16248 - Testing the Origin and Consequences of Vast Extended Molecular Gas Outside High-Redshift Post-Starburst Galaxies

Cycle: 28, 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) SDSSJ1448+1010	WFC3/IR	1	01-Oct-2020 10:00:18.0	yes
02	(1) SDSSJ1448+1010	WFC3/IR	1	01-Oct-2020 10:00:19.0	yes
03	(2) SDSSJ2258+2313	WFC3/IR	1	01-Oct-2020 10:00:20.0	yes
04	(2) SDSSJ2258+2313	WFC3/IR	1	01-Oct-2020 10:00:21.0	yes

4 Total Orbits Used

ABSTRACT

We have discovered spectacular vast molecular gas reservoirs reaching tens of kpc outside of two high-redshift post-starburst galaxies as part of an ongoing ALMA survey of such objects. While the host galaxies are only 3-5kpc in size, nearly half the total molecular gas in each system extends 25-45kpc from the hosts. This discovery was unexpected and both the scale and magnitude of the extended gas features are unprecedented at any redshift. The origin of the highly extended molecular gas we have discovered is unclear, but may be related to AGN outflows, stripped tidal tails, and/or material cooled from hotter circumgalactic gas - the spatial resolution and sensitivity of HST are needed to distinguish which. We propose an efficient, high-impact program using WFC3 G102 slitless spectroscopy and F105W direct imaging to determine the origins of the remarkable gas features and their broader implications for galaxy evolution, including galactic feedback, the formation of extended stellar halos, and circumgalactic metal enrichment. These observations are designed to detect and resolve in-situ star formation within the extended gas features, identify stellar tidal debris and close-in merging companions, and spectroscopically map out the local environment on 1Mpc scales. Together, the combination of direct imaging and slitless spectroscopy can uniquely determine the origin of the incredible molecular gas structures we have found and place this unexpected discovery in broader context.

OBSERVING DESCRIPTION

This program will acquire 2 orbits of WFC3/G102 imaging data for each of 2 target z~0.6 post-starburst galaxies. The primay goal is to search for extended H-alpha emission arising from large features seen in CO molecular gas maps of the galaxies that extend out to a few arcsec from the galaxy centers.

Observations of each target are split into two visits of a single orbit each. In order to disentangle the possibly-complex Halpha distribution, one visit for each target is requested to have ORIENT FROM 30 to 150degrees compared to the other visit (with unconstrained roll angle). This should enforce a minimum roll angle difference between the two visits of at least 30degrees.

We follow the 3D-HST dithering strategy, and take grism data in 4 dither positions per orbit. We use POS-TARG offsets to set the dither positions, using a slightly wider pattern than the default WFC3-IR-DITHER-BOX-MIN since some bad pixels come in clumps. As in 3D-HST, the pattern is:
POS-TARG: (0,0) (1.355,0.424) (0.881,1.212) (-0.474,0.788)
pixels: (0,0) (10.0,3.5) (6.5,10.0) (-3.5,6.5)
Each grism position integrates for ~550s using SAMP-SEQ = SPARS50 and NSAMP=12, for a total of ~2200s integration in the grism in each orbit. We use the F098M filter for direct imaging wavelength calibration, taking an image in the first and last dither positions at the beginning and end of

the orbit, respectively. The direct imaging exposures are ~130s each using NSAMP=14 and SAMP-SEQ = SPARS10.

Visit

Proposal 16248, J1448_orient1 (01), implementation Thu Oct 01 14:00:21 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

