15994 - A z=1.8 Cluster in the Clusters Occupied by Bent Radio AGN (COBRA) Survey

Cycle: 27, 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	(1) COBRA141155.2+341510	WFC3/IR	1	29-Jan-2020 17:00:15.0	yes
02	(1) COBRA141155.2+341510	WFC3/IR	1	29-Jan-2020 17:00:16.0	yes

2 Total Orbits Used

ABSTRACT

Bent, double-lobed radio sources associated with AGN are frequently found in clusters of galaxies. The hosts of these radio sources are typically giant elliptical or cD galaxies. Occasionally, the bent radio sources are hosted by optically luminous quasars. Our Spitzer IR observations of 646 bent

radio sources have revealed approximately 200 new, distant clusters. These objects comprise the Clusters Occupied by Bent Radio AGN (COBRA) survey. Here, we propose joint Chandra and HST observations of a COBRA cluster associated with a quasar with a spectroscopically measured redshift of 1.82. This cluster is one of very few known at z > 1.5 and can provide insight into AGN feedback and the formation of structure at high-z.

OBSERVING DESCRIPTION

We propose to observe our candidate z = 1.8 cluster with the Hubble Space Telescope using the WFC3 and the G141 grism. HST infrared grism observations have been instrumental, particularly in the last few years, in confirming several of the highest redshift clusters known and in measuring star formation rates in cluster member galaxies (Stanford et al. 2012, Zeimann et al. 2012, Gobat et al. 2013, Newman et al. 2014, Noirot et al. 2016). Our main observational goals are to spectroscopically confirm our target as a cluster by measuring redshifts for several cluster members, measure a mass independent of an X-ray-derived mass using the velocity dispersion of member galaxies, and measure star formation rates in individual galaxies. We propose to use the WFC3 with the G141 grism to accomplish our goals. Ground-based spectroscopic observations of cluster galaxies at this redshift are very difficult given the faintness of the galaxies and the Earth's atmospheric lines in the spectral region of interest.

The field of view of the WFC3 of 136 x 123 arcsec will cover a region of approximately 1 x 1 Mpc at the redshift of our source which is a sufficiently large region to detect many cluster member galaxies. Given the wavelength coverage of the WFC3 with the G141 grism of 1.08 - 1.70 um, our observations will cover the spectral regions that include the Hbeta 486.1 nm and [OIII] 495.9/500.7 nm lines as well as the 400 nm break.

We have used the online WFC3 + G141 exposure time calculator (ETC) to estimate an exposure time necessary for robust signal-to-noise ratios for cluster galaxies to a limit of an L* galaxy at the redshift of our cluster. We assume an L* galaxy with an SDSS i-band AB magnitude (mi = 25.6) appropriate to the redshift of our source assuming a Salpeter initial mass function and a Bruzual & Charlot stellar population model with a formation redshift of z = 3 (calculated using EzGal, Mancone & Gonzalez 2012). We assume an elliptical galaxy spectrum and an extended source with an effective radius of re approximately 0.3 arcsec. We then convert our total magnitude to surface brightness to use with the ETC and use a measurement box of 5 x 1 pixels. We find for an exposure of 2000 sec, we are able to achieve a SNR > 5 at 1.3 um and SNR > 8 at 1.5 um for our target galaxy limit.

Slitless grism observations require direct images before and after the grism exposures to set the wavelength zeropoint. Additionally, slitless grism observations can result in overlap of sources. We will therefore choose two different ORIENT settings. Successful measurements have been made for similar objects using this method (Zeiman et al. 2012, Stanford et al. 2012, Noirot et al. 2016).

Given a grism exposure of 2000 sec (33 min.) and allowing 6 min. for target acquisition, 1 min. for instrumental overhead and 5 min. for two images through the F160W filter (before and after each grism observation), we require 45 min. for our target. We will observe the target at two separate orientations to help reduce sources lost due to overlap. This can be achieved in 2 orbits.

Visit

Proposal 15994, COBRA1411-visit1 (01), implementation Wed Jan 29 22:00:16 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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		(1-2)

Fixed Targets

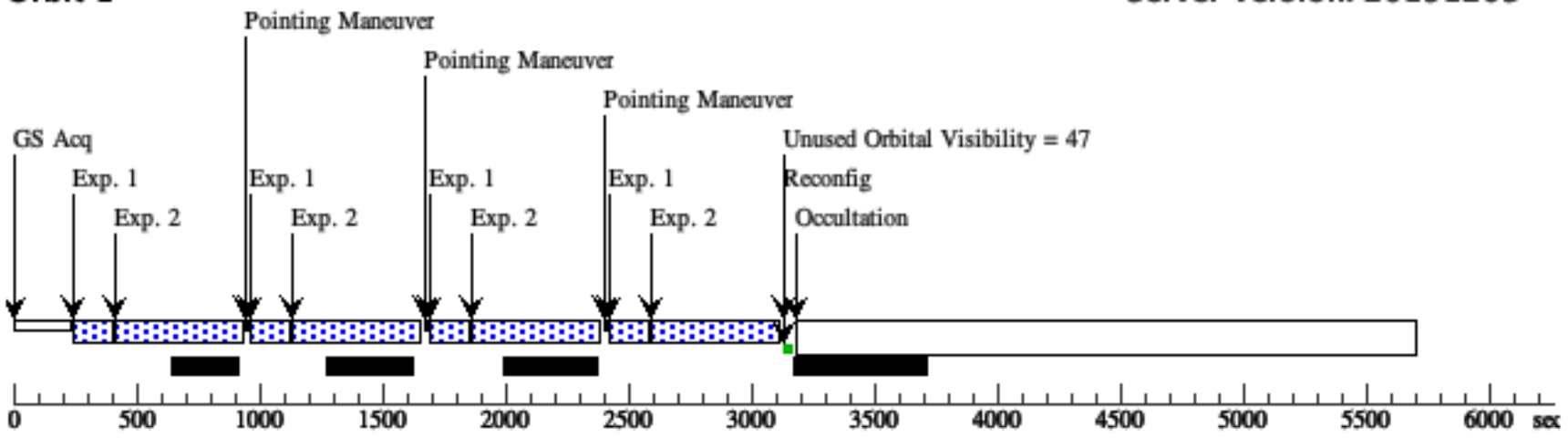
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COBRA141155.2+341510	RA: 14 11 55.2000 (212.9800000d) Dec: +34 15 10.00 (34.25278d) Equinox: J2000	Redshift: 1.8	V=24	Reference Frame: ICRS

Comments:
Category=CLUSTER OF GALAXIES
Description=[HIGH REDSHIFT CLUSTER]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	COBRA1411-image1	(1) COBRA141155.2+341510	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=6; SAMP-SEQ=SPARS25	GS ACQ SCENARIO SINGLE	Pattern 1, Exps 1-2 in COBRA1411-visit1 (01) (1)	127.934866 Secs (511.739 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	COBRA1411-spec1	(1) COBRA141155.2+341510	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-2 in COBRA1411-visit1 (01) (1)	502.936801 Secs (2011.747 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 15994, COBRA1411-visit2 (02), implementation Wed Jan 29 22:00:16 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 20D TO 160D FROM 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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		(1-2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COBRA141155.2+341510	RA: 14 11 55.2000 (212.9800000d) Dec: +34 15 10.00 (34.25278d) Equinox: J2000	Redshift: 1.8	V=24	Reference Frame: ICRS

Comments:
Category=CLUSTER OF GALAXIES
Description=[HIGH REDSHIFT CLUSTER]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	COBRA1411-v2-im1	(1) COBRA141155.2+341510	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=6; SAMP-SEQ=SPARS25	GS ACQ SCENARIO SINGLE	Pattern 1, Exps 1-2 in COBRA1411-visit2 (02) (1)	127.934866 Secs (511.739 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	COBRA1411-v2-sp1	(1) COBRA141155.2+341510	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-2 in COBRA1411-visit2 (02) (1)	502.936801 Secs (2011.747 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure