14730 - High spatial resolution imaging of AGN-driven super-bubbles in two low-redshift quasars

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Andrew Goulding (PI) (Contact)	**Princeton University**	**goulding@astro.princeton.edu**
Prof. Jenny Emma Greene (CoI)	Princeton University	jgreene@astro.princeton.edu
Dr. Ai-Lei Sun (CoI)	Princeton University	aisun@astro.princeton.edu
Aida Behmard (CoI)	Princeton University	aida.behmard@gmail.com
Kristina Pardo (CoI)	Princeton University	kpardo@astro.princeton.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 2MASX-J10001317+1242261	WFC3/IR WFC3/UVIS	1	29-Jul-2016 15:05:15.0	yes
02	(2) 2MASX-J10102294+1413009	WFC3/IR WFC3/UVIS	1	29-Jul-2016 15:05:17.0	yes

2 Total Orbits Used

ABSTRACT

The impact of active galactic nuclei on gas dynamics and star formation holds immense implications for galaxy formation models. We propose high spatial resolution HST imaging observations of SDSS J1000+1242 and SDSS J1010+1413, two luminous obscured AGN that seemingly host powerful galaxy-scale outflows indicative of on-going radiatively-driven feedback. Based on our previous long-slit spectroscopy with Magellan

IMACS, the high velocity (~1000km/s) outflows in these objects are extended on 5-10 kpc scales, and hence, are capable of strong interactions with the host galaxy. Analogous to SDSS J1356+1026, which we have previously confirmed to have spatially resolved hot X-ray emitting gas regions coincident with [OIII] emission, both our targets likely host ionized gas super-bubbles. Our proposed observations will provide morphologies of the ionized gas outflows seen in [OIII] emission, as well as measurements of the scattered light fraction that provides crucial information for determining the total gas mass and energetics of the outflows. When combined with previous multi-wavelength data, these observations will allow a complete multi-phase, multi-scale investigation of AGN feedback, and the ability to test the coupling of outflowing material and the central AGN.

OBSERVING DESCRIPTION

Here we propose 2 orbits of Hubble Space Telescope imaging of SDSSJ1000+1242 and SDSSJ1010+1413, two z=0.1-0.2 extremely luminous AGN outflow candidates, to probe fine morphological details in outflow features, such as ionized gas superbubbles, and clumps in both ionized gas and scattered light. Only HST can provide sufficiently high resolution imaging to constrain the physics of gas outflows in the efforts of shedding light on outflow origins and effects.

To achieve our primary goals, we must: (1) detect the [OIII] emission out to 10 kpc with SNR > 8 per resolution element, and (2) map the stellar light distribution.

The exposure times for each filter are as follows:

1. UVIS On-band: To capture the [OIII] emission line, we use the FQ575N band for target SDSS J1000+1242 (z = 0.1481) and the F621M band for SDSS J1010+1413 (z = 0.1993). We will use exposure times of 1520 sec and 1380 sec for the two targets, respectively. These observations will achieve S/N=8 per resolution element in the final reconstructed line image.
2. UVIS Off-band: To subtract the continuum from the line-band, we need to measure the continuum level using the off-bands F621M (J1000+1242) and F689M (J1010+1413). To achieve a SNR 6 and 11 for optimum continumm subtraction, we request exposure times of 480 and 650 sec, respectively.
3. IR F160W: This band allows us to map the stellar continuum with high fidelity and no line contamination. We can achieve a SNR of 8 and 6 for SDSS J1000+1242 and SDSS J1010+1413, respectively, for the extended features with 4x24 = 96 sec exposure times.

To facilitate cosmic-ray and hot-pixel removal in the UVIS bands, we will use a two point dither for the FQ575N band with the quad array, and for

the F621M and F689M bandsm we will use a three-point dither pattern using subarrays (1k x 1k UVIS2-C1K1C-SUB) to avoid buffer dumps, shorten read-out times, and reduce the CTE-losses. In the NIR, we will use the WFC3-IR-DITHER-BOX with a 4-point dither sequence in order to properly sample the PSF. We will use STEP25 with NSAMP=5 to maximize our dynamic range. A subarray configuration of IRSUB512 will also be used to reduce read-out times.

Due to our efficient use of sub-arrays, we can perform all three band observations into a single orbit of 54 min for each target, and we need not worry about buffer dumps. Our exposure time calculations include 18 min for overheads (6 min for guide-star acquisition, 4.2 min for dithering, 1.5 min for filter change, 5.6 min for readout, 1 min to change from UVIS to IR).

Visit

Proposal 14730, Visit 01, implementation Fri Jul 29 19:05:17 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: (none)

Diagnostics

(Exposure 1 (Pattern 3, Exps 1-1 in Visit 01)) Warning (Form): POS TARG & PATTERN should be used carefully with WFC3 quad filters to avoid placing the target on the vignetted part of the field of view or moving it to another quadrant.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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)
(2)	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		(3)
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

