14490 - Pop III material found 6 Gyr after the Big Bang? COS constraints on the lowest-metallicity gas at z<1

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) SDSSJ1500+4836	COS/NUV	3	21-Mar-2016 21:05:35.0	yes
02	(1) SDSSJ1500+4836	COS/NUV	2	21-Mar-2016 21:05:36.0	yes

5 Total Orbits Used

ABSTRACT

The explosions of Population III stars provided the first metal pollution of the Universe. These stars eventually polluted their own and other nearby halos with sufficient metals to allow the formation of a more normal, less top-heavy population of stars. The subsequent Pop II stars produced the majority of the metals seen in the Universe today. However, is that pollution complete? While some ultra-metal poor stars in the Galactic halo may

be fossils of the Pop III epoch, are there regions of the Universe that remain untouched by Pop II metal pollution at low redshift? We have identified a z~0.9 Lyman limit system - a dense stream of gas likely associated with a galaxy halo - with [Mg/H] < -2.4 on the basis of a low-resolution COS snapshot observation. We propose a 5 orbit COS NUV program to attempt to determine the metallicity of this gas through the very strong C III 977 Ang transition, pushing our sensitivity to [C/H] < -3.3, i.e., into the regime of Pop III-only enrichment at metallicities comparable to the z~4 IGM. We will also use these data to confirm our H I column density and study the temperature and kinematics of the gas using Lyman series absorption. With our statistical sample of metallicities in 60 LLSs, these observations will allow us to determine the fraction of high over-density gas at z<1 that remains relatively pristine, perhaps unenriched since the Pop III epoch.

OBSERVING DESCRIPTION

We have recently identified a Lyman limit system (LLS) - a dense stream of gas with H I column density log N(HI) ~ 17.2 - at z<1 that may have been unenriched since the epoch of Population III stars. This system was chosen from a sample of LLSs identified in a Cycle 18 snapshot survey and is H I selected.

Our proposed observations will target the z=0.89759 LLS toward J1500+4836 using the COS G185M grating with central wavelength setting 1850. This setting fortuitously provides coverage of most of the Lyman series lines for this absorber (spanning strengths from Ly -betathrough Ly-20) plus metal lines C II 1036, C III 977, and O VI 1031. Given the metallicity limits for this absorber, we do not expect to detect C II, but it provides a consistency check on our models. In 5 orbits we will obtain S/N~8 per resolution element for the metal transitions and S/N~6 for the higher-order Lyman series lines

Visit

Proposal 14490, J1500 Spectroscopy (01) Tue Mar 22 01:05:37 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: COS/NUV

Special Requirements: (none)

Diagnostics

(J1500 Spectroscopy (01)) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.

Fixed Targets

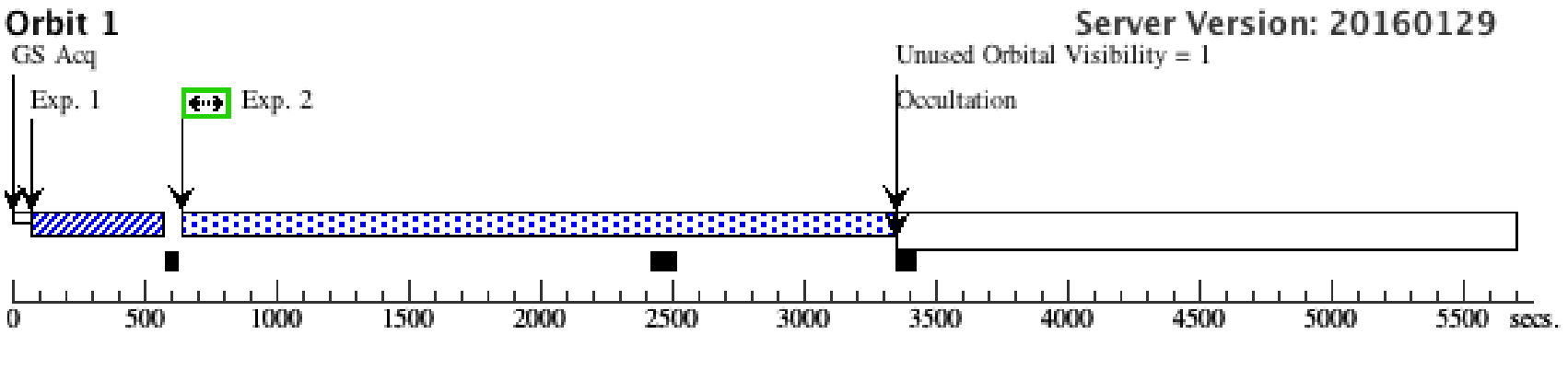
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1500+4836 Alt Name1: SDSSJ150031.79+483646.9 Alt Name2: RXJ1500.5+4836	RA: 15 00 31.7900 (225.1324583d) Dec: +48 36 46.85 (48.61301d) Equinox: J2000	Redshift: 1.02848	V=16.74+/-0.02	Reference Frame: ICRS

