14802 - Synoptic Imaging Polarimetry Observations of CRL 2688: What's Whipping the Egg?

Cycle: 24, Proposal Category: GO

(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) V-V1610-CYG	ACS/WFC	3	29-Jul-2016 15:51:45.0	yes
02	(1) V-V1610-CYG	ACS/WFC	3	29-Jul-2016 15:51:47.0	yes

6 Total Orbits Used

ABSTRACT

We propose to obtain new imaging polarimetry of the archetypical pre-planetary nebula, CRL 2688 (The Egg Nebula) with the ACS/WFC in the F606W and F775W filters. Pre-planetary nebulae are objects caught in the short-lived, rapidly changing transition phase between the AGB and planetary nebula (PN) stages of stellar evolution. Their morphology bridges the gap between the spherical mass-loss of AGB stars and the surprisingly non-spherical morphologies observed in PN. The mechanism(s) that drives this departure from sphericity is highly debated, and has

many implications for stellar and galactic evolution. CRL 2688 is the nearest (to Earth) pre-planetary nebula. Its complex morphology exhibiting lobes, rings, "search light beams," and a dust lane -- all of which shine in highly polarized light -- make it an ideal specimen for detailed investigation with the high spatial resolution and exquisite polarimetric precision and accuracy provided by HST/ACS. Our proposed observations will be compared with previous ACS imaging polarimetry obtained in 2002 (providing a ~14 year baseline) to: 1) look for secular changes in properties of the scattering particles and scattering geometries within the lobes, rings, SLBs and dust lane; 2) form perpendiculars to the polarization position angles to pinpoint the location of the central illuminating source -- comparison between epochs will place constraints on changes in that source; 3) precisely measure proper motions in the lobes, SLBs, and rings. Our results will provide new insights into the processes that transform the spherical envelopes of a dying low mass stars into the often highly aspherical structures witnessed in planetary nebulae.

OBSERVING DESCRIPTION

We will observe CRL 2688 with the WFC on ACS using two broad-band filters (F606W & F775W) combined with the POLV polarizers to obtain imaging polarimetry from 0.48-0.85|um. We use POLV polarizers, as they are most polarimetrically efficient at the desired wavelengths. We chose the F606W to match the observations obtained in 2002; therefore this is a duplicate, but the source structures have changed since then, which is the reason for obtaining new observations. We also include F775W observations to determine the wavelength dependence of the polarization, which in turn places strong constraints on the scattering particles and their scattering geometry. To minimize any systematics caused by residual field distortions in our images relative to the 2002 observations, we constrain the new observations to have a spacecraft orientation (roll) that is within a few degrees of the previous 2002 observations. We use a 4 point box dither to mitigate cosmic rays. We also include a postfash to mitigate CTE effects.

Visit

Proposal 14802, CRL 2688 POL*V/F606W (01) Fri Jul 29 19:51:48 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: BETWEEN 08-OCT-2016:00:00:00 AND 22-OCT-2016:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(1-3)

Fixed Targets

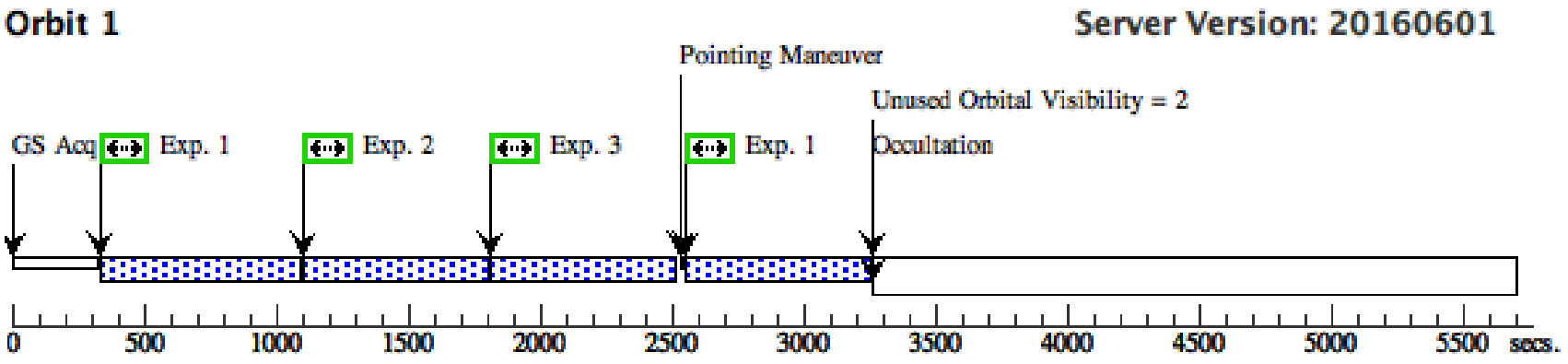
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V1610-CYG	RA: 21 02 18.8400 (315.5785000d) Dec: +36 41 41.10 (36.69475d) Equinox: J2000		V=17	Reference Frame: SIMBAD

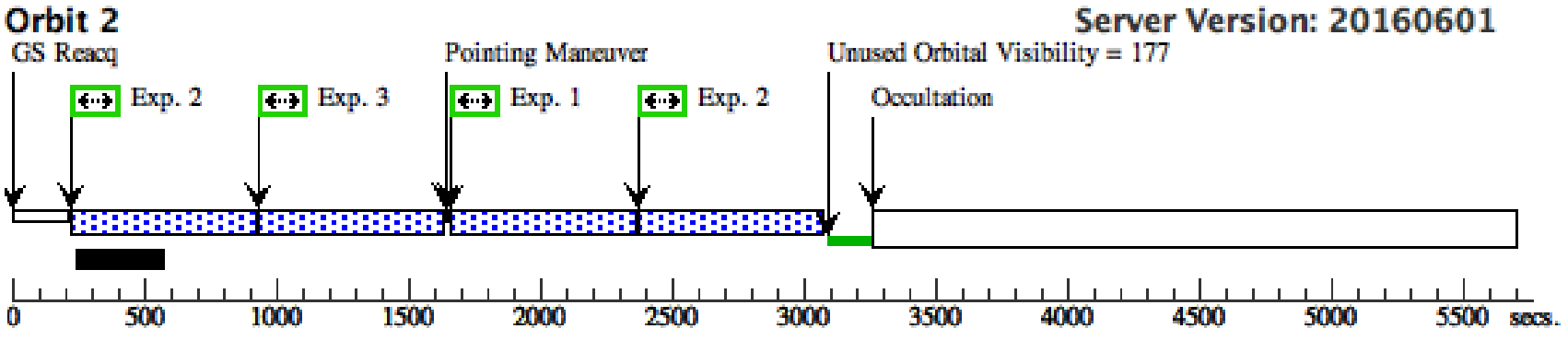
Comments: Highly polarized (30%-70%) preplanetary nebula. The magnitue is an average surface brightness in V-mag/sq. arcsec
Extended=YES

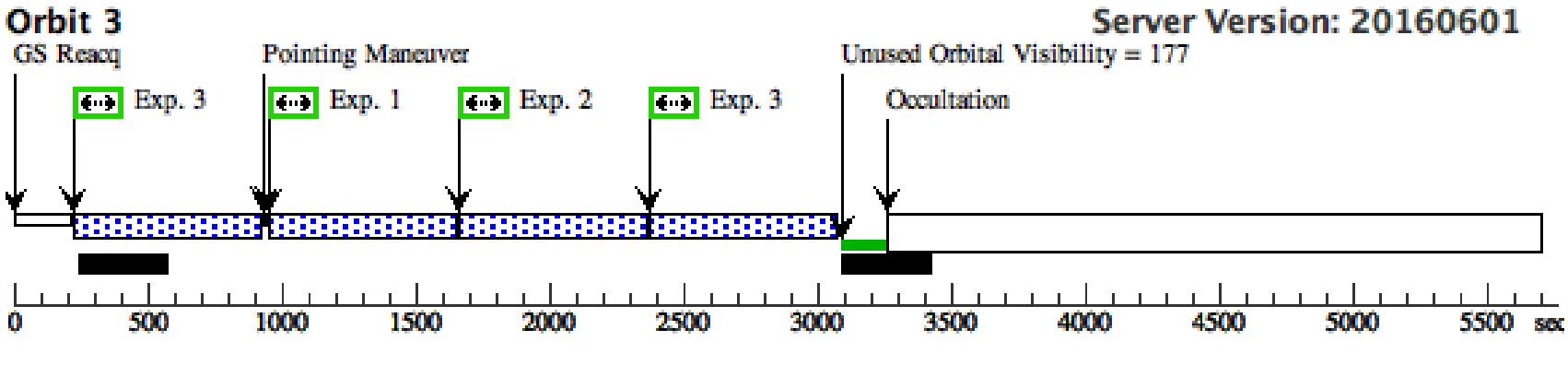
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	POL0V/F606W	(1) V-V1610-CYG	ACS/WFC, ACCUM, WFC	F606W POL0V			Pattern 1, Exps 1-3 in CRL 2688 POL*V/F606W (01) (1)	554 Secs (2216 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	***[2]***
								[==>(Pattern 4)]	***[3]***
2	POL0V/F606W	(1) V-V1610-CYG	ACS/WFC, ACCUM, WFC	F606W POL60V			Pattern 1, Exps 1-3 in CRL 2688 POL*V/F606W (01) (1)	554 Secs (2216 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	***[3]***
3	POL120V/F606W	(1) V-V1610-CYG	ACS/WFC, ACCUM, WFC	F606W POL120V			Pattern 1, Exps 1-3 in CRL 2688 POL*V/F606W (01) (1)	554 Secs (2216 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***
								[==>(Pattern 4)]	

Orbit Structure







Visit

Proposal 14802, CRL 2688 POL*V/F775W (02) Fri Jul 29 19:51:48 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 01; BETWEEN 08-OCT-2016:00:00:00 AND 22-OCT-2016:00:00:00; SEQ 01,02 WITHIN 4 Orbits

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(1-3)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V1610-CYG	RA: 21 02 18.8400 (315.5785000d) Dec: +36 41 41.10 (36.69475d) Equinox: J2000		V=17	Reference Frame: SIMBAD

Comments: Highly polarized (30%-70%) preplanetary nebula. The magnitue is an average surface brightness in V-mag/sq. arcsec
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	POL0V/F606W	(1) V-V1610-CYG	ACS/WFC, ACCUM, WFC	F775W POL0V			Pattern 1, Exps 1-3 in CRL 2688 POL*V/F775W (02) (1)	554 Secs (2216 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)]	***[2]***
								[==>(Pattern 4)]	***[3]***
2	POL0V/F606W	(1) V-V1610-CYG	ACS/WFC, ACCUM, WFC	F775W POL60V			Pattern 1, Exps 1-3 in CRL 2688 POL*V/F775W (02) (1)	554 Secs (2216 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)] *[==>(Pattern 3)]*	***[2]***
								[==>(Pattern 4)]	***[3]***
3	POL120V/F606W	(1) V-V1610-CYG	ACS/WFC, ACCUM, WFC	F775W POL120V			Pattern 1, Exps 1-3 in CRL 2688 POL*V/F775W (02) (1)	554 Secs (2216 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[3]***

Orbit Structure