14102 - The II Zw 40 Supernebula: 30 Doradus on Steroids

Cycle: 23, 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) UGCA-116	COS/FUV COS/NUV	4	24-Jul-2015 21:31:23.0	yes

4 Total Orbits Used

ABSTRACT

We propose COS G140L spectroscopy of the enigmatic nearby blue compact dwarf galaxy II Zw 40. The galaxy hosts a nuclear super star cluster with a luminosity 10 times that of 30 Doradus, the most powerful giant HII region in the Local Group. The super star cluster has been suggested to be the ionizing source of a "supernebula" detected via its free-free radiation in the radio. The physical conditions, however, are much more complex, as demonstrated by the detection of the nebular He II and the mid-infrared line of [O IV] 25.9. These lines are unlikely to be related to hot stars and require a different powering source. II Zw 40 shares many similarities with the related blue compact dwarfs NGC 5253 and Henize 2-10, both of which have been studied extensively with HST, yet no ultraviolet spectroscopy has ever been obtained for II Zw 40. This small 4-orbit proposal will provide the necessary UV data to study the massive-star content directly. We will determine reddening, age, and the stellar initial mass function and

perform a comparison with the local benchmark 30 Doradus. In particular we will investigate whether the hot stars are able to power the supernebula and the nebular high-excitation lines. Our modeling will utilize the latest generation of stellar evolutionary tracks with and without stellar rotation. If the stars fall short in terms of spectral hardness and luminosity, II Zw 40 may become the second candidate for a central black hole in a young starburst after Henize 2-10.

OBSERVING DESCRIPTION

We will use COS with the G140L (1105) grating to collect R ~ 3000 spectra in the wavelength range ~1120 A - 2150 A of the nuclear super star cluster of II Zw 40. Our target is labeled SSC-N in Figure 1. It is essentially a point source. Therefore the COS resolution will not be degraded. SSC-N accounts for ~90% of the total H-alpha luminosity of the nuclear clusters. SSC-S is south of SSC-N outside the radio supernebula. Its H-alpha luminosity is an order of magnitude lower than that of SSC-N. It will not be in the COS aperture.

We carefully considered the trades between the G130M and G140L gratings, in particular for the 1105 and 1280 settings for G140L. Both gratings provide comparable S/N over the wavelengths of interest when rebinned to the same spectral resolution. Our choice is mainly driven by wavelength coverage in as few settings as possible. This argues in favor of G140L. As for 1105 vs. 1280, we opted for the former in order to have continuous coverage rather than a gap around Lyman-alpha. The proposed G140L data with R ~ 3000 and S/N > 10 in the wavelength range ~1120 A - 2150 A will allow us to study the stellar populations, the ISM kinematics and the dust properties.

II Zw 40 has reliable GALEX data; therefore UV fluxes for estimating exposure times and evaluating target acquisition strategies are available. Essentially all the UV flux is concentrated in the central super star cluster, which will be fully encompassed by the circular 2.5" COS aperture. The 1500 A fluxes (column 8 of Table 1) were obtained from the GALEX magnitudes. As a consistency check, we also verified these fluxes by extrapolating the fluxes measured in optical spectra to the UV.

We require a minimum S/N of 10 over most of the wavelength range. This is based on our prior extensive experience with HST UV spectra of star-forming galaxies. S/N = 10 will allow us to analyze the strong stellar-wind profiles and compare them with population synthesis models, model nebular Lyman-alpha, measure the outflow properties of the ISM from interstellar absorption lines, and determine the dust properties from the continuum shape.

We will acquire the galaxies with a standard MIRROR-A NUV imaging acquisition, followed by time-tagged FUV spectra with the G140L grating

using the 1105 setting. Accounting for all the overhead due to guide-star acquisitions and reacquisitions, target acquisition, detector/grating overhead and exposure times to reach S/N = 10 - 20, we find that four orbits are needed (column 9 of Table 1). The average orbit duration assumed is 3200 s.

Visit

Proposal 14102, 1 (01) Sat Jul 25 01:31:24 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: (none)

Diagnostics

(1 (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE

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(1 (01)) Warning (Form): If the target coordinates are not known to 0.4" (or better), an ACQ/SEARCH should precede the ACQ/IMAGE.

(Exposure 2 (1 (01))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See the proposal instructions for more details.

(Exposure 3 (1 (01))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See the proposal instructions for more details.

(Exposure 4 (1 (01))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See the proposal instructions for more details.

(Exposure 5 (1 (01))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See the proposal instructions for more details.

Fixed Targets

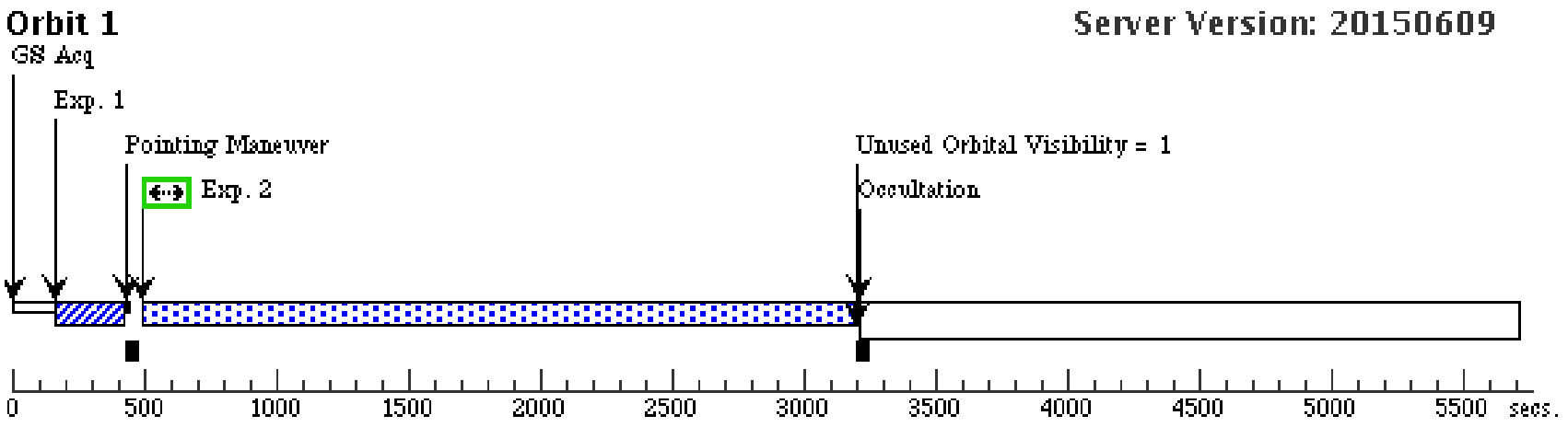
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	UGCA-116	RA: 05 55 42.6450 (88.9276875d)	Redshift: 0.00263	V=11.46+/-0.5	Reference Frame: SIMBAD
	Alt Name1: IIZW40	Dec: +03 23 32.23 (3.39229d)		F(1500)=6e-16	
		Equinox: J2000			

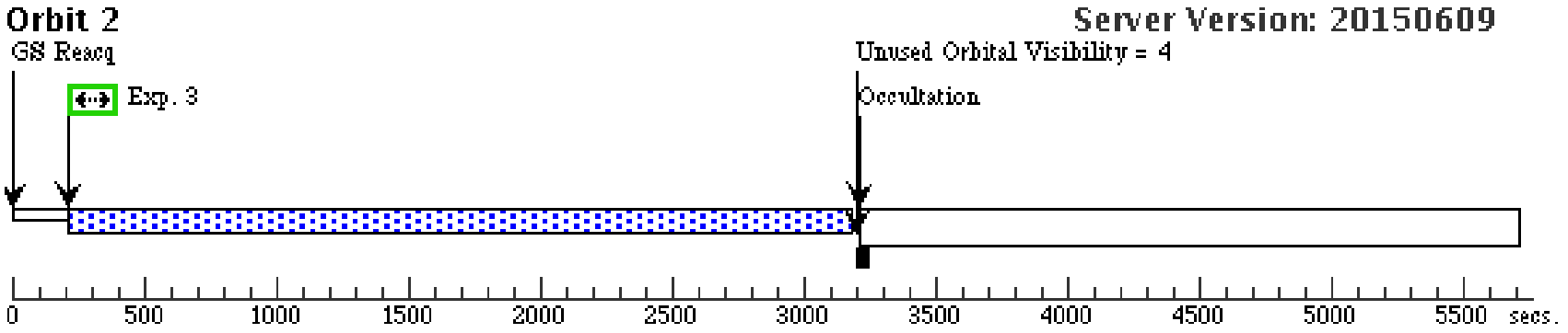
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=YES

