12817 - Longevity of dark matter substructure in Abell 3827

Cycle: 20, 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	(2) ACO3827-OFFSET814 (3) ACO3827-OFFSET606	ACS/WFC	3	21-Jun-2013 21:01:08.0	yes
02	(5) ACO3827-OFFSET160	WFC3/IR	1	21-Jun-2013 21:01:20.0	yes
03	(4) ACO3827-OFFSET336	WFC3/UVIS	2	21-Jun-2013 21:01:26.0	yes

6 Total Orbits Used

ABSTRACT

We will investigate the interaction properties of dark matter, through the infall of substructure into a galaxy cluster with a rare dynamical history. Abell 3827 appears to have grown rapidly through several simultaneous mergers, and currently hosts the stellar remnants of five massive elliptical galaxies within 15 kpc of the core. Only one other well-studied cluster (Abell 2261) contains a distribution of baryonic matter that is even comparably corrugated - and a strong lens threaded through the core of Abell 3827 provides a unique gravitational handle on its distribution of dark matter.

We will measure the late-stage dissipation of the dark matter halos that would have initially accompanied the infalling galaxies. The timescale for this dissipation is a key ingredient in models of structure formation. Most interestingly, our analysis of extant ground-based data also found dark matter offset from its stellar counterpart. This is predicted by numerical simulations if dark matter has (even a small) self-interaction cross section. If confirmed by a robust HST analysis, this result would achieve the same level of impact on fundamental physics as did HST confirmation of the Bullet Cluster offset between dark matter and gas. Constraints on both the tidal gravitational stripping and electroweak interactions of dark matter will be especially aided by the simultaneous measurement of multiple substructures within this single extended halo.

This project will require UV, optical and NIR imaging, plus a combined strong-lensing, weak-lensing and flexion analysis. We request six orbits with WFC3/UVIS, ACS/WFC and WFC3/IR, and will also exploit new Chandra data already in the archive.

OBSERVING DESCRIPTION

Multiband imaging with ACS/WFC, WFC3/UVIS and WFC3/IR of a single galaxy cluster.

REAL TIME JUSTIFICATION

None.

CALIBRATION JUSTIFICATION

None.

ADDITIONAL COMMENTS

There is a brightish (V=12.1) star nearby. The specified orients have been chosen to avoid that star. Different orients would also be acceptable; but if the orient changes, the POS TRAGs must also change.

Visit

Proposal 12817, ACS optical imaging (01), implementation Sat Jun 22 01:01:34 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 30%; ORIENT 31D TO 41 D

Comments: The F814W imaging should occur immediately after the F606W imaging and with the same orientation, to maximise thermal stability during the F814W exposures. To achieve full depth near the cluster core, one ACS/WFC detector covers it on both orbits; to enlarge the field of view, a different detector is centered for each orbit, with the other one covering an outlying region.

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	Pattern Type=LINE	Coordinate Frame=POS-TARG	Pattern Type=LINE	Coordinate Frame=POS-TARG	(1), (2), (3)
	Purpose=DITHER	Pattern Orientation=91.16385	Purpose=DITHER	Pattern Orientation=85.38987	
	Number Of Points=2	Angle Between Sides=	Number Of Points=2	Angle Between Sides=	
	Point Spacing=6.10486	Center Pattern=false	Point Spacing=3.08553	Center Pattern=false	
	Line Spacing=		Line Spacing=		

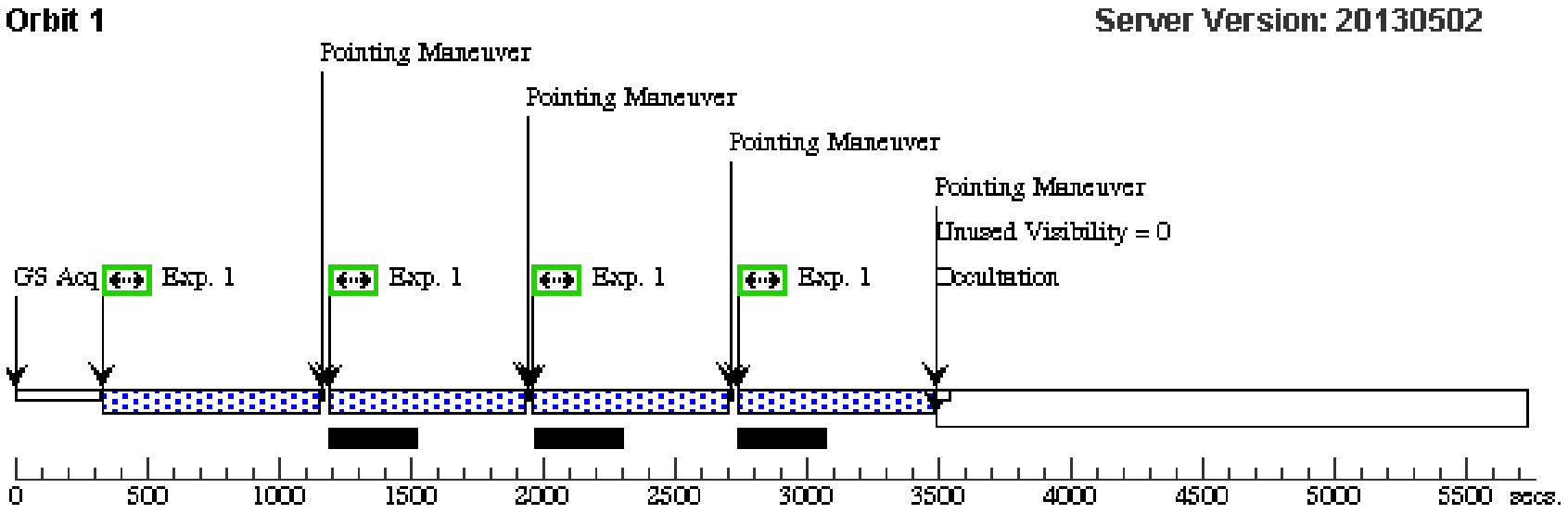
Fixed Targets

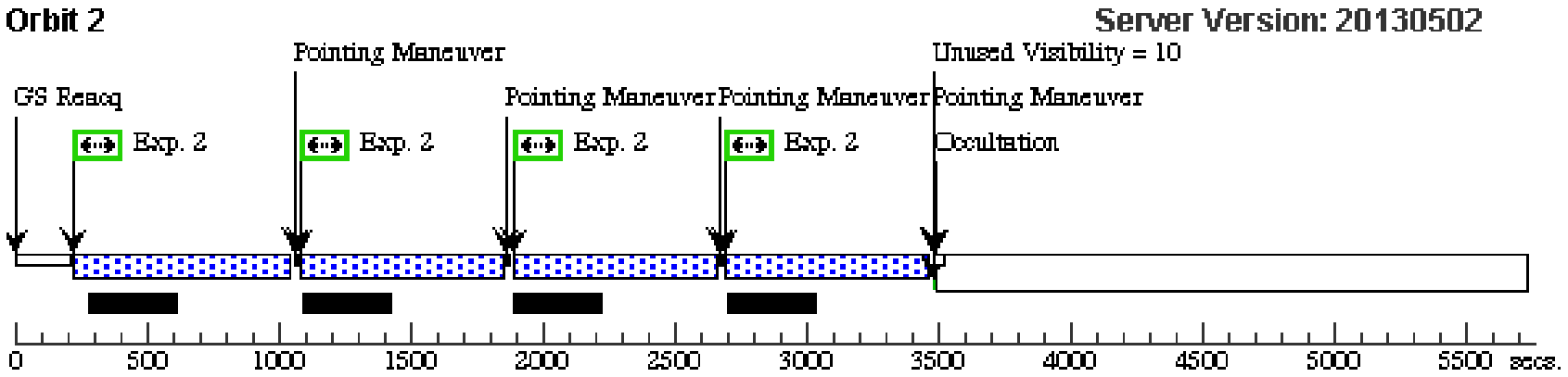
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	ACO3827-OFFSET814	RA: 22 01 55.0446 (330.4793525d)		V=14	Reference Frame: ICRS
	Alt Name1: ABELL3827	Dec: -59 57 14.85 (-59.95412d)			
	Alt Name2: A3827	Equinox: J2000			
(3)	ACO3827-OFFSET606	RA: 22 01 57.9187 (330.4913279d)		V=14	Reference Frame: ICRS
	Alt Name1: ABELL3827	Dec: -59 56 41.13 (-59.94476d)			
	Alt Name2: A3827	Equinox: J2000			

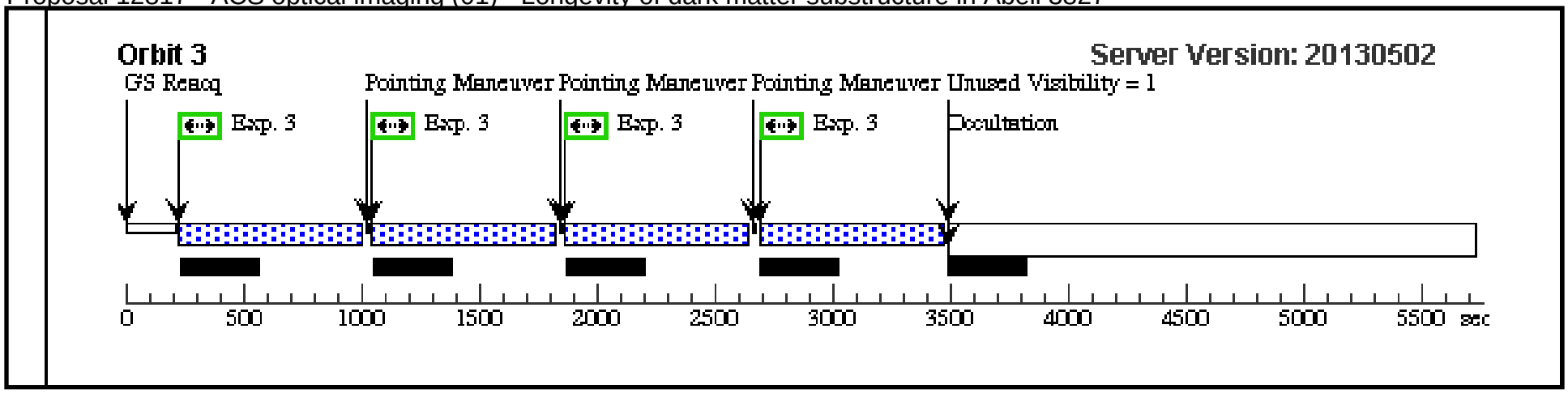
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W	(3) ACO3827-OFFSET606	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0,0	Pattern 1, Exps 1-1 in ACS optical imaging (01) (1)	610 Secs (2452 Secs)	
								[==>613.0 Secs (Pattern 1,1)]	***[1]***
								[==>613.0 Secs (Pattern 1,2)]	
								[==>613.0 Secs (Pattern 2,1)]	
								[==>613.0 Secs (Pattern 2,2)]	
2	F814W-2	(2) ACO3827-OFFSET814	ACS/WFC, ACCUM, WFC2-FIX	F814W		POS TARG 0,0	Pattern 1, Exps 2-2 in ACS optical imaging (01) (1)	645 Secs (2580 Secs)	
								[==>(Pattern 1,1)]	***[2]***
								[==>(Pattern 1,2)]	
								[==>(Pattern 2,1)]	
								[==>(Pattern 2,2)]	
3	F814W-1	(2) ACO3827-OFFSET814	ACS/WFC, ACCUM, WFC1-FIX	F814W		POS TARG 1,-15	Pattern 1, Exps 3-3 in ACS optical imaging (01) (1)	645 Secs (2644 Secs)	
								[==>661.0 Secs (Pattern 1,1)]	***[3]***
								[==>661.0 Secs (Pattern 1,2)]	
								[==>661.0 Secs (Pattern 2,1)]	
								[==>661.0 Secs (Pattern 2,2)]	

Orbit Structure






Orbit 3
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Pointing Maneuver
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Pointing Maneuver
Unused Visibility = 1
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
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sec

Visit

Proposal 12817, WFC3 IR imaging (02), implementation Sat Jun 22 01:01:38 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 30%; ORIENT 10D TO 20 D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(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=131.788 Angle Between Sides= Center Pattern=false	(1)

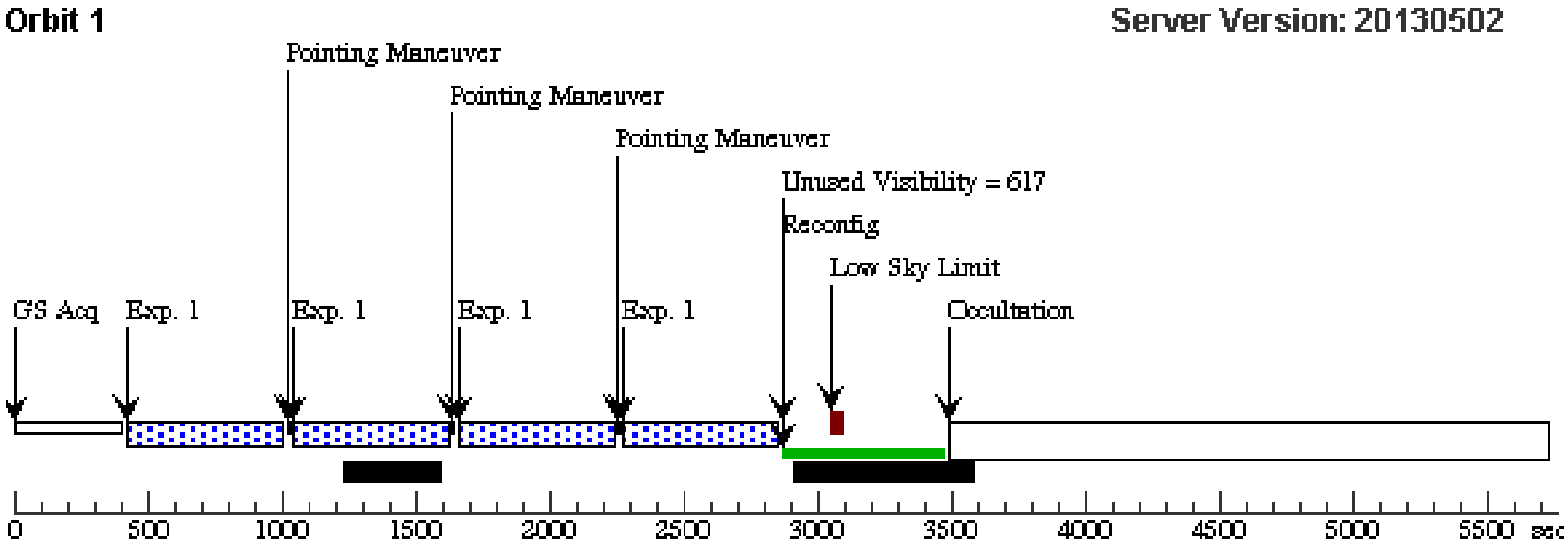
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	ACO3827-OFFSET160 Alt Name1: ABELL3827 Alt Name2: A3827	RA: 22 01 54.5968 (330.4774867d) Dec: -59 56 54.07 (-59.94835d) Equinox: J2000		V=14	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F160W	(5) ACO3827-OFFSET160	WFC3/IR, MULTIACCUM, IR-FIX	F160W	NSAMP=12; SAMP-SEQ=SPARS50	LOW-SKY	Pattern 3, Exps 1-1 in WFC3 IR imaging (02) (3)	552.937252 Secs (2211.749 Secs) *[==>(Pattern 1,1)]* *[==>(Pattern 1,2)]* *[==>(Pattern 2,1)]* *[==>(Pattern 2,2)]*	*[1]*

Orbit Structure



Visit

Proposal 12817, WFC3 UV imaging (03), implementation Sat Jun 22 01:01:39 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 30%; ORIENT 0D TO 10 D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(2)	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=MOSAIC Number Of Points=3 Point Spacing=2.4 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.754 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.119 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=33.606 Angle Between Sides= Center Pattern=false	(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	ACO3827-OFFSET336 Alt Name1: ABELL3827 Alt Name2: A3827	RA: 22 01 54.2069 (330.4758621d) Dec: -59 56 58.66 (-59.94963d) Equinox: J2000		V=14	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F336W	(4) ACO3827-OFFSET336	WFC3/UVIS, ACCUM, UVIS-FIX	F336W	FLASH=9.0	POS TARG 0,0	Pattern 2, Exps 1-1 in WFC3 UV imaging (03) (2)	940 Secs (5871 Secs)	
								[==>960.0 Secs (Pattern 1,1)]	
								[==>960.0 Secs (Pattern 1,2)]	***[1]***
								[==>960.0 Secs (Pattern 2,1)]	
								[==>997.0 Secs (Pattern 2,2)]	
								[==>997.0 Secs (Pattern 3,1)]	***[2]***
								[==>997.0 Secs (Pattern 3,2)]	

Orbit Structure