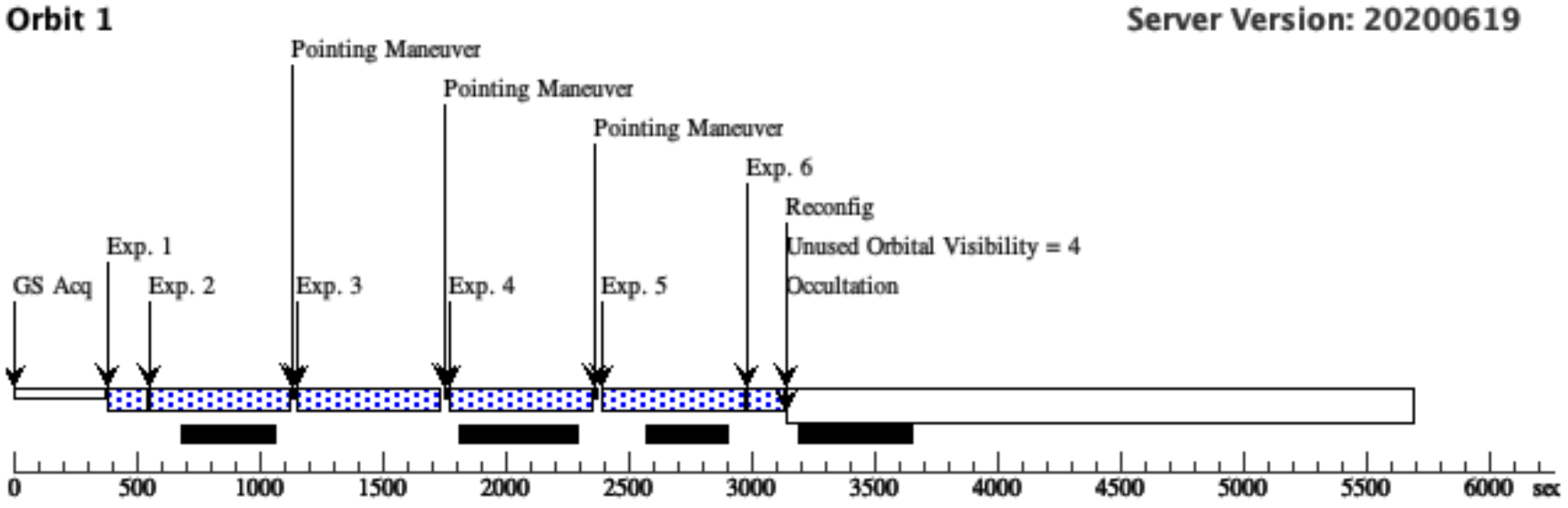
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1448+1010	RA: 14 48 45.9192 (222.1913300d) Dec: +10 10 10.55 (10.16960d) Equinox: J2000		V=20.03	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, INTERACTING GALAXY, TIDAL TAIL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	image_pos1	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG 0,0		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*
2	grism_pos1	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0,0		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
3	grism_pos2	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 1.355,0.424		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
4	grism_pos3	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0.881,1.212		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
5	grism_pos4	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG -0.474,0.788		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
6	image_pos4	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG -0.474,0.788		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16248, J1448_orient2 (02), implementation Thu Oct 01 14:00:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 30D TO 150D FROM 01

Fixed Targets

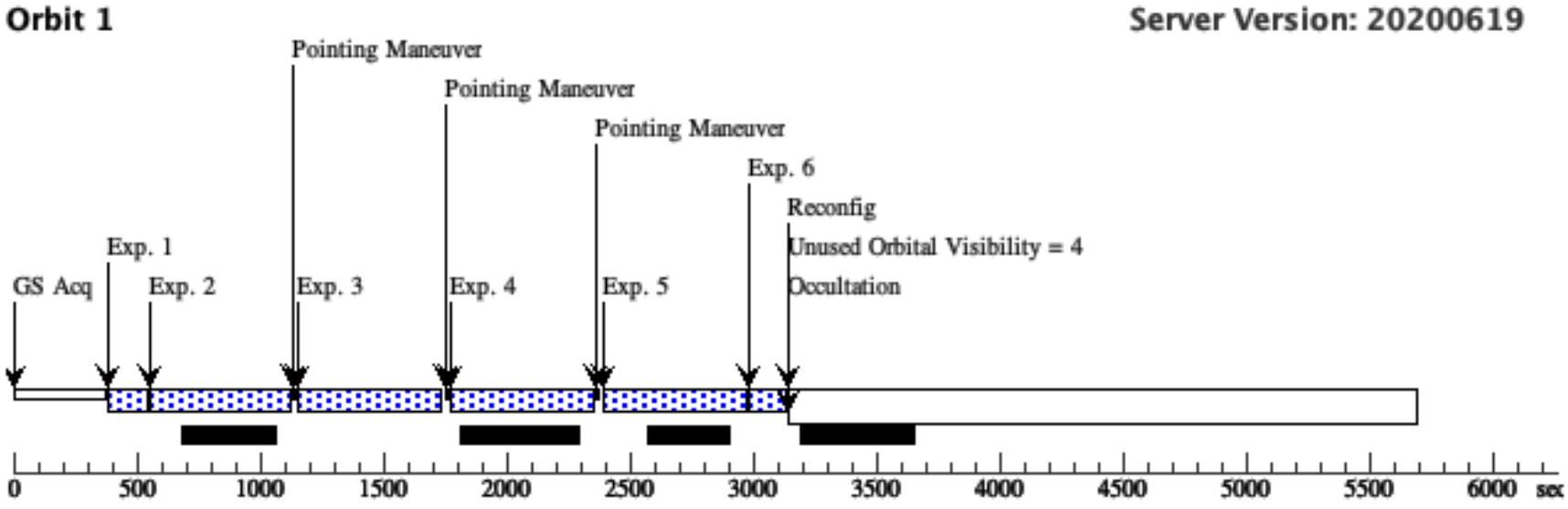
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1448+1010	RA: 14 48 45.9192 (222.1913300d) Dec: +10 10 10.55 (10.16960d) Equinox: J2000		V=20.03	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, INTERACTING GALAXY, TIDAL TAIL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	image_pos1	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG 0,0		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*
2	grism_pos1	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0,0		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
3	grism_pos2	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 1.355,0.424		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
4	grism_pos3	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0.881,1.212		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
5	grism_pos4	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG -0.474,0.788		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
6	image_pos4	(1) SDSSJ1448+1010	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG -0.474,0.788		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16248, J2258_orient1 (03), implementation Thu Oct 01 14:00:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