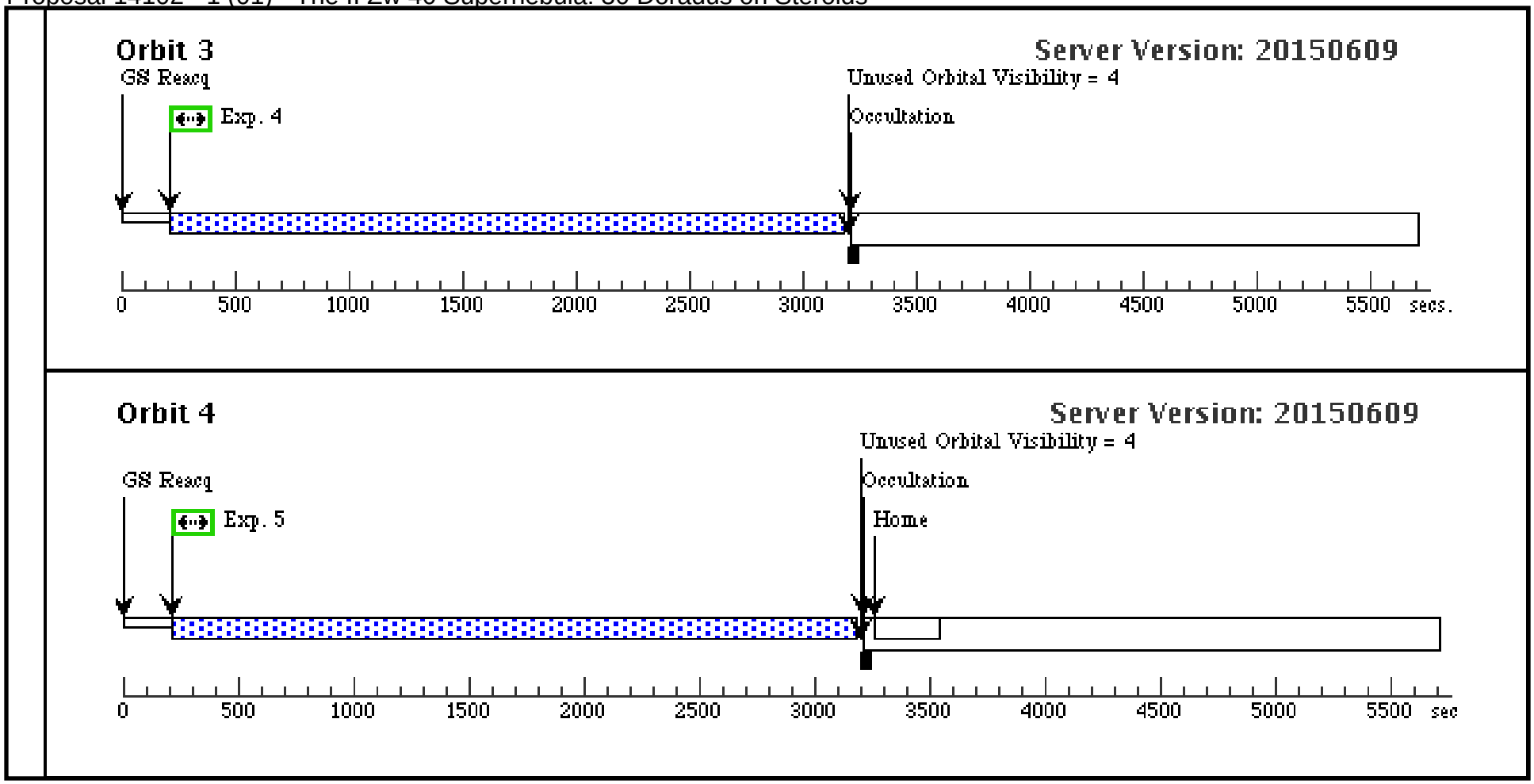
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.714427)	(1) UGCA-116	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				15 Secs (15 Secs)	
								[==>]	***[1]***
2	(COS.sp.714428)	(1) UGCA-116	COS/FUV, TIME-TAG, PSA	G140L	FP-POS=1;			2520 Secs (2520 Secs)	
				1105 A	BUFFER-TIME=9000			*[==>]*	***[1]***
3	(COS.sp.714428)	(1) UGCA-116	COS/FUV, TIME-TAG, PSA	G140L	FP-POS=2;			2920 Secs (2920 Secs)	
				1105 A	BUFFER-TIME=9000			*[==>]*	***[2]***
4	(COS.sp.714428)	(1) UGCA-116	COS/FUV, TIME-TAG, PSA	G140L	FP-POS=3;			2920 Secs (2920 Secs)	
				1105 A	BUFFER-TIME=9000			*[==>]*	***[3]***
5	(COS.sp.714428)	(1) UGCA-116	COS/FUV, TIME-TAG, PSA	G140L	FP-POS=4;			2920 Secs (2920 Secs)	
				1105 A	BUFFER-TIME=9000			*[==>]*	***[4]***

Orbit Structure



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secs.
Orbit 4
Server Version: 20150609
Unused Orbital Visibility = 4
GS Reacq
Occultation
Exp. 5
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sec