14809 - An Accurate Measurement of the IGM HeII Lyman Alpha Forest toward a Newly Discovered UV-bright Quasar at z>3.5

Cycle: 24, 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) QSO-235452-203320	COS/FUV COS/NUV	4	29-Jul-2016 15:54:07.0	yes

4 Total Orbits Used

ABSTRACT

The advent of GALEX and COS have revolutionized our view of HeII reionization, the final major phase transition of the intergalactic medium. COS spectra of the HeII Lyman alpha forest have confirmed with high confidence the high HeII transmission that signifies the completion of HeII

reionization at z~2.7. However, the handful of z>3.5 quasars observed to date show a set of HeII transmission 'spikes' and larger regions with non-zero transmission that suggest HeII reionization was well underway by z=4. This is in striking conflict with predictions from state-of-the-art radiative transfer simulations of a HeII reionization driven by bright quasars. Explaining these measurements may require either faint quasars or more exotic sources of hard photons at z>4, with concomitant implications for HI reionization. We propose here to observe J2354-2033, an FUV-bright quasar at z=3.786 that we recently discovered in a dedicated survey for likely HeII-transmitting quasars. With this COS/G140L spectrum, we would confirm that the quasar is valuable for studies of the HeII Lyman alpha forest by identifying possible interloping low-z HI absorbers, provide accurate measurements of the IGM HeII opacity, and provide only the third z>3.5 sightline that would allow for high-resolution G130M spectroscopy before the end of HST's mission. The proposed observations would mark only the fourth observation of the HeII Lyman alpha forest at z>3.7 and the source would be the 2nd-brightest known on the sky at these redshifts.

OBSERVING DESCRIPTION

We will obtain a COS FUV G140L spectrum of a newly discovered UV-bright z=3.8 quasar to characterize intergalactic HeII Lyman alpha absorption along its sightline. Our target has a sufficiently accurate flux in the quasar continuum just redward of the HeII break (GALEX FUV), and a sufficiently accurate GALEX NUV magnitude for reliable acquisition via ACQ/IMAGE. The target is safe to observe with COS and has precise SDSS coordinates. It is relatively faint in the NUV, resulting in a NUV acquisition exposure time of 120sec to reach the recommended S/N~40.
The G140L grating provides the wavelength coverage to define the quasar continuum and the necessary resolution to measure the onset of patchy HeII absorption. We require a S/N~3 per resolution element at 1500A, which results in a total request of 4 orbits. Continuous wavelength coverage at good sensitivity (lambda>1150A) is required to maximize the coverage of the HeII Lyman alpha absorption, only provided by the G140L 1105A setup. The target will be observed in a single 4-orbit visit, using all FP-POS offsets in consecutive orbits. Spectra will be recorded in TIME-TAG mode with concurrent wavelength calibration (TAGFLASH). Time intervals spent in the Earth's shadow will be used to correct for geocoronal OI and NI emission. Given our faint source, airglow will dominate the COS count rates. However, even at the high airglow conditions conservatively assumed in our ETC calculations, the buffer time is longer than the exposure time. All exposure times have been adjusted to use the full visibility period in each orbit.
Gain sag limits the accuracy of the COS dark current subtraction, which is critical to reach our science goals. We have developed a custom pipeline to determine the dark current in the COS PSA by post-processing COS dark monitoring exposures (Worseck et al. 2016, ApJ in press, arXiv:1405.7405). For this calibration we require COS dark monitoring exposures taken at the same detector voltage as the science observations in a ~3 month window around the date of the science observations. Therefore, our observations should not be scheduled immediately before or after a voltage change on COS Segment A.

To minimize scattered geocoronal Lyman alpha emission that contaminates the HeII absorption region (Worseck et al. 2016, ApJ in press, arXiv:1405.7405) we strongly prefer our observations being scheduled in orbits with a large fraction of the visibility period spent in orbital night.

Visit

Proposal 14809, Visit 01, implementation Fri Jul 29 19:54:08 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BETWEEN 2016.298 AND 2016.342; BETWEEN 2017.276 AND 2017.296; BETWEEN 2017.309 AND 2017.315

Fixed Targets

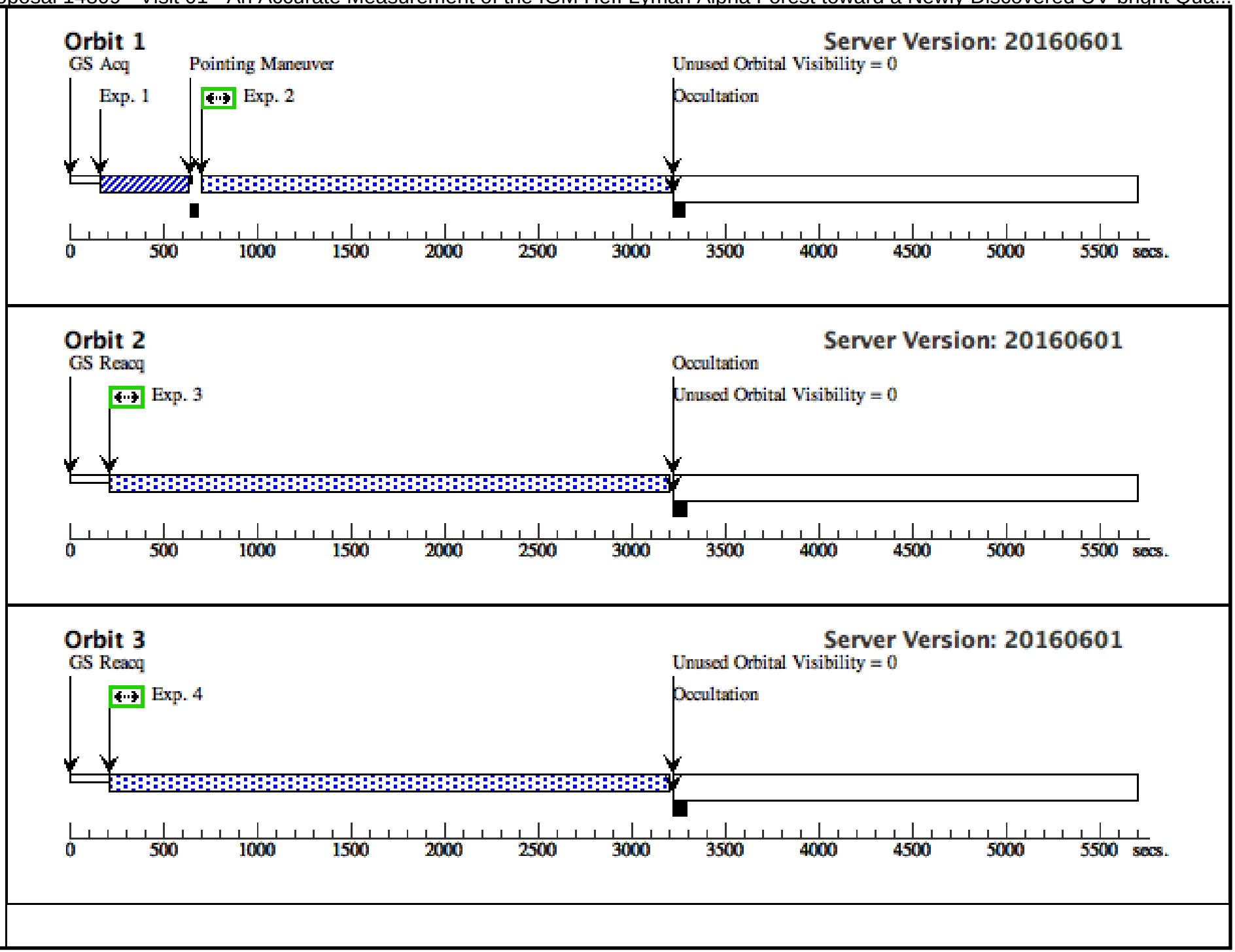
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	QSO-235452-203320	RA: 23 54 52.0000 (358.7166667d) Dec: -20 33 20.73 (-20.55576d) Equinox: J2000	Redshift: 3.786	V=19.06+/-0.10 GALEX FUV=21.50+/-0.25 NU V=21.29+/-0.19	Reference Frame: ICRS