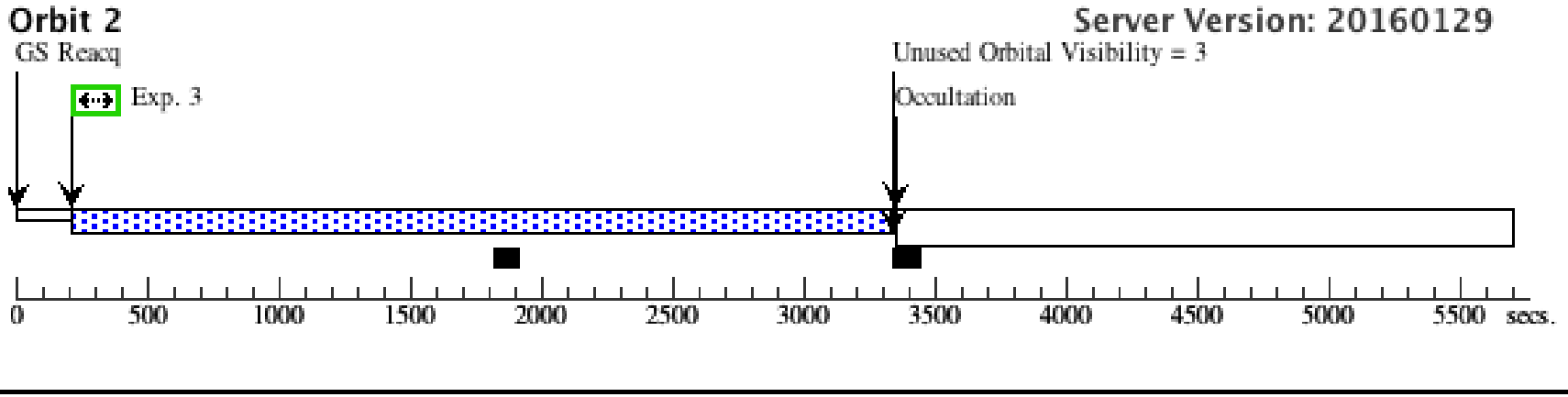
Comments: Extended=NO

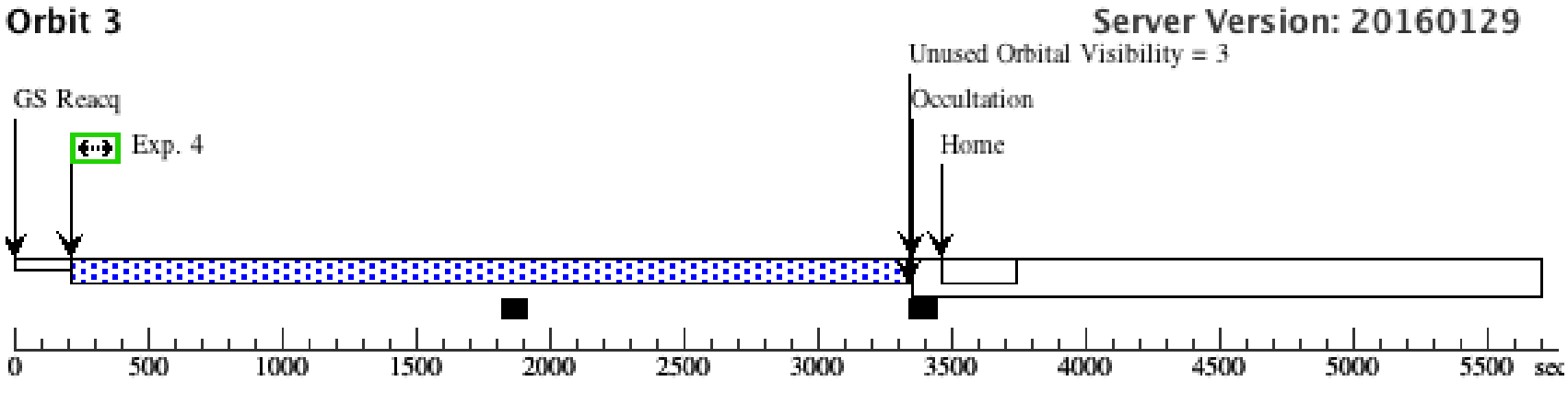
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.781294)	(1) SDSSJ1500+4836	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				90 Secs (90 Secs) *[==>]*	***[1]***
Comments: Used as input for the ETC a model of the observed spectrum. This uses a Telfer composite continuum absorbed by the Lyman limit systems we have fit along this sight line. The use of the model allows us to extend the flux to longer wavelengths as needed for the imaging.									
2	(COS.sp.781326)	(1) SDSSJ1500+4836	COS/NUV, TIME-TAG, PSA	G185M 1850 A	BUFFER-TIME=1600; FP-POS=1			2500 Secs (2500 Secs) *[==>]*	***[1]***
3	(COS.sp.781326)	(1) SDSSJ1500+4836	COS/NUV, TIME-TAG, PSA	G185M 1850 A	BUFFER-TIME=1600; FP-POS=2			3100 Secs (3100 Secs) *[==>]*	***[2]***
4	(COS.sp.781326)	(1) SDSSJ1500+4836	COS/NUV, TIME-TAG, PSA	G185M 1850 A	BUFFER-TIME=1600; FP-POS=3			3100 Secs (3100 Secs) *[==>]*	***[3]***

Orbit Structure







Visit

Proposal 14490, J1500 Spectroscopy (02) Tue Mar 22 01:05:38 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: COS/NUV

