17285 - From Galactic Cores to the Cosmic Web -- A Study of Feedback and Multiphase Galactic Winds with HST and JWST

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

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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) NGC-7469	WFC3/IR	1	19-Dec-2022 16:00:24.0	yes
02	(2) VV-114	WFC3/IR	1	19-Dec-2022 16:00:24.0	yes
03	(3) II-ZW-96	WFC3/IR	2	19-Dec-2022 16:00:26.0	yes

4 Total Orbits Used

ABSTRACT

Feedback plays a pivotal role in regulating the galactic life cycle through its manifestation in shocks and turbulent gas. And yet, the complex interplay between outflows and their host galaxy remains largely unconstrained at relevant physical scales. The lack of direct observational measurements of small-scale energetic properties of the multiphase ISM is a big hurdle for constraining feedback prescriptions for the next generation cosmological models.

Since July, new JWST results shed light on the dust-obscured energy sources in nearby (U)LIRGs, prompting the question of what the total contribution to the energy budget from shocks due to said sources across entire galaxies.

Here we propose deep narrowband imaging of key near-infrared diagnostic lines for a pilot sample of 3 galaxy mergers with newly published JWST results that represent the best laboratories to explore the starburst-AGN-shocks connection in the nearby universe. Resolving the shocked gas in ionized outflows with wide-field, high-resolution WFC3 images, this study aims to address:

1. How AGN and stellar feedback drive shocks across the ISM; and
2. How winds impact star formation and chemical enrichment within the host galaxy.

Our proposed study will tackle complex feedback physics in high gas content environments, commonplace among star-forming galaxies near the cosmic noon. Leveraging a rich ancillary data set including ground-based optical and newly analyzed JWST infrared imaging and integral-field observaions, the new HST observations will yield unique insights

into the role of feedback in galaxy evolution and establish the significance of near-infrared diagnostics in the early JWST era.

OBSERVING DESCRIPTION

WFC3 provides a set of narrowband filters in the J-band, unavailable to JWST/NIRCam, that is uniquely suited to image [Fe ii] (1.26um) and Pab (1.28um) among nearby objects. We will use a combination of narrow- (F126N, F128N, F130N, F132N) and wide-band (F110W and F160W) filters, since continuum subtraction works better and more efficiently given the color correction as determined from two wide-band images than that from an off-line narrowband filter.

We estimated exposure times using ancillary groundbased APO/TripleSpec spectra of our targets, where available, centered on the body of the galaxy with extraction aperture width of 7.5". We estimate that the emission line at the 10 kpc outskirts would be 2 orders of magnitude fainter based on the dynamic range in typical outflows. With the WFC3/IR ETC aiming for a target SNR of 10 per resolution element (2 px x 2 px), we calculate the exposure time needed to reach our S/N limit.

We request 3 exposures / dithers per filter for robust cosmic-ray removal. Two of our 3 targets have one narrowband or wideband images available in the archive; we have checked and found that the depth of the archival data sufficient for our study. Therefore, the corresponding narrowband or wideband data will not be requested; instead, we will incorporate the archival data into our analysis to enhance the legacy value of HST data sets. Overhead estimates include setup + filter changes + readout (1 min per each of 3 exposures), dithering (1-6 min per offset), and guide star (re)acquisition (6 min at the first orbit, 5 min after in non-CVZ). These calculations amount to 1-2 orbits being requested for each source. Accounting for orbital visibility, we request a total of 4 new orbits for the complete set of narrow- and wide-band images for our pilot sample.

Visit

Proposal 17285, NGC7469 (01) Mon Dec 19 21:00:26 GMT 2022

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

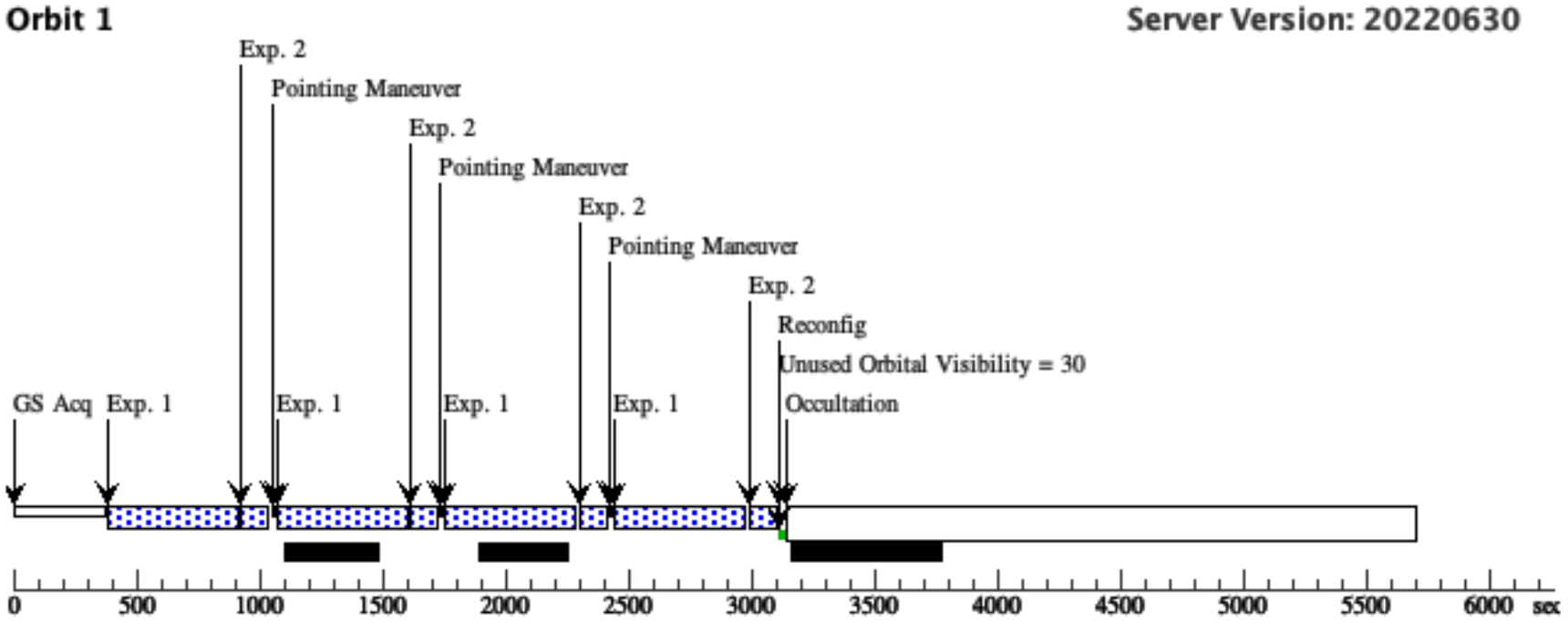
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-7469	RA: 23 03 16.6595 (345.8194146d) Dec: +08 52 45.94 (8.87943d) Equinox: J2000	Epoch of Position: 2015.5	V=12.34	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[INTERACTING GALAXY, SEYFERT]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) NGC-7469	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=6; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-2 in NGC7469 (01) (1)	502.933906 Secs (2011.736 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
2		(1) NGC-7469	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=9; SAMP-SEQ=SPARS10		Pattern 1, Exps 1-2 in NGC7469 (01) (1)	82.939995 Secs (331.76 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***

Orbit Structure



Visit

Proposal 17285, VV114 (02) Mon Dec 19 21:00:26 GMT 2022

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

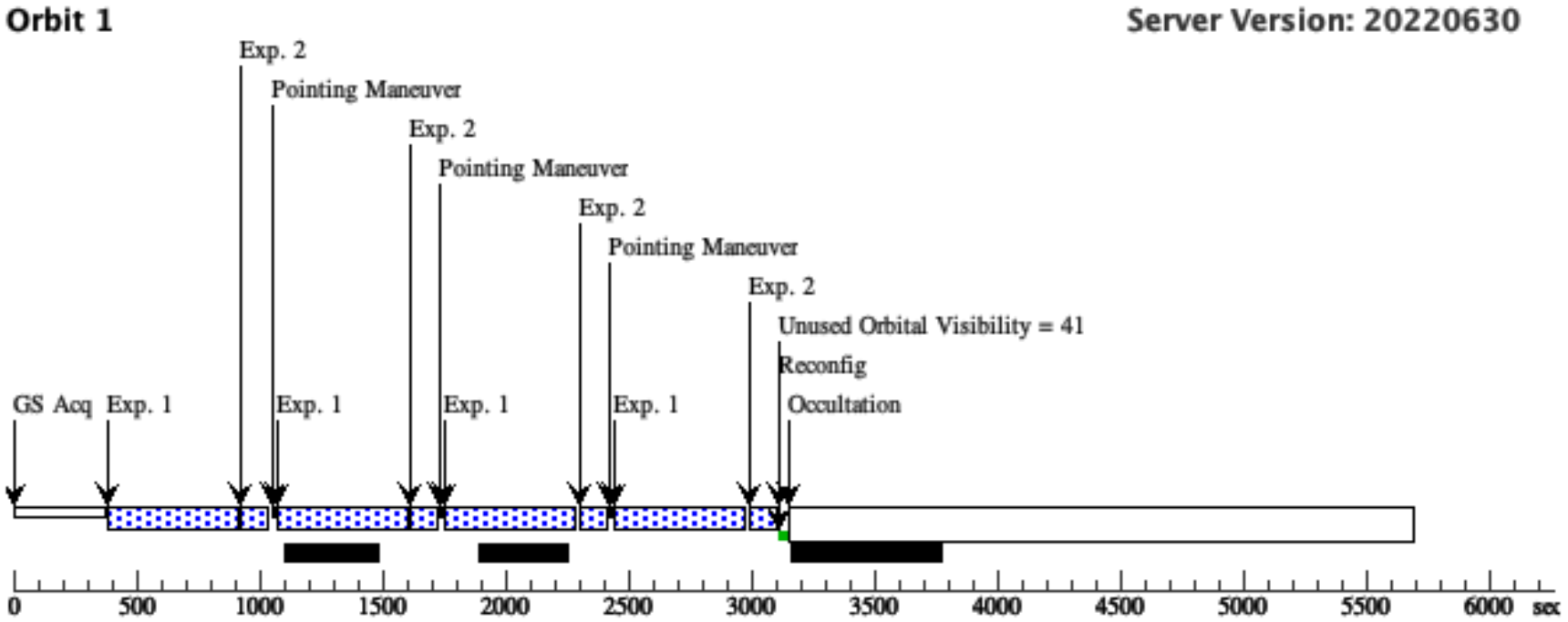
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	VV-114	RA: 01 07 47.2000 (16.9466667d) Dec: -17 30 25.00 (-17.50694d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) 2.489E-02	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Given flux is V-band flux in Jy.
Category=GALAXY
Description=[INTERACTING GALAXY, MULTIPLE NUCLEI, STARBURST, ULTRALUMINOUS IR GAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) VV-114	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=6; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-2 in VV114 (02) (1)	502.933906 Secs (2011.736 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(2) VV-114	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=9; SAMP-SEQ=SPARS10		Pattern 1, Exps 1-2 in VV114 (02) (1)	82.939995 Secs (331.76 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17285, IIZw96 (03) Mon Dec 19 21:00:27 GMT 2022

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		(1-4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	II-ZW-96	RA: 20 57 24.1252 (314.3505217d) Dec: +17 07 36.10 (17.12669d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) 14.2	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Given flux is B-band magnitude.
Category=GALAXY
Description=[INTERACTING GALAXY, MULTIPLE NUCLEI, STARBURST, ULTRALUMINOUS IR GAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) II-ZW-96	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=6; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-4 in IIZw96 (03) (1)	502.933906 Secs (2011.736 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
2		(3) II-ZW-96	WFC3/IR, MULTIACCUM, IR	F132N	NSAMP=6; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-4 in IIZw96 (03) (1)	502.933906 Secs (2011.736 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
3		(3) II-ZW-96	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=9; SAMP-SEQ=SPARS10		Pattern 1, Exps 1-4 in IIZw96 (03) (1)	82.939995 Secs (331.76 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
4		(3) II-ZW-96	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=9; SAMP-SEQ=SPARS10		Pattern 1, Exps 1-4 in IIZw96 (03) (1)	82.939995 Secs (331.76 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***

Orbit Structure