



# 16445 - The puzzling Lya profile of Pox 186: a local analogue of reionization era galaxies

Cycle: 28, Proposal Category: GO  
(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
<b>Dr. Nimisha Kumari (PI) (ESA Member) (Contact)</b>	<b>Space Telescope Science Institute - ESA</b>	<b>kumari@stsci.edu</b>
Dr. Renske Smit (CoI) (ESA Member)	Liverpool John Moores University	r.smit@ljmu.ac.uk
Dr. Claus Leitherer (CoI)	Space Telescope Science Institute	leitherer@stsci.edu

## 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) LEDA-46982	COS/FUV COS/NUV	2	02-Dec-2020 15:00:49.0	yes

2 Total Orbits Used

## ABSTRACT

ALMA has revolutionized the study of reionization-era galaxies. With the launch of JWST just over one year away, it is crucial to establish a local reference sample of high-redshift "analog" galaxies covering essential UV, optical and FIR emission lines that will soon become available in the upcoming JWST+ALMA era. A local ( $z \sim 0.0040705$ ), metal-poor ( $12 + \log(\text{O}/\text{H}) = 7.76$ ) blue compact dwarf galaxy, Pox 186, exhibits the brightest CIII] 1908 emission (equivalent width  $\sim 36 \text{ \AA}$ ) observed at any redshifts as revealed in the archival HST/COS observations, along with an extreme [OIII] 88/[CII] 158 ( $\sim 10$ ). This extreme CIII] is comparable to those observed in galaxies at redshifts of  $z \sim 6-7$ , when the reionization process is thought to be completed. We request mid-cycle time to obtain COS spectroscopy for this galaxy, to probe Ly $\alpha$  feature (emission and/or

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absorption) in addition to obtaining high S/N constraints on the UV nebular and stellar lines, as it will allow us to maximize the science return of a multiwavelength initiative involving radio, far-infrared and optical integral field spectroscopy. The proposed mid-cycle HST/COS observations will be very timely as they will provide directions to proposals for the upcoming observations using JWST, targeted to explore the epoch of reionization.

## **OBSERVING DESCRIPTION**

We propose to obtain good quality ( $S/N > 5$ ) HST/COS UV spectrum of Pox 186, the potentially most extreme local analogue of high-redshift (6-7) galaxies. We will use G130M/1291 to cover wavelength range of 1137-1274 Å and 1292-1432 Å, respectively, which will allow us to probe Ly feature and key stellar features such as C III 1175, N V 1239, which might be ubiquitous at high redshifts and will be revealed by JWST observations. The wavelength also covers the low-ionization transitions of Si II (1190, 1193, 1260, 1304 Å) and C II (1334 Å) and the intermediate ionization transition of Si III (1206 Å). The previous UV observations have revealed double-peaked CIV emission. It is not clear whether there is a direct link between the line profiles of CIV and Ly emission. However, if the velocity profile of Ly $\alpha$  is similar to CIV in this galaxy, the double-peak of Ly will be resolved by G130M as its spectral resolution is 2 times better than G160M. We prefer COS to STIS as COS is 10 times more sensitive than STIS in the FUV, and its spectral resolution is 50 times better than STIS (7.5 km s<sup>-1</sup> for G130 M compared to 360 km s<sup>-1</sup> for STIS). Pox 186 is compact and unresolved in F336W, and thus is ideal to be observed by COS which is optimized for observing point sources. We used COS ETC to estimate the exposure times for spectroscopic observations and target acquisition as described below: We extracted the FUV spectrum from the archival STIS observations (PID:8333) and used it in COS ETC for the G130M/1291 setting for FUV spectroscopy. We estimated the required exposure time for achieving  $S/N = 5$  (per resolution element) at wavelengths of 1215 Å for grating G130M. Similarly, using the HST/COS NUV spectrum, we also estimated exposure time for obtaining the ACQ/Image using PSA/MirrorA for a recommended  $S/N \sim 20$ . We made a conservative estimate of an HST orbit lasting 52 minutes excluding overheads related to guide-star (re-)acquisition and FP-POS split suggested by the APT. The above procedure resulted in 2 orbits for G130M. The target is safe for observation as our ETC estimates report no warnings for violations of the local and/or global bright object limit. Moreover, the same target was observed as part of HST-GO-16071. Complying with COS 2025 policy, we will obtain the spectroscopic exposures at FP-POS=3 & 4. The exposures at the two FP-POS will allow us to reduce flat-fielding uncertainties, eliminate grid wire residuals and increase S/N. The G130M has dispersions of 54 mÅ resolution element. We will estimate the approximate spectral resolution by fitting narrow Milky Way absorption features, which we will use to bin the reduced and extracted (via CALCOS pipeline) one-dimensional spectra by averaging over the length of resolution elements (or multiple thereof) to achieve higher S/N per pixel. This will allow us to detect and analyse any weak spectral features. Given that there has been hardly any HI detected in Pox 186 (basis of our JVLA proposal), we do not expect damped Ly associated with Pox 186. In case of Ly absorption, it will blend with the MW Ly $\alpha$  absorption. We will retrieve the damped Ly $\alpha$  absorption line related to H I gas content of Pox 186 by fitting a theoretical Ly $\alpha$  damping profile with velocities corresponding to the MW and our

Proposal 16445 (STScI Edit Number: 0, Created: Wednesday, December 2, 2020 at 3:00:50 PM Eastern Standard Time) - Overview target. We emphasise that geocoronal Ly $\alpha$ , if present, is not an issue because the COS aperture is five times wider than the STIS aperture that was used. However, even if we get swamped by the geocoronal, the expected FWHM is still only about 1.1 Å (9.97 mÅ/pix, 109 pix in PSA), and is tolerable for our science.

In total, we request for 2 HST orbits to obtain FUV spectra using HST/COS covering a wavelength range of 1137-1274 & 1292-1432 Å for Pox 186.

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Wed Dec 02 20:00:50 GMT 2020

Visit	<b>Proposal 16445, Pox 186 (01)</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	LEDA-46982	RA: 13 25 48.6413 (201.4526721d) Dec: -11 36 37.94 (-11.61054d) Equinox: J2000	Epoch of Position: 2000	V=17.43+/-0.03 B = 17.93+/-0.53	Reference Frame: ICRS			
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=GALAXY Description=[DWARF COMPACT] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Acq/Image (1433821)	(1) LEDA-46982	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				7 Secs (7 Secs)	
									[==>]	[1]
	<i>Comments: We notice that BOT/GSC reports a warning about exceeding the local count rate. However, when we ran ETC using already existing FUV and NUV spectra of this target, ETC reported no such warning. We also checked 21.5" arcsec field around the target in a HST/F336W image, which shows that the field does not have any other source other than our target.</i>									
2	COS/FUV (1467891)	(1) LEDA-46982	COS/FUV, TIME-TAG, PSA	G130M 1291 A		BUFFER-TIME=51 78; FP-POS=3; FLASH=YES			2430 Secs (2430 Secs)	
									[==>]	[1]
3	COS/FUV (1467891)	(1) LEDA-46982	COS/FUV, TIME-TAG, PSA	G130M 1291 A		FP-POS=4; BUFFER-TIME=51 78; FLASH=YES			2693 Secs (2693 Secs)	
									[==>]	[2]