Special Requirements: (none)

Diagnostics

(J1500 Spectroscopy (02)) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.

Fixed Targets

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(1)	SDSSJ1500+4836 Alt Name1: SDSSJ150031.79+483646.9 Alt Name2: RXJ1500.5+4836	RA: 15 00 31.7900 (225.1324583d) Dec: +48 36 46.85 (48.61301d) Equinox: J2000	Redshift: 1.02848	V=16.74+/-0.02	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.781294)	(1) SDSSJ1500+4836	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				90 Secs (90 Secs) *[==>]*	***[1]***
Comments: Used as input for the ETC a model of the observed spectrum. This uses a Telfer composite continuum absorbed by the Lyman limit systems we have fit along this sight line. The use of the model allows us to extend the flux to longer wavelengths as needed for the imaging.									
2	(COS.sp.781326)	(1) SDSSJ1500+4836	COS/NUV, TIME-TAG, PSA	G185M 1850 A	BUFFER-TIME=1600; FP-POS=1			2500 Secs (2500 Secs) *[==>]*	***[1]***
3	(COS.sp.781326)	(1) SDSSJ1500+4836	COS/NUV, TIME-TAG, PSA	G185M 1850 A	BUFFER-TIME=1600; FP-POS=4			3100 Secs (3100 Secs) *[==>]*	***[2]***

Orbit Structure