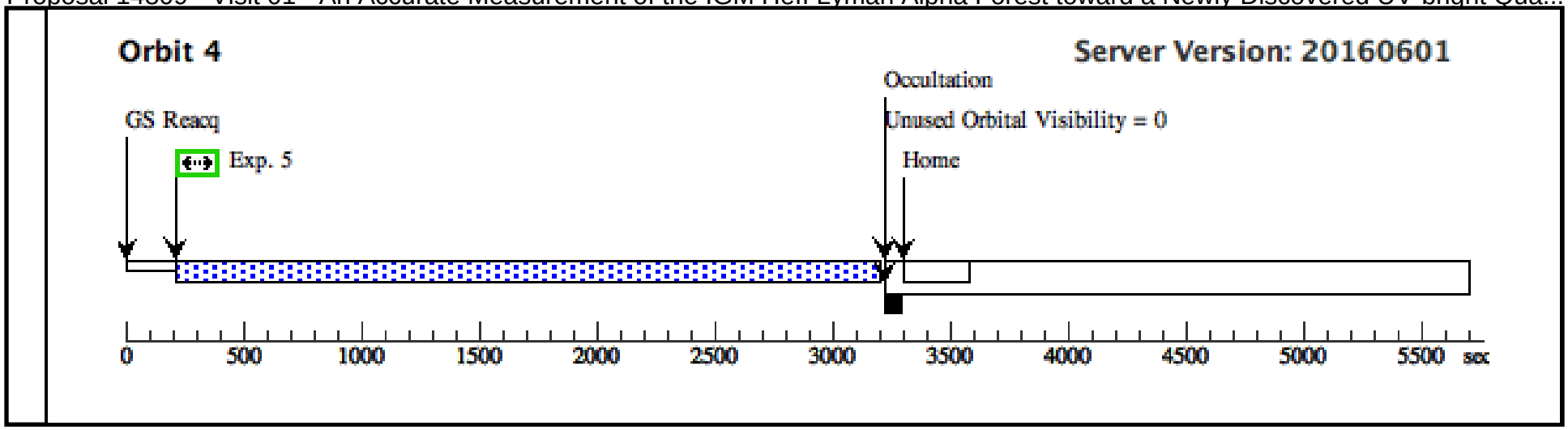
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.823867)	(1) QSO-235452-203320	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				120 Secs (120 Secs) *[==>]*	*[1]*
2	(COS.sp.823870)	(1) QSO-235452-203320	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=4995; FLASH=YES; FP-POS=1			3000 Secs (2323 Secs) *[==>2323.0 Secs]*	*[1]*
	Comments: The ETC run conservatively assumes high background conditions, but given the faint target, the buffer time is still considerably larger than the exposure time.								
3	(COS.sp.823870)	(1) QSO-235452-203320	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=4995; FLASH=YES; FP-POS=2			3000 Secs (2936 Secs) *[==>2936.0 Secs]*	*[2]*
	Comments: The ETC run conservatively assumes high background conditions, but given the faint target, the buffer time is still considerably larger than the exposure time.								
4	(COS.sp.823870)	(1) QSO-235452-203320	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=4995; FLASH=YES; FP-POS=3			3000 Secs (2936 Secs) *[==>2936.0 Secs]*	*[3]*
	Comments: The ETC run conservatively assumes high background conditions, but given the faint target, the buffer time is still considerably larger than the exposure time.								
5	(COS.sp.823870)	(1) QSO-235452-203320	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=4995; FLASH=YES; FP-POS=4			3000 Secs (2936 Secs) *[==>2936.0 Secs]*	*[4]*
	Comments: The ETC run conservatively assumes high background conditions, but given the faint target, the buffer time is still considerably larger than the exposure time.								

Orbit Structure

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