14093 - Stellar Populations and Physical Conditions at ~100 pc Resolution in a Lensed Galaxy at z ~ 4

Cycle: 23, 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) FOR-J0332-3557	WFC3/IR	1	10-Sep-2015 21:05:08.0	yes
02	(1) FOR-J0332-3557	WFC3/UVIS	1	10-Sep-2015 21:05:10.0	yes

2 Total Orbits Used

ABSTRACT

Large surveys of star-forming galaxies at high redshift (z > 1.5) have provided us with a broad understanding of how galaxies assemble and evolve, but the spatial and spectral limitations inherent in observing faint, distant objects mean that many of the physical processes regulating this dynamic evolution are poorly constrained. Much of our most detailed knowledge of the physical conditions in distant galaxies comes from careful studies of gravitationally lensed sources, few of which are at z>3.5. FOR J0332-3557 is a gravitationally lensed galaxy at z ~ 4 for which we and other groups have obtained a total of 37.3 hours of VLT spectroscopy. The rest-frame UV spectrum is notable for its unusual combination of both strong emission lines in the rest-frame UV and strong Lya and interstellar absorption, and for the unusual spatial variation seen in the nebular emission lines, which

are less extended than the underlying stellar continuum. We propose high spatial resolution imaging of FOR J0332-3557 with four broadband filters on WFC3, taking advantage of both the HST resolution and the lensing magnification to study star formation and extinction on ~100 pc scales. Because the interpretation of our unusual rest-frame UV and optical spectra requires an accurate reddening estimate, combining these observations with ground-based spectroscopy will give the most complete picture to date of chemical evolution in a distant galaxy.

OBSERVING DESCRIPTION

The observational goal of our program is to use the Wide Field Camera 3 to obtain unprecedented high spatial resolution multi-wavelength imaging of the strongly-lensed star-forming galaxy, FOR J0332-3557, at redshift z ~ 4. In order to reliably model the wavelength dependence of spatial variations of FOR J0332-3557 we will obtain high resolution WFC3/F160W, F125W, F814W, and F606W imaging, tracing the rest-frame SED at 3228 AA, 2610 AA, 1740 AA, and 1238 AA respectively. This combination of filters samples the rest-frame SED at the ideal wavelengths to constrain the UV slope, and subsequently, the dust extinction, model the stellar populations, and constrain the current SED-derived SFR.

FOR J0332-3557 will be observed in four filters over 2 orbits. Each filter will be observed in three sub exposures using the standard WFC3 3PT line dithers in order to fill the chip gap and remove cosmic rays, bad pixels, and other artifacts.

In the first orbit we observe FOR J0332-3557 in the F125W and F160W filters in the IR configuration. For each subexposure, we select (NSAMP=) 9 and 10 nondestructuve readouts of the SAMP-SEQ=SPARS50 sequence respectively for the F125W and F160W filters. We select the maximum number of readouts possible that fit with in the orbit visibility in order to drive down the read noise. We choose to designate the extra readout to the F160W filter in which our target has lower S/N. This combination of readout parameters results in 3 exposures of 403 seconds for F125W, or a total exposure time of 1209 seconds, and 3 exposures of 453 seconds for F160W, or a total exposure time of 1359 seconds.

In the second orbit we observe FOR J0332-3557 in the F606W and F814W filters in the UVIS configuration. Each subexposure in the F606W filter is 360 seconds, for a total exposure of 1080 seconds. The WFC3 ETC predicts a stronger S/N for F606W over the F814W filter for our target. In order to ensure strong signal in the F814W filter, each subexposure is 390 seconds, for a total exposure of 1170 seconds. To mitigate CTE losses, we utilize a post-flash of 3e (FLASH=3) with the F814W filter.

Visit

Proposal 14093, IR (01), implementation Fri Sep 11 01:05:11 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: PCS MODE FINE

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1), (2)

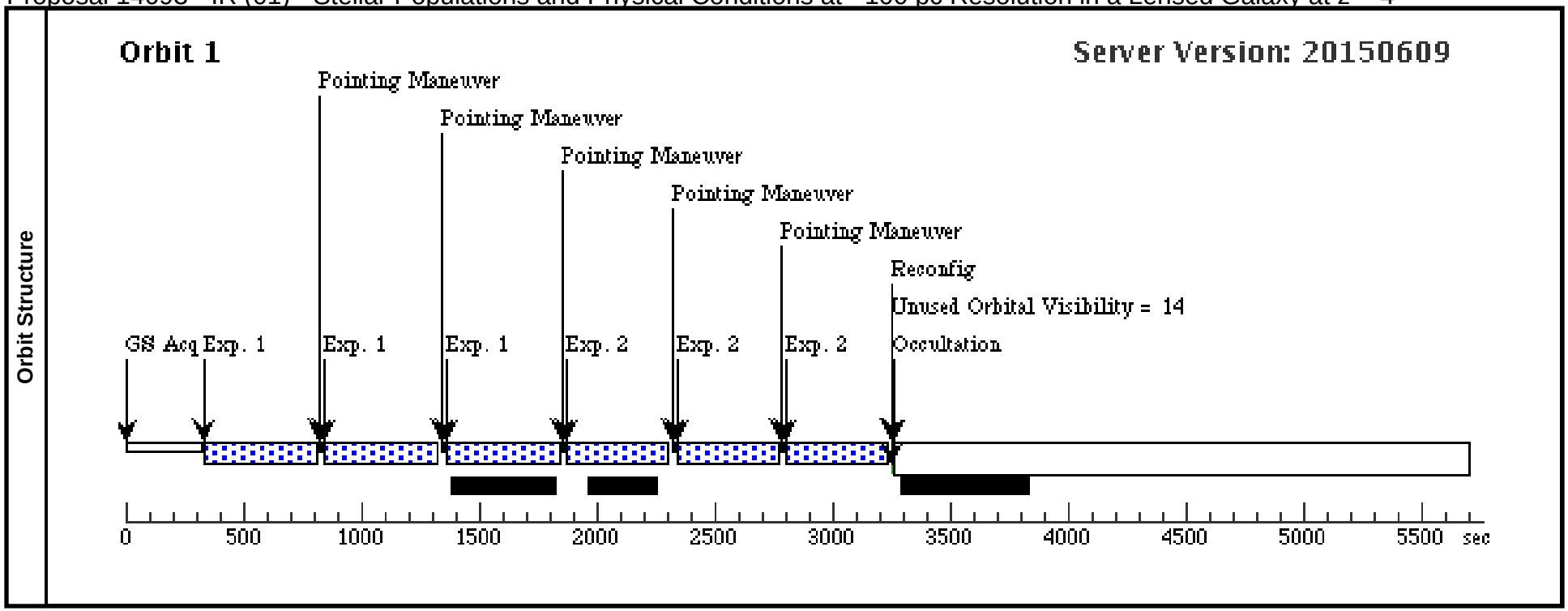
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	FOR-J0332-3557	RA: 03 32 59.9400 (53.2497500d) Dec: -35 57 51.70 (-35.96436d) Equinox: J2000	Redshift: 3.773	V=(?) R_c=22.6	Reference Frame: NED

Comments: This object was generated by the targetselector and retrieved from the NED 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	F160W (696137)	(1) FOR-J0332-3557	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=SPARS50; NSAMP=10	GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in IR (01) (1)	452.93635 Secs (1358.809 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***
2	F125W (696156)	(1) FOR-J0332-3557	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=9; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-2 in IR (01) (1)	402.935899 Secs (1208.808 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***


Orbit Structure
Orbit 1
Server Version: 20150609
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Reconfig
Unused Orbital Visibility = 14
GS Acq
Exp. 1
Exp. 1
Exp. 1
Exp. 2
Exp. 2
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14093, UVIS (02), implementation Fri Sep 11 01:05:12 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: PCS MODE FINE

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	FOR-J0332-3557	RA: 03 32 59.9400 (53.2497500d) Dec: -35 57 51.70 (-35.96436d) Equinox: J2000	Redshift: 3.773	V=(?) R_c=22.6	Reference Frame: NED

Comments: This object was generated by the targetselector and retrieved from the NED 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	F606W (696201)	(1) FOR-J0332-3557	WFC3/UVIS, ACCUM, UVIS	F606W		GS ACQ SCENARIO BASE1B3	Pattern 2, Exps 1-1 in UVIS (02) (2)	360 Secs (1080 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2	F814W (696172)	(1) FOR-J0332-3557	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=3		Pattern 2, Exps 2-2 in UVIS (02) (2)	390 Secs (1170 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure