15410 - The Nature of the Host Galaxies of Damped Lyman-alpha Absorbers at z~4

Cycle: 25, 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) J0834+2140	WFC3/IR	1	15-Dec-2017 19:00:47.0	yes
02	(2) J1101+0531	WFC3/IR	1	15-Dec-2017 19:00:48.0	yes
03	(3) J1443+2724	WFC3/IR	1	15-Dec-2017 19:00:49.0	yes
04	(4) J0817+1351	WFC3/IR	1	15-Dec-2017 19:00:50.0	yes

4 Total Orbits Used

ABSTRACT

Absorption-selected galaxies, specifically those associated with damped Ly-alpha absorbers (DLAs), provide a unique opportunity to study the gas in 'typical' galaxies at high redshifts. We have recently used ALMA to detect the [CII] 158 micron line from four of five targeted DLAs at z > 4, and have also used the VLA to detect CO (2-1) emission from one of these systems, obtaining a large molecular gas mass. We propose to continue this successful ALMA+VLA project, by complementing the ALMA [CII] 158 micron observations with (1) a VLA Q-band search for CO(2-1) emission from the 3 remaining [CII] 158 micron detections at z~4.2-4.4, and (2) an HST-WFC3 imaging of the 4 DLA host galaxies with ALMA+VLA observations in the F160W filter. The VLA observations will yield molecular gas masses for the 3 galaxies, while the HST-WFC3 observations will

measure the dust-unobscured star formation rates; the combination of ALMA, VLA and HST data will allow us to obtain the most complete picture of high-z DLA host galaxies to date, and to directly test whether such galaxies might have been missed in emission-selected samples due to dust obscuration. We request 35.75 hours of VLA Q-band time and 4 orbits of HST time.

OBSERVING DESCRIPTION

We will image 4 galaxies associated with z~4 DLAs in the near-infrared with the F160W filter on the WFC3 camera. The four targets were selected from a sample of DLA host galaxies which have been observed with ALMA (see Neeleman et al. , 2017). The target galaxies all have been detected in [CII] 158 micron line emission, confirming their association with the DLAs (including redshift), and yielding solid measurements of the angular separation between the host galaxy and the quasar sightline. As this is a joint proposal with the VLA, we will also obtain information on the molecular content of the galaxy through the observation of the CO(2-1) emission line from the 4 galaxies associated with these DLAs.

The primary goal of the HST observations is a measurement of the rest-frame NUV flux from the galaxies in order to determine the unobscured SFR. SFR estimates from the ALMA observations (i.e., from dust-processed light) are on average 20 Msun/year. One orbit with the WFC3/F160W camera/filter combination will yield a 3sigma detection limit of 26.5 AB, where we have assumed that the light is emitted from a centrally located source with a radius of 0.25". This is consistent with the ALMA observations, which have synthesized beams of 0.5" full width at half maximum, and only the highest star-forming galaxy is barely resolved.

The proposed flux limit of 26.5 AB corresponds to a 3sigma SFR of 2 Msun/year (Kennicutt & Evans (2012)), and will allow us to determine the amount of dust extinction in these galaxies. In case of a detection, we will further be able to determine the extent of the emission, and compare this to the emission seen in [CII] and the possible CO molecular line emission. This allows us to ascertain if all of the emission is co-spatial or arises from different parts of the galaxy.

We will apply four dither positions for each of the targets. This will provide sub-pixel sampling of the PSF, and due to the multiple non-destructive reads with WFC3/IR, is ample to remove cosmic rays and create clean images.

Visit

Proposal 15410, Visit 01 Sat Dec 16 00:00:50 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

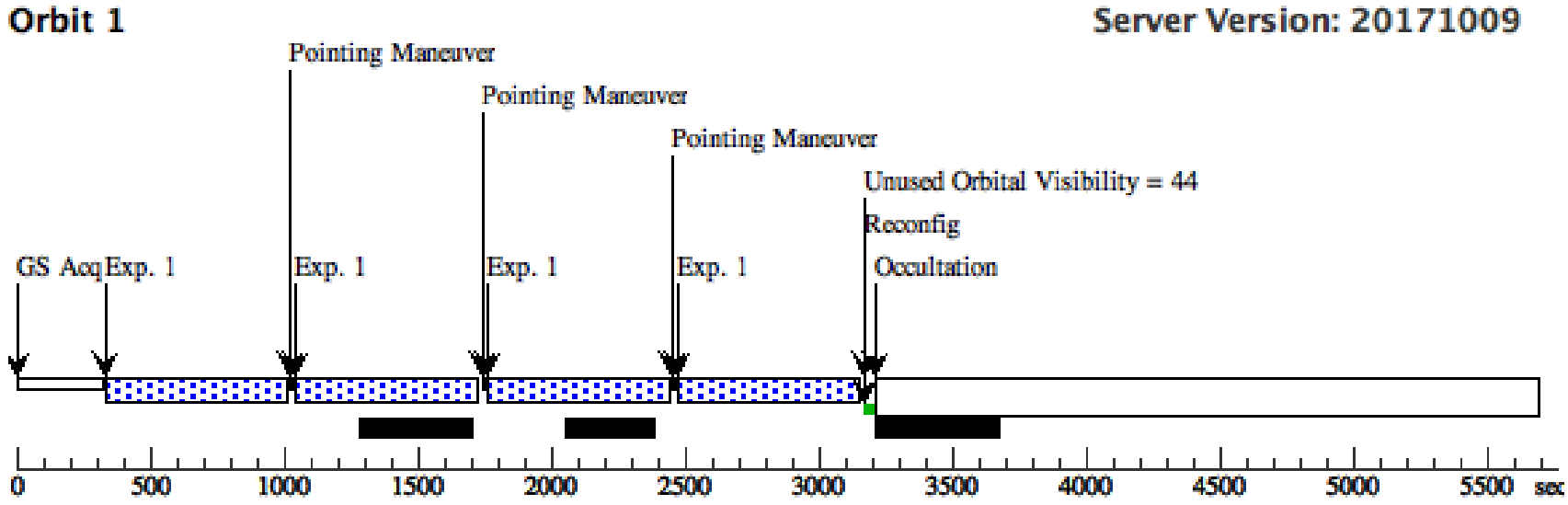
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J0834+2140	RA: 08 34 29.4500 (128.6227083d) Dec: +21 40 24.79 (21.67355d) Equinox: J2000	Redshift: 4.3900	V=27	Reference Frame: ICRS

Comments: V-magnitude is an estimate as no optical information is available for this galaxy
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) J0834+2140	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in Visit 01 (1)	652.938154 Secs (2611.753 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 15410, Visit 02 Sat Dec 16 00:00:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

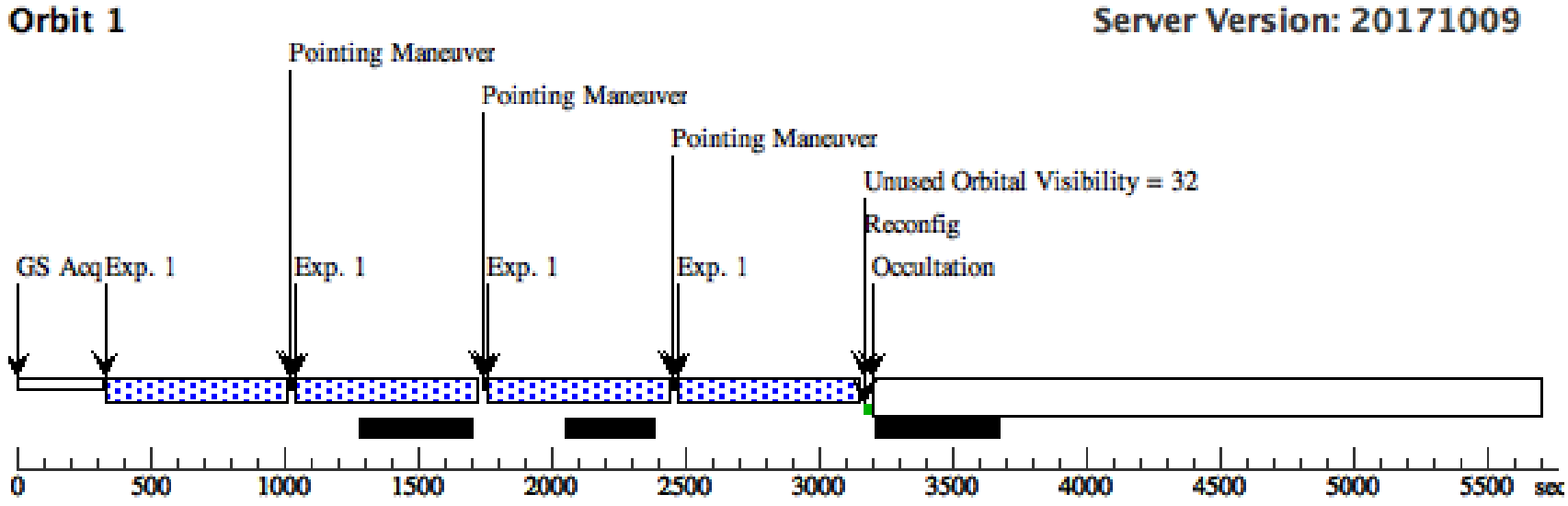
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	J1101+0531	RA: 11 01 34.3600 (165.3931667d) Dec: +05 31 34.12 (5.52614d) Equinox: J2000	Redshift: 4.3446	V=27	Reference Frame: ICRS

Comments: V-magnitude is an estimate as no optical information is available for this galaxy
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) J1101+0531	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in Visit 02 (1)	652.938154 Secs (2611.753 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 15410, Visit 03 Sat Dec 16 00:00:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

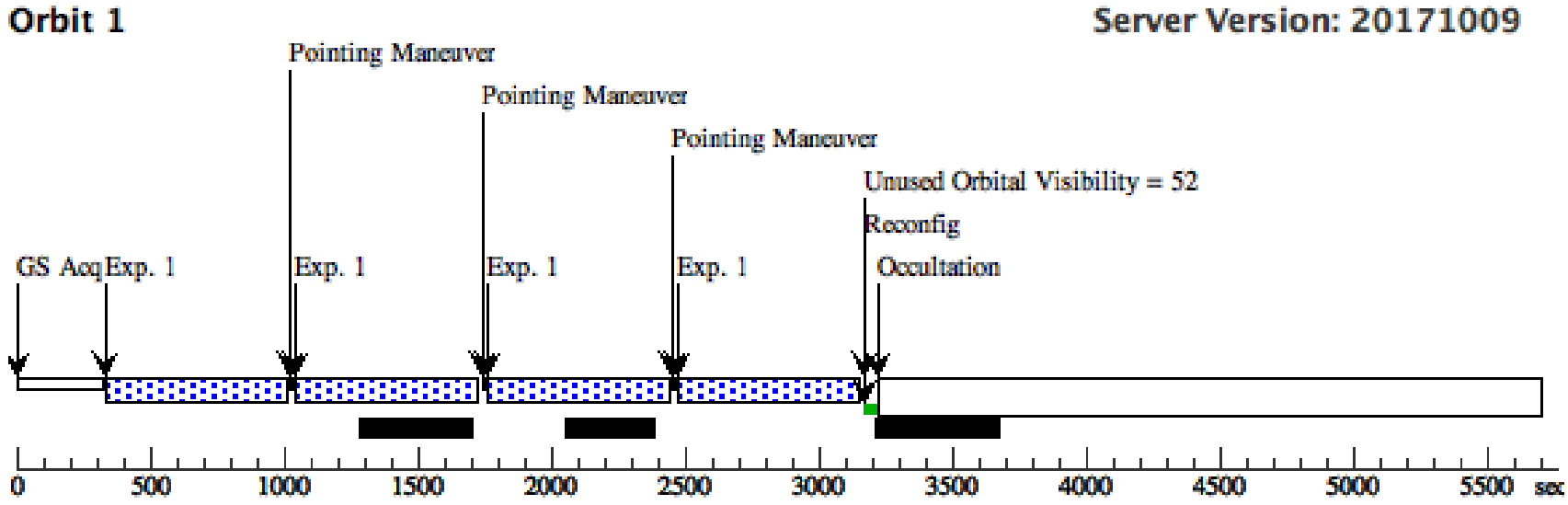
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	J1443+2724	RA: 14 43 31.1700 (220.8798750d) Dec: +27 24 36.73 (27.41020d) Equinox: J2000		V=27	Reference Frame: ICRS

Comments: V-magnitude is an estimate as no optical information is available for this galaxy
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) J1443+2724	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in Visit 03 (1)	652.938154 Secs (2611.753 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 15410, Visit 04 Sat Dec 16 00:00:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	J0817+1351	RA: 08 17 40.5300 (124.4188750d) Dec: +13 51 34.60 (13.85961d) Equinox: J2000		V=27.0	Reference Frame: ICRS

Comments: V-magnitude is an estimate as no optical information is available for this galaxy
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) J0817+1351	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in Visit 04 (1)	652.938154 Secs (2611.753 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure