



12220 - Linking Star Formation with Intracuster Medium Cooling and AGN Heating in a Sample of Herchel Galaxy Clusters

Cycle: 18, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Rupal Mittal (PI)	Rochester Institute of Technology	rmittal@astro.rit.edu
Dr. Christopher P. O'Dea (CoI)	Rochester Institute of Technology	cposps@cis.rit.edu
Dr. Stefi A. Baum (CoI)	Rochester Institute of Technology	Baum@cis.rit.edu
Dr. Alastair C. Edge (CoI) (ESA Member)	University of Durham	Alastair.Edge@Durham.ac.uk
Dr. Brian R. McNamara (CoI)	University of Waterloo	mcnamara@scimail.uwaterloo.ca
Mr. Grant Tremblay (CoI)	Rochester Institute of Technology	grant@astro.rit.edu
Dr. Megan Donahue (CoI)	Michigan State University	donahue@pa.msu.edu
Dr. Francoise Combes (CoI) (ESA Member)	Observatoire de Paris	francoise.combes@obspm.fr
Dr. Alice Quillen (CoI)	University of Rochester	aquillen@pas.rochester.edu
Prof. Andrew C. Fabian (CoI) (ESA Member)	University of Cambridge	acf@ast.cam.ac.uk
Dr. Craig L. Sarazin (CoI)	The University of Virginia	sarazin@virginia.edu
Dr. Richard Wilman (CoI)	Swinburne University of Technology	RWILMAN@groupwise.swin.edu.au
Dr. Eiichi Egami (CoI)	University of Arizona	eegami@as.arizona.edu
Dr. Malcolm Bremer (CoI) (ESA Member)	University of Bristol	m.bremer@bristol.ac.uk
Mr. Raymond Oonk (CoI)	Sterrewacht Leiden	oonk@strw.leidenuniv.nl
Dr. Walter Jaffe (CoI) (ESA Member)	Sterrewacht Leiden	jaffe@strw.leidenuniv.nl

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) HYDRA-A	ACS/SBC ACS/WFC	2	07-Jul-2010 22:06:15.0	yes
02	(2) A2199	ACS/SBC	1	07-Jul-2010 22:06:19.0	yes
03	(3) A1068	ACS/SBC	1	07-Jul-2010 22:06:22.0	yes
04	(4) PKS0745-1910	ACS/SBC	1	07-Jul-2010 22:06:24.0	yes
05	(5) RXJ1504.1-0248	ACS/SBC WFC3/UVIS	2	07-Jul-2010 22:06:27.0	yes

7 Total Orbits Used

ABSTRACT

Numerous studies of the cores of galaxy clusters have revealed that the gas in central regions is not cooling at the rates predicted by the traditional cooling flow model. This discrepancy has inspired a search for heating models that can explain current observations. AGN feedback is considered an attractive solution to several connected problems, such as the high-mass end truncation of galaxy distribution and the absence of cooling-flows in centers of galaxy clusters. Amidst the emerging hypothesis of self-regulated AGN feedback, infrared, optical and FUV observations of clusters also indicate the presence of large amounts of cold gas in their brightest cluster galaxies (BCGs). There are over 30 BCGs that exhibit active star formation based on their mid-infrared and several of those have direct evidence based on FUV and/or optical imaging. In this proposal we aim to investigate a sample of 11 BCGs forming the basis of a Herschel Key Project, which has been awarded 130 hrs to study the detailed properties of the cold gas and dust in these clusters. We propose ACS/SBC FUV observations of five of the 11 BCGs lacking high resolution FUV data needed to probe the star forming regions. The remaining six already have archival ACS/SBC FUV data. We further propose ACS/WFC and WFC3/UVIS observations of two BCGs lacking HST optical data which will allow us to obtain FUV-optical colours to discriminate between young and old stellar populations. These observations are vital to understand the complex inter-relationship between the cooling of the intracluster-medium, cold gas and dust, star formation and AGN activity.

OBSERVING DESCRIPTION

We will observe ACS/SBC observations of the FUV continuum in the brightest cluster galaxies (BCGs) of 5 cool-core clusters of galaxies, which constitute a subset of a Herschel Key Project sample. All but one of the proposed five BCGs have luminous line emission, $L[\text{H}_{\alpha}] > 1\text{E}+40$ erg/s. The objects have a redshift range from 0.03 to 0.22 and so we propose the continuum filter F140LP for $z < 0.11$, F150LP for $0.11 < z < 0.19$

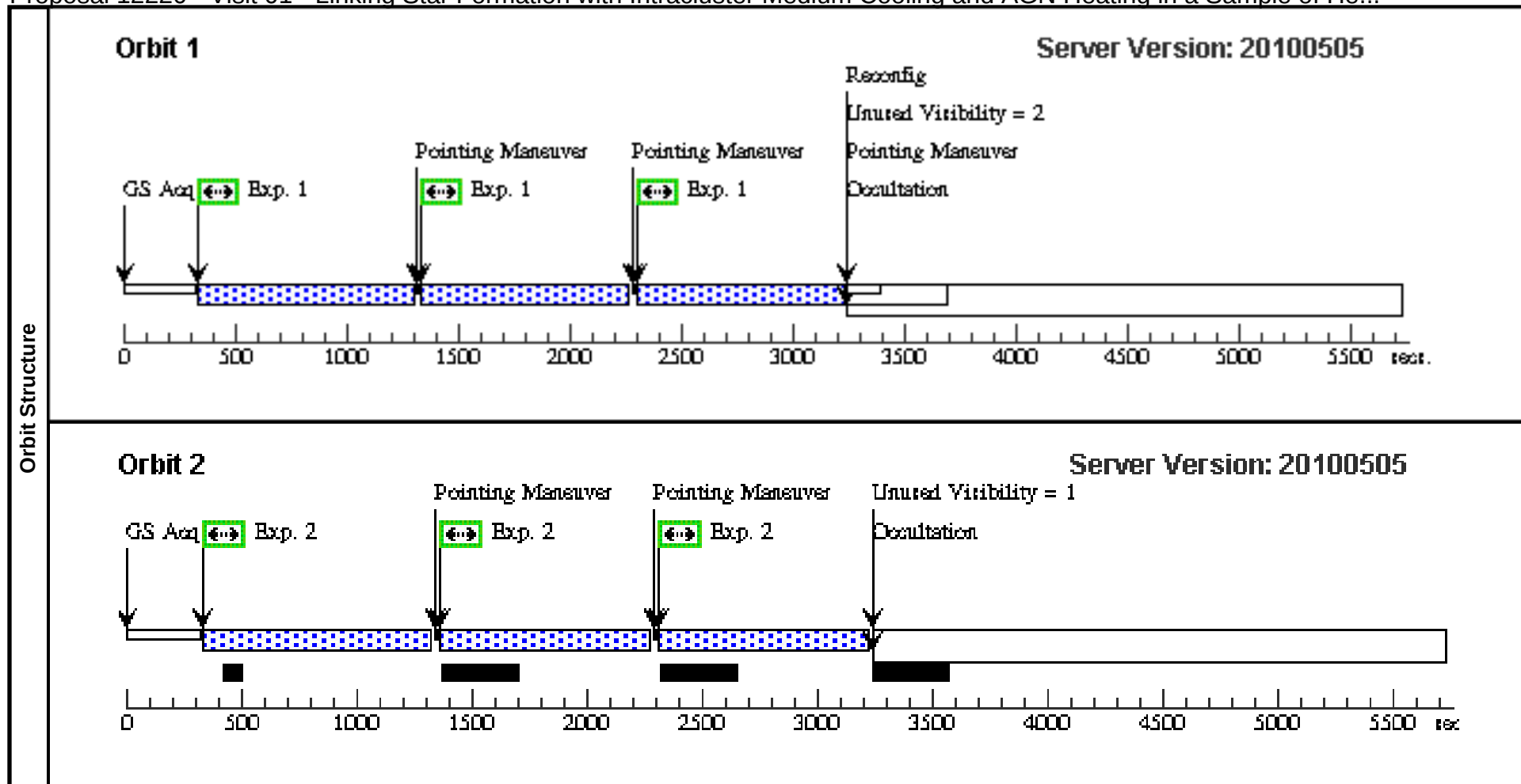
and F165LP for $0.19 < z < 0.31$. We have run a series of ETC calculations using the signal-to-noise ratio (SNR) and the average source surface-brightness obtained for the seven clusters that formed the subject of an earlier accepted proposal (cycle 16). In order to reach comparable sensitivity to image the sites of recent star formation, we propose an orbit for each of the five BCGs. We have checked against the bright-object constraints for ACS/SBC and we are well under the safety limits.

We will also obtain ACS/WFC F814W and WFC3/UVIS F689W line-free continuum observations of Hydra-A and RXJ1504.1-024, respectively, the only two galaxies in the Herschel sample without such data. This will allow us to obtain FUV-optical colour and determine the contribution from the old stellar population.

All observations are done with a 3 point dither.

Proposal 12220 (STScI Edit Number: 1, Created: Wednesday, July 7, 2010 9:06:31 PM EST) - Overview

Visit	Proposal 12220, Visit 01, implementation					Thu Jul 08 02:06:32 GMT 2010				
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: ACS/SBC, ACS/WFC									
	Special Requirements: (none)									
Patterns	#	Primary Pattern			Secondary Pattern		Exposures			
	(1)	Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false			(1)				
	(2)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides= Center Pattern=false			(2)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HYDRA-A	RA: 09 18 5.6700 (139.5236250d) Dec: -12 05 43.90 (-12.09553d) Equinox: J2000 <i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>		V=16.6	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) HYDRA-A	ACS/SBC, ACCUM, SBC	F140LP			Pattern 1, Exps 1-1 (1)	903 Secs [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[1]
	2		(1) HYDRA-A	ACS/WFC, ACCUM, WFC1	F814W			Pattern 2, Exps 2-2 (2)	789 Secs [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[2]



Proposal 12220 - Visit 02 - Linking Star Formation with Intracluster Medium Cooling and AGN Heating in a Sample of He...

Visit	Proposal 12220, Visit 02, implementation Thu Jul 08 02:06:33 GMT 2010				
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/SBC Special Requirements: (none)				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false	(1)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(2)	A2199	RA: 16 28 38.5328 (247.1605533d) Dec: +39 33 8.34 (39.55232d) Equinox: J2000		V=12.61
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.					
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.
	1		(2) A2199	ACS/SBC, ACCUM, SBC	F140LP
					Opt. Params.
					Special Reqs.
					Groups
					Exp. Time/[Actual Dur.]
					Orbit
					Pattern 1, Exps 1-1 (1) 923 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>921.0 Secs (Pattern 3)]
Orbit Structure					
Orbit 1 GS Acq Exp. 1 Pointing Maneuver Exp. 1 Pointing Maneuver Exp. 1 Unused Visibility = 0 Occultation					

Proposal 12220 - Visit 03 - Linking Star Formation with Intracluster Medium Cooling and AGN Heating in a Sample of He...

Visit	Proposal 12220, Visit 03, implementation										Thu Jul 08 02:06:33 GMT 2010												
	Diagnostic Status: No Diagnostics																						
	Scientific Instruments: ACS/SBC																						
	Special Requirements: (none)																						
Patterns	#	Primary Pattern										Secondary Pattern										Exposures	
	(1)	Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false																				(1)	
Fixed Targets	#	Name		Target Coordinates				Targ. Coord. Corrections				Fluxes				Miscellaneous							
	(3)	A1068		RA: 10 40 44.4000 (160.1850000d) Dec: +39 57 12.00 (39.95333d) Equinox: J2000								V=17.0				Reference Frame: ICRS							
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.																						
Exposures	#	Label	Target	Config,Mode,Aperture			Spectral Els.		Opt. Params.		Special Reqs.		Groups		Exp. Time/[Actual Dur.]		Orbit						
	1		(3) A1068	ACS/SBC, ACCUM, SBC			F150LP						Pattern 1, Exps 1-1 (1)		922 Secs								
																[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]						
Orbit Structure	Orbit 1 Server Version: 20100505																						
	GS Acq Exp. 1 Pointing Maneuver Pointing Maneuver Unused Visibility = 1 Occultation																						

Proposal 12220 - Visit 04 - Linking Star Formation with Intracluster Medium Cooling and AGN Heating in a Sample of He...

Visit	Proposal 12220, Visit 04, implementation Thu Jul 08 02:06:33 GMT 2010				
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/SBC Special Requirements: (none)				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false	(1)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(4)	PKS0745-1910	RA: 07 47 31.3500 (116.8806250d) Dec: -19 17 39.70 (-19.29436d) Equinox: J2000		V=18.6
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.
	1		(4) PKS0745-1910	ACS/SBC, ACCUM, SBC	F140LP
					Opt. Params. Special Reqs. Groups: Pattern 1, Exps 1-1 (1)
					Exp. Time/[Actual Dur.] 905 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]
					Orbit [1]
Orbit Structure	Orbit 1 Server Version: 20100505				
	GS Acq Exp. 1 Pointing Maneuver Exp. 1 Pointing Maneuver Exp. 1 Occultation Unused Visibility = 0 0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 sec				

Proposal 12220 - Visit 04 - Linking Star Formation with Intracluster Medium Cooling and AGN Heating in a Sample of He...

Visit	Proposal 12220, Visit 05, implementation										Thu Jul 08 02:06:34 GMT 2010
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: ACS/SBC, WFC3/UVIS										
	Special Requirements: (none)										
Patterns	#	Primary Pattern				Secondary Pattern				Exposures	
	(1)	Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false						(1)	
	(3)	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						(2)	
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(5)	RXJ1504.1-0248	RA: 15 04 7.5000 (226.0312500d) Dec: -02 48 16.00 (-2.80444d) Equinox: J2000				V=15.6		Reference Frame: ICRS		
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]		Orbit
	1		(5) RXJ1504.1-0248	ACS/SBC, ACCUM, SBC	F165LP		GS ACQ SCENARI O BASE1B3	Pattern 1, Exps 1-1 (1)	900 Secs		
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]		[1]
	2		(5) RXJ1504.1-0248	WFC3/UVIS, ACCUM, UVIS1	F689M			Pattern 3, Exps 2-2 (3)	879 Secs		
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]		[2]

