15467 - The Brightest Lens in the Sky: Stellar Populations on ~50 pc Scales at the Peak Epoch of Star Formation

Cycle: 25, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Dawn K. Erb (PI) (Contact)	**University of Wisconsin - Milwaukee**	**erbd@uwm.edu**
Dr. Matthew Auger (CoI) (ESA Member)	University of Cambridge	mauger@ast.cam.ac.uk
Dr. Bethan Lesley James (CoI) (ESA Member)	Space Telescope Science Institute - ESA	bjames@stsci.edu
Lindsay Oldham (CoI)	Smithsonian Institution Astrophysical Observatory	ljo31@ast.cam.ac.uk
Prof. Max Pettini (CoI) (ESA Member)	University of Cambridge	pettini@ast.cam.ac.uk
Mr. Cameron Lemon (CoI) (ESA Member)	University of Cambridge	cl522@ast.cam.ac.uk

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SDSSJ1059+4251	WFC3/UVIS	1	01-Jun-2018 12:01:22.0	yes
02	(1) SDSSJ1059+4251	WFC3/IR	1	01-Jun-2018 12:01:24.0	yes
03	(1) SDSSJ1059+4251	WFC3/IR	1	01-Jun-2018 12:01:25.0	yes

3 Total Orbits Used

ABSTRACT

While thousands of galaxies have now been observed at the peak epoch of star formation, only the rare and highly magnified gravitationally lensed sources in conjunction with high resolution HST imaging enable the study of star formation at sub-kpc scales. We propose multiwavelength WFC3 imaging of J1059+4251 at z=2.79, the brightest galaxy-scale gravitational lens discovered to date. With F606W imaging obtained only a month ago,

we have discovered that the source is magnified by an extraordinary factor of ~130, with multiple knots of star formation on scales of ~50 pc in the source plane. We therefore now request imaging in three additional filters in order to constrain the stellar populations across the source. These data will enable measurements of the stellar mass surface density, the star formation rate and specific star formation rate, the surface density of star formation, and the age and reddening of the stellar populations, all on ~50 pc spatial scales. With these results we will test models of star formation at high redshift by determining the fraction of the total star formation arising in clumps with sizes << 1 kpc, and relate the properties of the star-forming regions to spectroscopic measurements of galactic outflows in order to determine whether the outflows are locally or globally sourced. The unprecedented brightness of J1059+4251 will make it one of the preeminent laboratories for the study of star formation in the high redshift universe, and high resolution, multiwavelength HST imaging will be an essential component of that work. The scientific returns of these observations will be maximized if they are taken during Cycle 25 via the mid-cycle program.

OBSERVING DESCRIPTION

The goal of this program is to obtain multi-band imaging of the bright, gravitationally lensed arc SDSSJ1059+4251. Our primary concern is to optimize the spatial sampling, and we will therefore use a 4-point box dither for the UVIS observations. For the IR observations with larger pixels, we will use a 4-point box dither followed by a 3-point line for a total of 7 exposures at 6 different positions. The repeated position, corresponding to the first exposure in each dither pattern, will enable a consistency check of the slightly different exposure times of the two patterns, and the combination of the two patterns will improve the sub-pixel sampling over either pattern alone. We will use the STEP100 sampling sequence in order to obtain good sampling on both the lensed arc and on PSF stars to be used for the de-lensing model. The dither sequences will also enable rejection of detector artifacts and cosmic rays.

Visit

Proposal 15467, Visit 01 Fri Jun 01 16:01:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

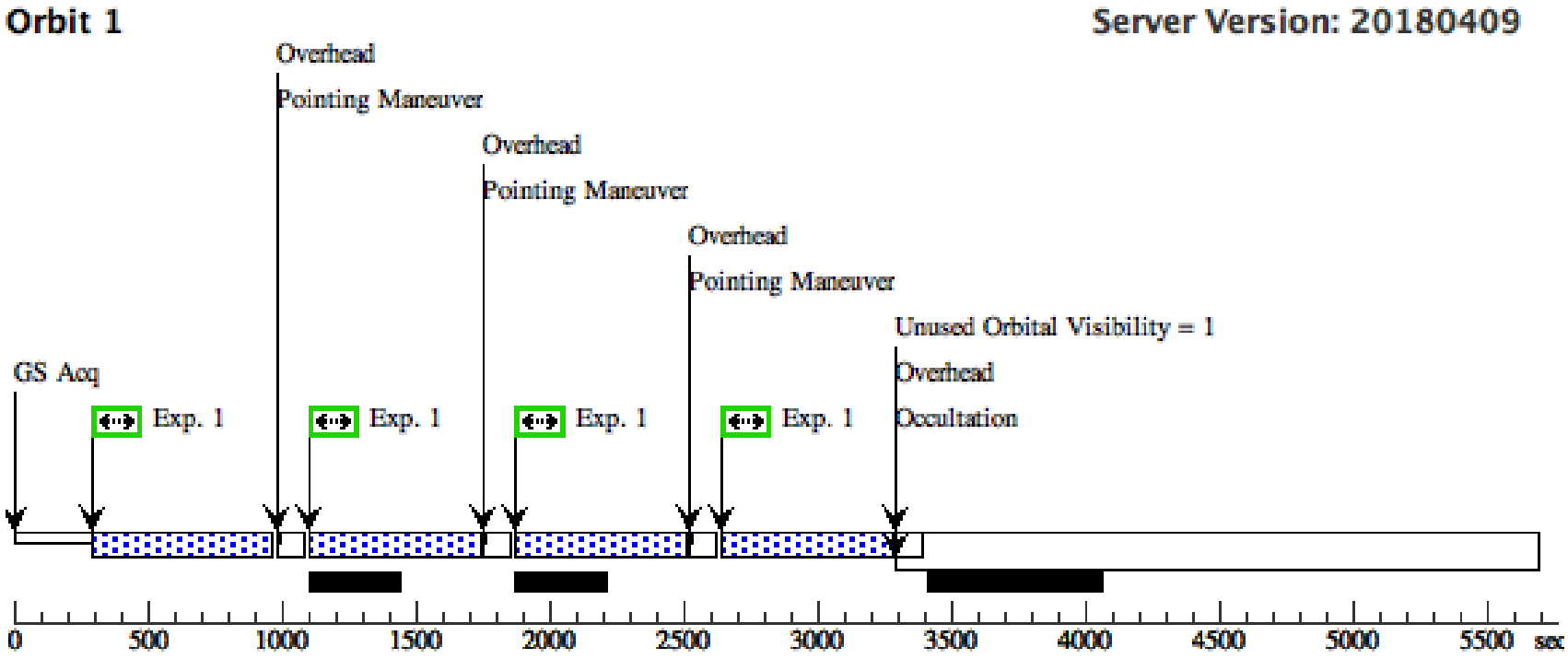
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1059+4251	RA: 10 59 55.1592 (164.9798300d) Dec: +42 51 34.16 (42.85949d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS, HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SDSSJ1059+4251	WFC3/UVIS, ACCUM, UVIS1	F814W			Pattern 1, Exps 1-1 in Visit 01 (1)	643 Secs (2572 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	

Orbit Structure



Visit

Proposal 15467, Visit 02 Fri Jun 01 16:01:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	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)
(3)	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		(2)

Fixed Targets

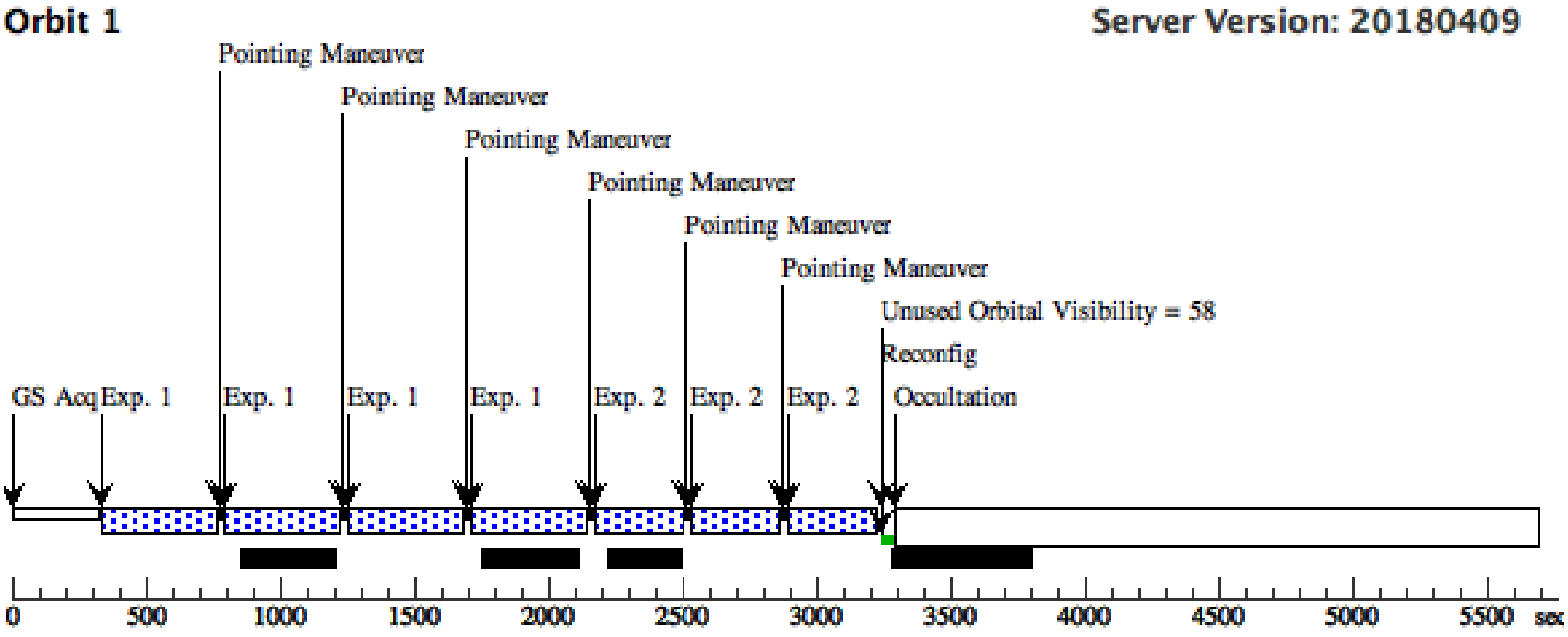
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1059+4251	RA: 10 59 55.1592 (164.9798300d) Dec: +42 51 34.16 (42.85949d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS, HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SDSSJ1059+4251	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=10; SAMP-SEQ=STEP100		Pattern 2, Exps 1-1 in Visit 02 (2)	399.231646 Secs (1596.927 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) SDSSJ1059+4251	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=9; SAMP-SEQ=STEP100		Pattern 3, Exps 2-2 in Visit 02 (3)	299.231323 Secs (897.694 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure



Visit

Proposal 15467, Visit 03 Fri Jun 01 16:01:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	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)
(3)	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		(2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1059+4251	RA: 10 59 55.1592 (164.9798300d) Dec: +42 51 34.16 (42.85949d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS, HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SDSSJ1059+4251	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=10; SAMP-SEQ=STEP100		Pattern 2, Exps 1-1 in Visit 03 (2)	399.231646 Secs (1596.927 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) SDSSJ1059+4251	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=9; SAMP-SEQ=STEP100		Pattern 3, Exps 2-2 in Visit 03 (3)	299.231323 Secs (897.694 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure