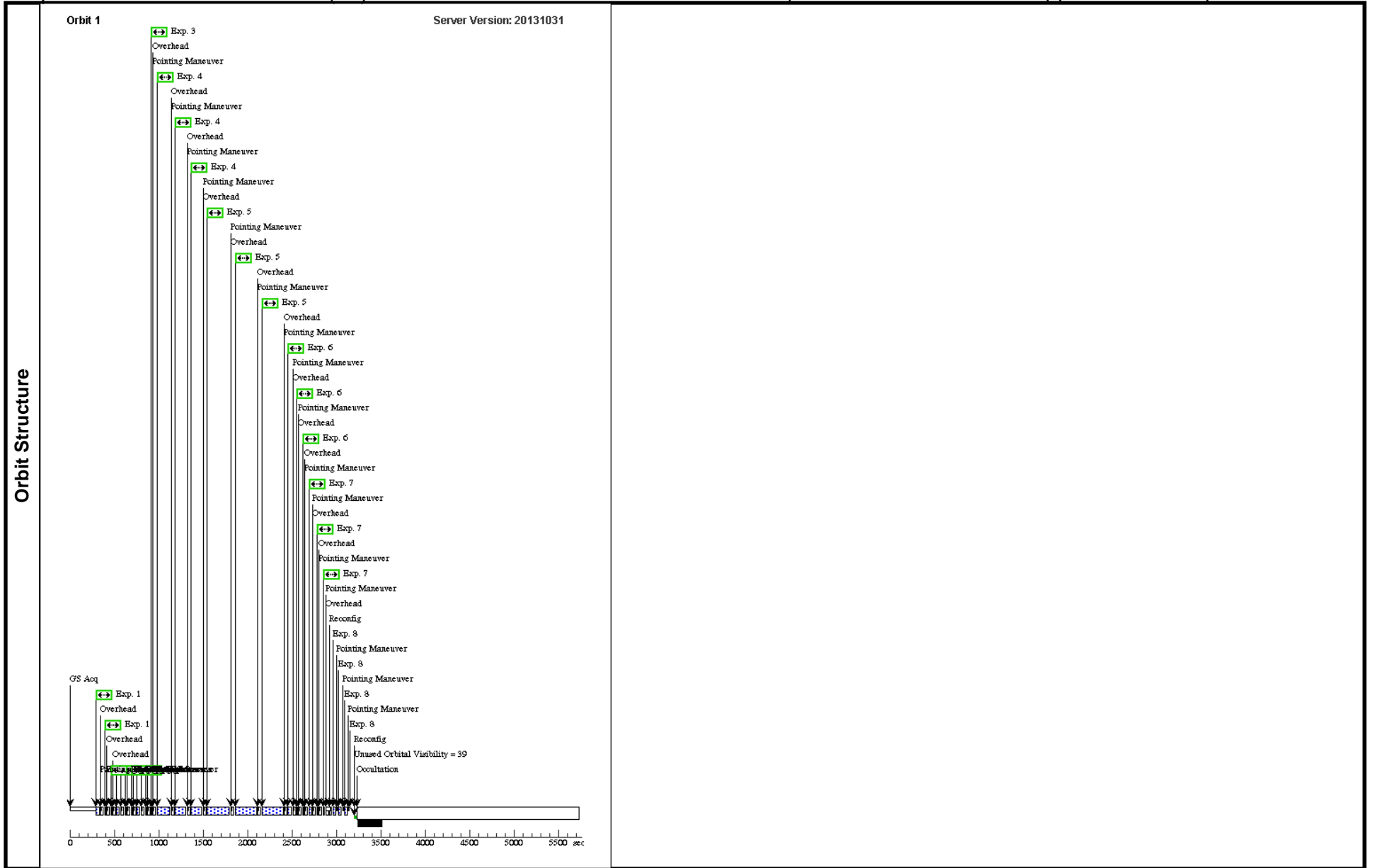
Proposal 13469 - EGB 6 WFC3 (02) - Tol 26 and the EGB 6 Class of Planetary-Nebula Nuclei: What Happens to a Companion Star w...

Thu Feb 20 02:05:44 GMT 2014

Visit	Proposal 13469, EGB 6 WFC3 (02), completed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)					
Patterns	#	Primary Pattern	Secondary Pattern	Exposures		
	(2)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=true		(8)	
	(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=true		(1), (2), (3), (4), (5), (6), (7)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(2)	EGB6	RA: 09 52 59.0000 (148.2458333d) Dec: +13 44 35.00 (13.74306d) Equinox: J2000		V=16.0	Reference Frame: ICRS

Proposal 13469 - EGB 6 WFC3 (02) - Tol 26 and the EGB 6 Class of Planetary-Nebula Nuclei: What Happens to a Companion Star w...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 3, Exps 1-1 i n EGB 6 WFC3 (02) (3)	5 Secs (15 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	2	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F275W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 3, Exps 2-2 i n EGB 6 WFC3 (02) (3)	5 Secs (15 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	3	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F336W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 3, Exps 3-3 i n EGB 6 WFC3 (02) (3)	5 Secs (15 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	4	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F502N	CR-SPLIT=NO; FLASH=12		Pattern 3, Exps 4-4 i n EGB 6 WFC3 (02) (3)	120 Secs (360 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	5	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F656N	CR-SPLIT=NO; FLASH=12		Pattern 3, Exps 5-5 i n EGB 6 WFC3 (02) (3)	240 Secs (720 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	6	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F555W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 3, Exps 6-6 i n EGB 6 WFC3 (02) (3)	5 Secs (15 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	7	(2) EGB6		WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F814W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 3, Exps 7-7 i n EGB 6 WFC3 (02) (3)	10 Secs (30 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	8	(2) EGB6		WFC3/IR, MULTIACCUM, IRSUB512	F160W	NSAMP=6; SAMP-SEQ=RAPID		Pattern 2, Exps 8-8 i n EGB 6 WFC3 (02) (2)	5.118162 Secs (20.473 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]



Proposal 13469 - Tol 26 COS (03) - Tol 26 and the EGB 6 Class of Planetary-Nebula Nuclei: What Happens to a Companion Star whe...

Thu Feb 20 02:05:46 GMT 2014

Visit	Proposal 13469, Tol 26 COS (03), implementation Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	TOL26-UPDATED	RA: 12 33 12.9769 (188.3040704d)		V=15.5	Reference Frame: ICRS				
		Alt Name1: TOL1230-275	Dec: -27 48 53.14 (-27.81476d)							
		Alt Name2: PNG298.0+34.8	Equinox: J2000							
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Tol 26 ACQ /PEAKXD (516399)	(3) TOL26-UPDAT ED	COS/FUV, ACQ/PEAKXD, PSA	G140L 1105 A				5 Secs (5 Secs) [==>]	[1]
	2	Tol 26 ACQ /PEAKD (516399)	(3) TOL26-UPDAT ED	COS/FUV, ACQ/PEAKD, PSA	G140L 1105 A	NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-W T-FLR			5 Secs (5 Secs) [==>]	[1]
	3	Tol 26 Time -Tag (516399)	(3) TOL26-UPDAT ED	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=10 00; FLASH=YES; FP-POS=ALL			100 Secs (2080 Secs) [==>520.0 Secs (Split 1)] [==>520.0 Secs (Split 2)] [==>520.0 Secs (Split 3)] [==>520.0 Secs (Split 4)]	[1]