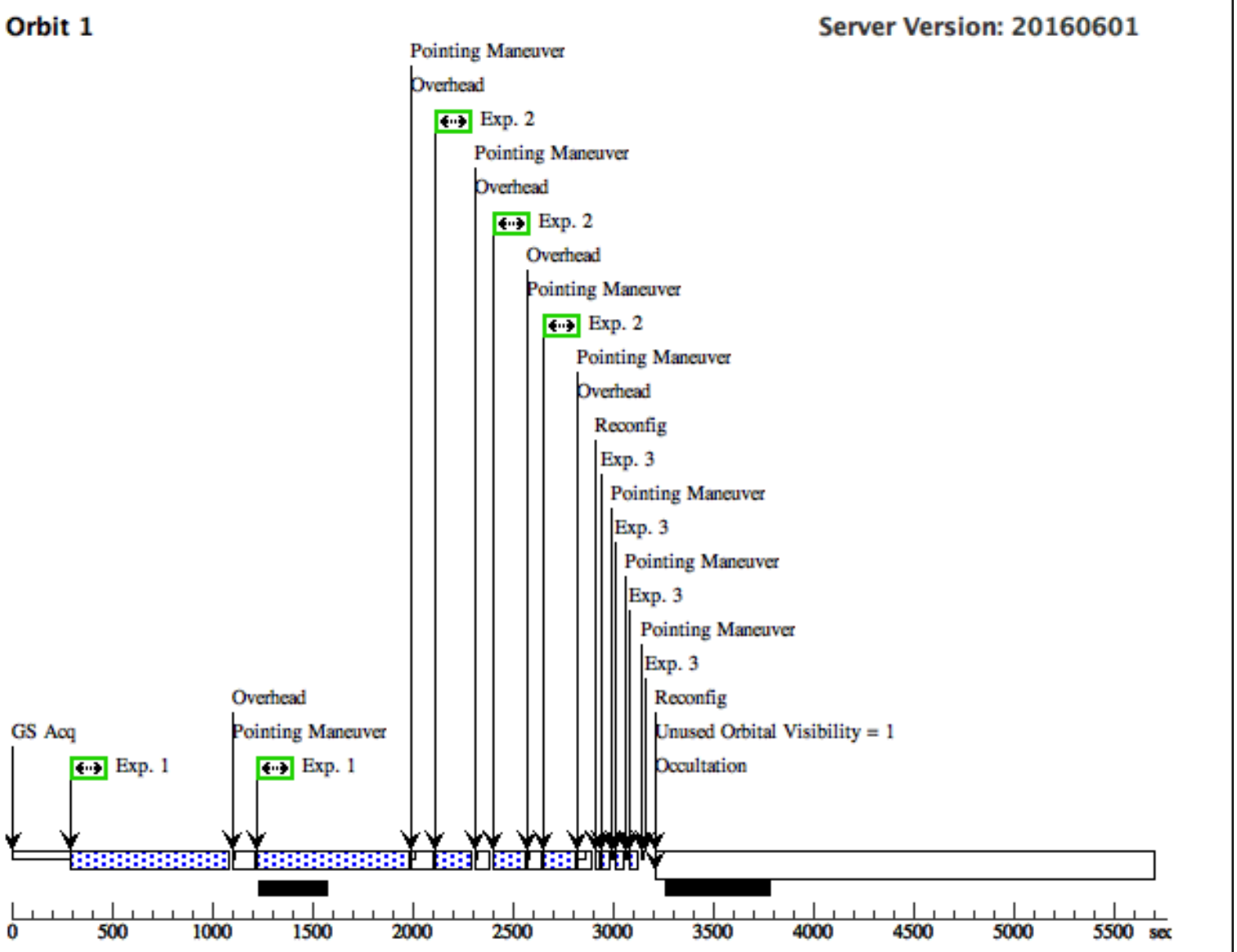
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2MASX-J10001317+1242261	RA: 10 00 13.1424 (150.0547600d) Dec: +12 42 26.21 (12.70728d) Equinox: J2000		V=(?) SDSS r-band = 16.610 +/-0.004	Reference Frame: NED

Comments: This object was generated by the targetselector and retrieved from the NED database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 2MASX-J10001317+1242261	WFC3/UVIS, ACCUM, UVIS-QUAD	FQ575N	FLASH=10	GS ACQ SCENARIO BASE1B3	Pattern 3, Exps 1-1 in Visit 01 (3)	761 Secs (1522 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2		(1) 2MASX-J10001317+1242261	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F621M	FLASH=10		Pattern 1, Exps 2-2 in Visit 01 (1)	160 Secs (477 Secs) *[==>159.0 Secs (Pattern 1)]* *[==>159.0 Secs (Pattern 2)]* *[==>159.0 Secs (Pattern 3)]*	***[1]***
3		(1) 2MASX-J10001317+1242261	WFC3/IR, MULTIACCUM, IRSUB512	F160W	NSAMP=5; SAMP-SEQ=STEP25		Pattern 2, Exps 3-3 in Visit 01 (2)	13.833391 Secs (55.334 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 14730, Visit 02, implementation Fri Jul 29 19:05:18 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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		(1), (2)
(2)	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		(3)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2MASX-J10102294+1413009	RA: 10 10 22.9608 (152.5956700d) Dec: +14 13 0.98 (14.21694d) Equinox: J2000		V=(?) SDSS r-band = 16.825 +/- 0.004	Reference Frame: NED

Comments: This object was generated by the targetselector and retrieved from the NED database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) 2MASX-J10102294+1413009	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F621M	FLASH=6		Pattern 1, Exps 1-1 in Visit 02 (1)	460 Secs (1380 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(2) 2MASX-J10102294+1413009	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F689M	FLASH=9		Pattern 1, Exps 2-2 in Visit 02 (1)	211 Secs (633 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
3		(2) 2MASX-J10102294+1413009	WFC3/IR, MULTIACCUM, IRSUB512	F160W	NSAMP=5; SAMP-SEQ=STEP25		Pattern 2, Exps 3-3 in Visit 02 (2)	13.833391 Secs (55.334 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure