17101 - Clash of Titans: Characterizing SPT-CLJ0307-6225, a major merger in the plane of the sky

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Alfredo Zenteno (PI) (Contact)	**NOIRLab - CTIO (Chile)**	**alfredo.zenteno@noirlab.edu**
Dr. Rogerio Monteiro-Oliveira (CoI)	Academia Sinica, Institute of Astronomy and Astrophysics	rogerionline@gmail.com
Dr. Armin Rest (CoI)	Space Telescope Science Institute	arest@stsci.edu
Dr. Eleazar Rodrigo Carrasco Damele (CoI)	NOIRLab - Gemini South (Chile)	rodrigo.carrasco@noirlab.edu
Dr. Guillaume Mahler (CoI) (ESA Member)	Durham Univ.	guillaume.mahler@gmail.com
Dr. Hector Cuevas (CoI)	Universidad de La Serena	hcuevas@userena.cl
Dr. Matthew Bayliss (CoI)	University of Cincinnati Main Campus	mbbayliss@gmail.com
Dr. Annalisa Calamida (CoI)	Space Telescope Science Institute	calamida@stsci.edu
Mr. Daniel Hernandez-Lang (CoI) (ESA Member)	Ludwig Maximilian Universitat of Munich	daniel.hernandez@physik.lmu.de
Hugo Antonio Prado Plaza (CoI)	Universidad de La Serena	hprado@alumnosuls.cl
Dr. Alexandro Saro (CoI) (ESA Member)	Universita degli Studi di Trieste	alexandro.saro@inaf.it

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(2) BCG-NORTH	ACS/WFC	2	13-Jan-2023 14:00:17.0	yes
04	(3) BCG-SOUTH-1	ACS/WFC	3	13-Jan-2023 14:00:18.0	yes

5 Total Orbits Used

ABSTRACT

Mergers of galaxy clusters are natural dark matter (DM) colliders. If DM particles self interact, signatures of the interaction can be found in merging clusters as an spatial offset among the collisionless cluster galaxies, the intracluster gas, and the cluster potential, dominated by the DM. Typically, to place constraints on the value of the DM particle self-interacting cross section, ensembles (~ 40) of merging clusters are used. Nevertheless, most of the constraining power comes from a special type of mergers: oriented in the plane of the sky, with (relatively) similar cluster masses, and showing a large displacement between the collisional and the collisionless components. Finding those special mergers would significantly improve the current constraints on the DM particle self-interacting cross section. SPT-CLJ0307-6225 is a merging cluster in the plane of the sky, with {\it Chandra} X--ray showing a comet like gas distribution, Gemini/GMOS and VLT/MUSE spectroscopy that confirms a plane-of-the-sky orientation of the merger, and ground based imaging confirming both, a large gas galaxy offsets (~ 790 and ~ 360 kpc) and the need for space base observations, for a robust weak lensing analysis. The superb imaging of HST will allow us to map the dark matter mass density distribution of SPT-CLJ0307-6225, and to use it to place constraints on the self-interacting DM cross section.

OBSERVING DESCRIPTION

Our observing plan covers the primary cluster mass with two pointings of ACS (WFC), with 3 orbits covering the most concentrated southern region and 2 orbits in the north. Both pointings use a 4-step dither patter for optimal PSF sampling, with an additional F606W exposure and dither over the chip gap in the southern pointing. The restricted orient rages are intended to align the mosaic with the cluster mass distribution.

NOTE that for scheduling purposes, we have included orient ranges that are 180 degrees rotated as it keeps the same coverage of the field. However, if the orient falls in the 280-300deg range then the tiles need to be swapped, ensuring that the pointing with 3 orbits covers the BCG-SOUTH targets regardless of orientation. Overall coverage of the BCG targets 2-4 is critical, so in the scheduling process once the final orientation is set we would like to review the final detector placement to ensure it gives optimal coverage.

Visit

Proposal 17101, BCG-NORTH (03), implementation Fri Jan 13 19:00:19 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 89D TO 105 D

Comments: Orient ranges are inteded to follow the cluster mass distribution, but this tile MUST comfortably cover target BCG-NORTH.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=false		(1-2)

Fixed Targets

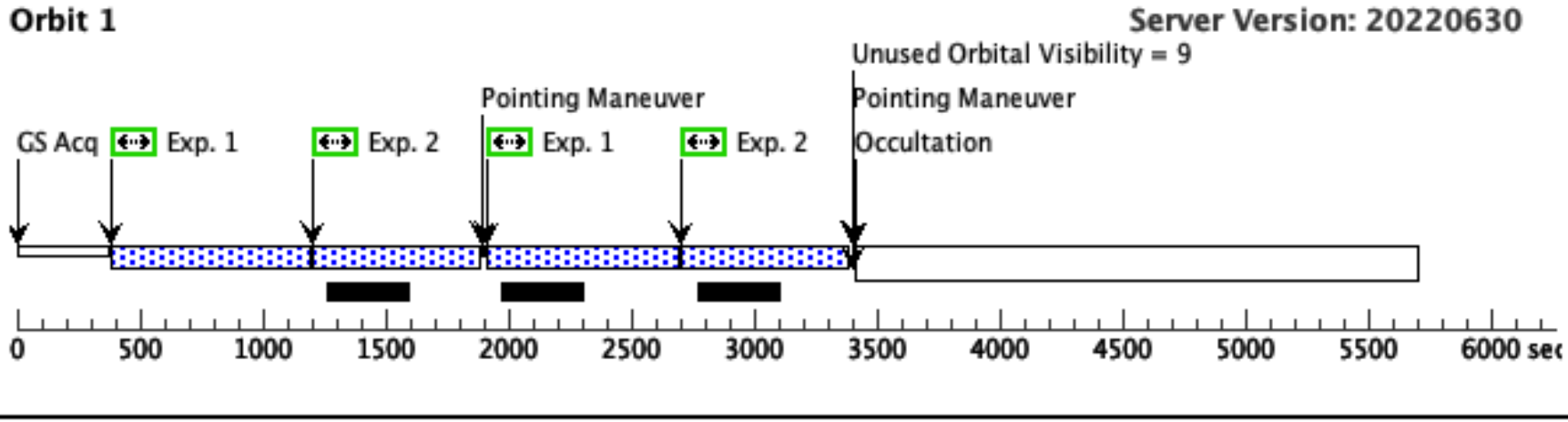
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	BCG-NORTH	RA: 03 07 20.8500 (46.8368750d) Dec: -62 24 32.12 (-62.40892d) Equinox: J2000		V=23	Reference Frame: ICRS

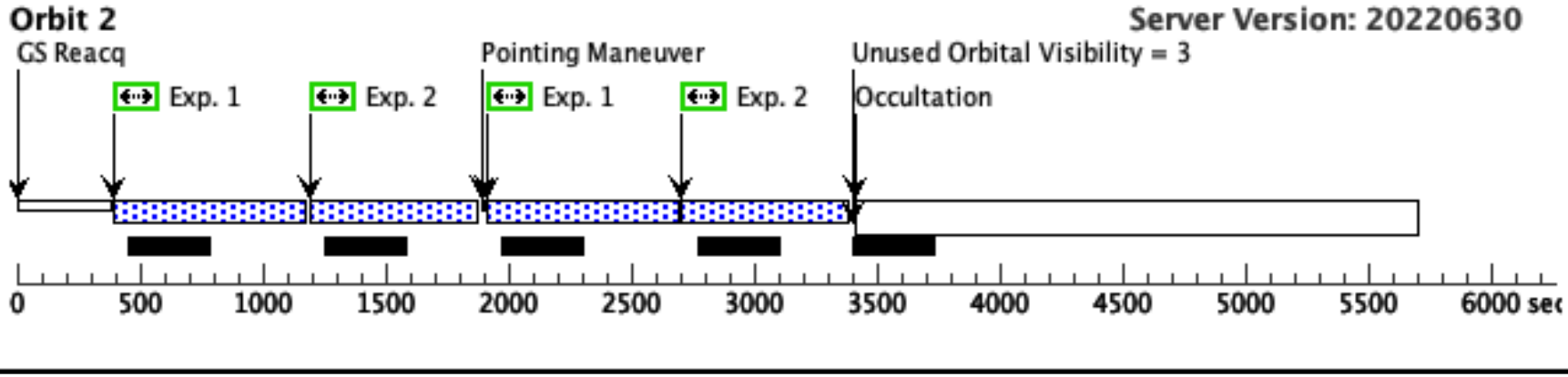
Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.18 15765)	(2) BCG-NORTH	ACS/WFC, ACCUM, WFCENTER	F606W			Pattern 1, Exps 1-2 in BCG-NORTH (03) (1)	600 Secs (2412 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>606.0 Secs (Pattern 3)] *[==>606.0 Secs (Pattern 4)]*	***[2]***
Comments: Part of a ACS WFC Dither Box pattern, which alternates with the F814W filter over the course of 2 orbits. A deeper F606W exposure is preferred for the science case.									
2	(ACS.im.18 15767)	(2) BCG-NORTH	ACS/WFC, ACCUM, WFCENTER	F814W			Pattern 1, Exps 1-2 in BCG-NORTH (03) (1)	500 Secs (2012 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>506.0 Secs (Pattern 3)] *[==>506.0 Secs (Pattern 4)]*	***[2]***
Comments: Part of a ACS WFC Dither Box pattern, which alternates with the F606W filter over the course of 2 orbits.									

Orbit Structure





Visit

Proposal 17101, BCG-SOUTH (04), implementation Fri Jan 13 19:00:19 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 03

Comments: Orient ranges are inteded to follow the cluster mass distribution, but this tile MUST comfortably cover target BCG-SOUTH-1 and 2.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=false		(1-2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	BCG-SOUTH-1	RA: 03 07 12.7500 (46.8031250d) Dec: -62 27 40.43 (-62.46123d) Equinox: J2000		V=23	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.18 15769)	(3) BCG-SOUTH-1	ACS/WFC, ACCUM, WFCENTER	F606W			Pattern 1, Exps 1-2 in BCG-SOUTH (04) (1)	800 Secs (3211 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>806.0 Secs (Pattern 3)]	***[2]***
								[==>805.0 Secs (Pattern 4)]	***[3]***
Comments: Part of a ACS WFC Dither Box pattern, which alternates with the F814W filter over the course of 2 orbits.This is the deeper of the two pointings, and the extra exposure is in F606W as a deeper F606W exposure is preferred for the science case.									
2	(ACS.im.18 15768)	(3) BCG-SOUTH-1	ACS/WFC, ACCUM, WFCENTER	F814W			Pattern 1, Exps 1-2 in BCG-SOUTH (04) (1)	800 Secs (3217 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>806.0 Secs (Pattern 2)] *[==>806.0 Secs (Pattern 3)]*	***[2]***
								[==>805.0 Secs (Pattern 4)]	***[3]***
Comments: Part of a ACS WFC Dither Box pattern, which alternates with the F606W filter over the course of 2 orbits. This is the deeper of the two pointings.									
3	(ACS.im.18 15769xv)	(3) BCG-SOUTH-1	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG .247,2.984		800 Secs (805 Secs)	
								[==>805.0 Secs]	***[3]***
Comments: The 5th exposure in F606W for this pointing, which brings the total F606W exposure to 3200s. We add a final dither after the box to step over the chip gap.									

Orbit Structure