



17084 - Zooming In On Two Strongly Lensed Galaxies During the Epoch of Re-Ionization

Cycle: 30, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Matthew Bayliss (PI) (Contact)	University of Cincinnati Main Campus	mbbayliss@gmail.com
Prof. Michael D. Gladders (CoI)	University of Chicago	gladders@astro.uchicago.edu
Prof. Keren Sharon (CoI)	University of Michigan	kerens@umich.edu
Mr. Joshua Aaron Roberson (CoI)	University of Cincinnati Main Campus	robersju@mail.uc.edu
Dr. Gourav Khullar (CoI)	University of Chicago	gourav.khullar@pitt.edu
Dr. Keunho J. Kim (CoI)	University of Cincinnati Main Campus	kim2k8@ucmail.uc.edu
Mr. Alexander Edwin Navarre (CoI)	University of Cincinnati Main Campus	navarrae@mail.uc.edu
Dr. Lindsey Bleem (CoI)	Argonne National Laboratory	lbleem@anl.gov
Dr. Guillaume Mahler (CoI) (ESA Member)	Durham Univ.	guillaume.mahler@gmail.com
Juan David Remolina Gonzalez (CoI)	University of Michigan	jremolin@umich.edu
Prof. Mark Brodwin (CoI)	University of Missouri - Kansas City	brodwinm@umkc.edu
Dr. Behzad Ansarinejad (CoI)	University of Melbourne	behzad.ansarinejad@gmail.com
Ms. Kate Napier (CoI)	University of Michigan	kanapier@umich.edu
Michael S. Calzadilla (CoI)	Massachusetts Institute of Technology	mcs92@mit.edu
Mr. Benjamin Floyd (CoI)	University of Missouri - Kansas City	bfloyd@mail.umkc.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) SPT-DROPOUT-0304	ACS/WFC WFC3/IR	2	21-Sep-2022 10:00:22.0	yes
02	(2) SPT-DROPOUT-0216	ACS/WFC WFC3/IR	2	21-Sep-2022 10:00:23.0	yes

4 Total Orbits Used

ABSTRACT

Deep field observations with the Hubble Space Telescope have revealed several hundred galaxy candidates in the universe's first billion years leading up to re-ionization, but only a small fraction are bright enough ($H < 24$ AB) for detailed, high-S/N spectroscopic follow-up study with the James Webb Space Telescope (JWST). We propose for WFC3/IR + ACS imaging observations of two exceptionally bright (F110W_AB~23.8) $z \sim 7$ dropout galaxies that were recently identified in archival HST data. Both targets appear as multiply imaged pairs near the cores of massive foreground galaxy clusters, indicating that they are strongly lensed, and therefore highly magnified. While both lensed sources appear as exceptionally bright $z \sim 7$ galaxies, their intrinsic brightnesses are much smaller. Unlike the brightest high- z galaxies discovered in deep fields, our target source are drawn from the population of faint high- z galaxies that are likely responsible for re-ionization. These lensed sources provide a unique opportunity to perform detailed studies of typical, intrinsically faint, galaxies during the epoch of re-ionization. Our proposed observations will simultaneously achieve three science goals: 1) inform a detailed strong lensing model for each system (necessary to recover their true intrinsic properties), 2) measure the stellar mass and UV spectral slopes of multiple spatially resolved (via lensing magnification) star-forming clumps in each dropout galaxy, and 3) reduce photometric redshift uncertainties for both lensed galaxies by a factor $> 3x$ (necessary to plan future spectroscopic observations).

OBSERVING DESCRIPTION

The goal of this program is to observe two different targets in F814W with ACS and in F098M+F160W imaging with WFC3/IR. The purpose of the observations are to sample the spectral energy distributions of both foreground cluster galaxies and candidate strongly lensed dropout galaxies at $z > 6$.

Each target will receive two orbits of data. The first orbit for each target will be spent entirely on F814W (ACS) imaging, and the second orbit will be split between the F098M and F160W imaging using WFC3/IR. The observations will be organized into two visits, one for each target. Each visit will

Proposal 17084 (STScI Edit Number: 0, Created: Wednesday, September 21, 2022 at 9:00:24 AM Eastern Standard Time) - Overview contain two orbits (one using ACS the other using WFC3/IR).

This being a 4 orbit program, we are splitting orbits up quite aggressively. Our observations are designed with the biggest priority being that we obtain a minimum of 4 dithered observations in each band, for each target. For ACS/WFC F814W imaging we use the ACS-WFC-DITHER-BOX, and split a single orbit up into 4 equal exposures that use the full target visibility window. For WFC3/IR F098M and F160W we use a pattern composed of a macro-scale dither (a 2pt version of WFC3-IR-DITHER-BLOB) with a sub-pattern that has a small-scale dither (a 2 pt version of WFC3-IR-DITHER-LINE).

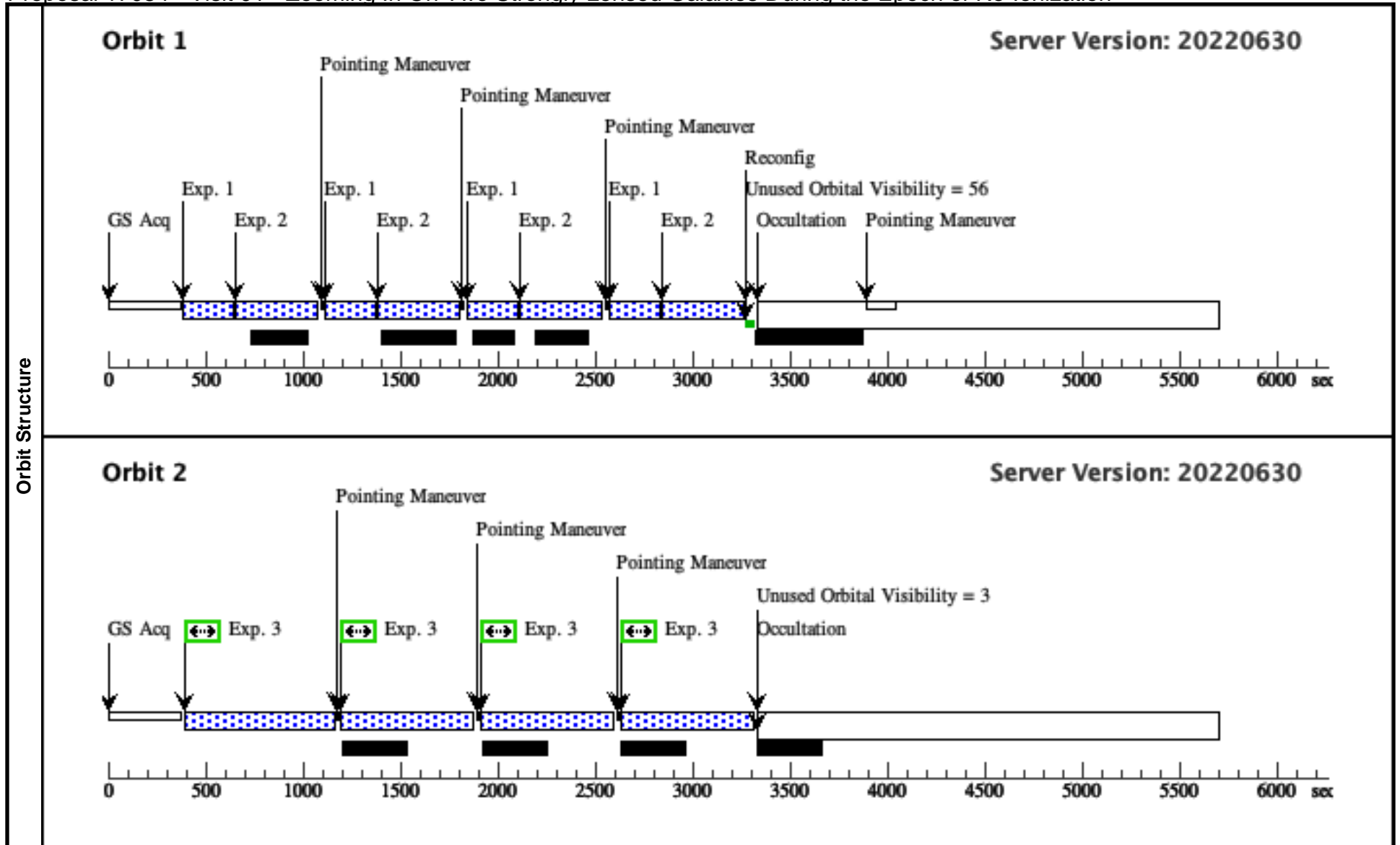
For the WFC3/IR imaging we try to maximize the value of NSAMP to improve cosmic ray rejection and minimize readnoise. However, we are packing a lot of exposures (8) into a single orbit and so buffer dumping constraints require us to use longer individual integrations with lower values of NSAMP that would be strictly optimal from a signal-to-noise perspective. That said, our targets are quite bright and so we prioritize having 4 dither points over maximizing NSAMP in our exposures.

Any thoughts/feedback/comments from the instrument experts would be very much welcome!

Proposal 17084 - Visit 01 - Zooming In On Two Strongly Lensed Galaxies During the Epoch of Re-Ionization

Wed Sep 21 14:00:24 GMT 2022

Visit	Proposal 17084, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: (none)									
	#	Primary Pattern	Secondary Pattern	Exposures						
Patterns	(3)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1-2)				
	(5)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.2637 Line Spacing=0.1856	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.02 Center Pattern=false			(3)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SPT-DROPOUT-0304	RA: 03 04 52.6893 (46.2195388d) Dec: -54 03 58.06 (-54.06613d) Equinox: J2000		V=30+/-1 F110W = 23.8	Reference Frame: ICRS				
<i>Comments:</i> 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) SPT-DROPOUT-0304	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=SPARS 25; NSAMP=10		Pattern 3, Exps 1-2 in Visit 01 (3)	227.936926 Secs (911.748 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]
	2		(1) SPT-DROPOUT-0304	WFC3/IR, MULTIACCUM, IR	F098M	SAMP-SEQ=SPARS 50; NSAMP=9		Pattern 3, Exps 1-2 in Visit 01 (3)	402.935899 Secs (1611.744 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]
	3		(1) SPT-DROPOUT-0304	ACS/WFC, ACCUM, WFCENTER	F814W			Pattern 5, Exps 3-3 in Visit 01 (5)	562 Secs (2244 Secs) [==>561.0 Secs (Pattern 1)] [==>561.0 Secs (Pattern 2)] [==>561.0 Secs (Pattern 3)] [==>561.0 Secs (Pattern 4)]	[2]



Proposal 17084 - Visit 02 - Zooming In On Two Strongly Lensed Galaxies During the Epoch of Re-Ionization

Wed Sep 21 14:00:24 GMT 2022

Visit	Proposal 17084, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: (none)									
	#	Primary Pattern	Secondary Pattern	Exposures						
Patterns	(3)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1-2)				
	(5)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.2637 Line Spacing=0.1856	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.02 Center Pattern=false			(3)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	SPT-DROPOUT-0216	RA: 02 16 35.8520 (34.1493833d) Dec: -26 10 1.33 (-26.16704d) Equinox: J2000		V=30+/-1 F110W = 23.8	Reference Frame: ICRS				
<i>Comments:</i> 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		(2) SPT-DROPOUT-0216	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=SPARS 25; NSAMP=10		Pattern 3, Exps 1-2 in Visit 02 (3)	227.936926 Secs (911.748 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]
	2		(2) SPT-DROPOUT-0216	WFC3/IR, MULTIACCUM, IR	F098M	SAMP-SEQ=SPARS 50; NSAMP=8		Pattern 3, Exps 1-2 in Visit 02 (3)	352.935448 Secs (1411.742 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]
	3		(2) SPT-DROPOUT-0216	ACS/WFC, ACCUM, WFCENTER	F814W			Pattern 5, Exps 3-3 in Visit 02 (5)	519 Secs (2076 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]