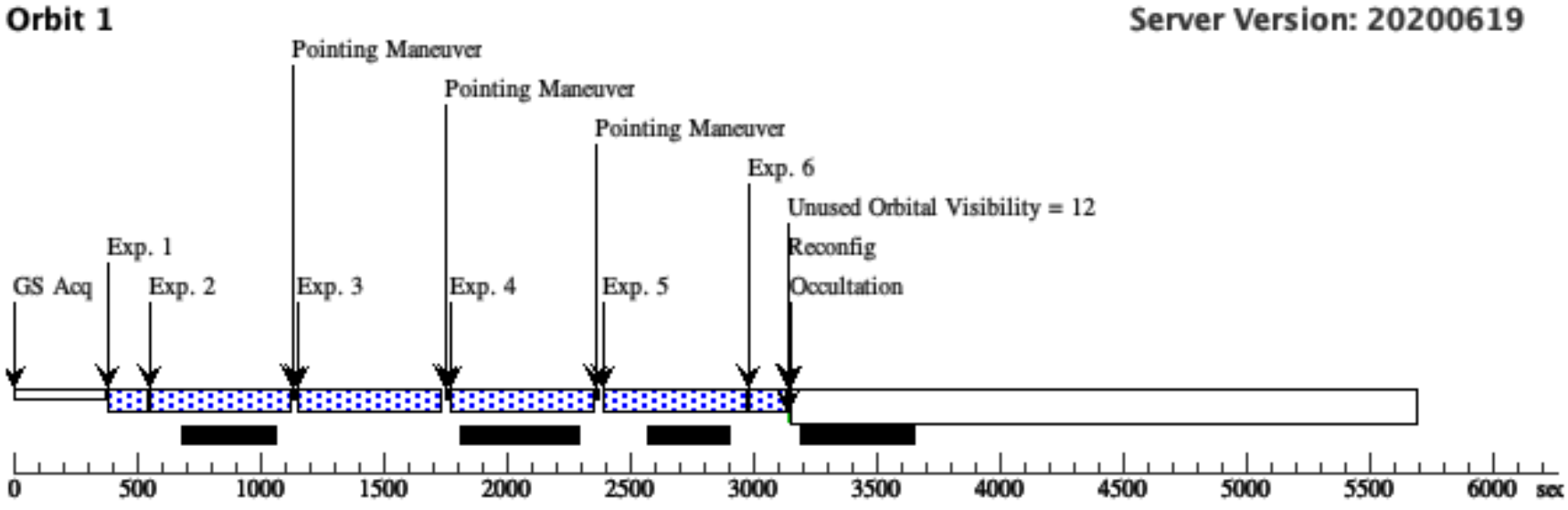
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SDSSJ2258+2313	RA: 22 58 5.6750 (344.5236458d) Dec: +23 13 16.12 (23.22114d) Equinox: J2000		V=20.5	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, INTERACTING GALAXY, TIDAL TAIL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	image_pos1	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG 0,0		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*
2	grism_pos1	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0,0		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
3	grism_pos2	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 1.355,0.424		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
4	grism_pos3	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0.881,1.212		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
5	grism_pos4	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG -0.474,0.788		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
6	image_pos4	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG -0.474,0.788		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16248, J2258_orient2 (04), implementation Thu Oct 01 14:00:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 30D TO 150D FROM 03

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SDSSJ2258+2313	RA: 22 58 5.6750 (344.5236458d) Dec: +23 13 16.12 (23.22114d) Equinox: J2000		V=20.5	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, INTERACTING GALAXY, TIDAL TAIL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	image_pos1	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG 0,0		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*
2	grism_pos1	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0,0		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
3	grism_pos2	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 1.355,0.424		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
4	grism_pos3	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG 0.881,1.212		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
5	grism_pos4	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=12; SAMP-SEQ=SPARS50	POS TARG -0.474,0.788		552.937252 Secs (552.937 Secs) *[==>]*	*[1]*
6	image_pos4	(2) SDSSJ2258+2313	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=14; SAMP-SEQ=SPARS10	POS TARG -0.474,0.788		132.94481 Secs (132.945 Secs) *[==>]*	*[1]*

Orbit Structure