14667 - Differentiating Gas Infall and Outflows with Resolved Star Formation Morphology

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Hsiao-Wen Chen (PI) (Contact)	**University of Chicago**	**hchen@oddjob.uchicago.edu**
Prof. Joseph Hennawi (CoI) (ESA Member)	Max-Planck-Institut fur Astronomie, Heidelberg	joe@mpia.de
Mr. Fakhri S Zahedy (CoI)	University of Chicago	fsz@uchicago.edu
Mr. Sean Johnson (CoI)	Princeton University	seanjohnson@uchicago.edu
Mr. Jia Liang (CoI)	University of Chicago	jwliang@oddjob.uchicago.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SDSS-J080932.70+193847.2	ACS/WFC	1	29-Jul-2016 14:33:22.0	yes
02	(2) SDSS-J082046.2+035741	ACS/WFC	1	29-Jul-2016 14:33:23.0	yes
03	(3) SDSS-J104143.85+195724.4	ACS/WFC	1	29-Jul-2016 14:33:24.0	yes
04	(4) SDSS-J132059.73+164405.5	ACS/WFC	1	29-Jul-2016 14:33:25.0	yes
05	(5) SDSS-J142758.9-012131	ACS/WFC	1	29-Jul-2016 14:33:25.0	yes

5 Total Orbits Used

ABSTRACT

Traditional QSO absorption-line spectroscopy along single sightlines through galactic halos does not provide the necessary constraints for distinguishing between gas inflows and outflows, because of the degeneracy between line-of-sight velocity offsets from inflowing and outflowing gas. To break the degeneracy requires a sharper view of gas kinematics in galactic halos. We are initiating a program to spatially resolve halo gas motions using projected quasar pairs. The program has yielded a sample of 24 star-forming galaxies at redshift z=0.3-1.2 in five fields with resolved MgII absorption profiles available at two distinct locations separated by 30-60 kpc per galactic halo. A critical component in our study is spatially resolved morphologies of the star-forming disks which, when combined with absorption spectroscopy at multiple sightlines per galaxy, provide the necessary reference frame for constructing a 3D gas flow model. We propose to use ACS and the F814W filter to obtain high spatial resolution, optical images of the fields around the five projected QSO pairs in our sample. The primary goals are (1) to determine the morphological parameters of foreground galaxies identified in our survey and (2) to investigate possible connections between galaxy interactions/satellite mergers and metal transport to large galactic distances based on the presence/absence of disturbed morphologies/tidal features. With a minimal amount of HST time, we will be able to establish the first large sample of 24 intermediate-redshift galaxies for a comprehensive study of spatially and spectrally resolved interplay between star-forming disks and halo gas.

OBSERVING DESCRIPTION

We will obtain deep F814W images of five fields surrounding projected QSO pairs using the Wide-Field channel (WFC) in the Advanced Camera for Surveys (ACS). The primary goals of the proposed optical imaging observations are (1) to obtain detailed optical morphologies of ~24 galaxies with known halo gas properties at z =0.3-1.5 that are found near projected QSO pair sightlines, and (2) to examine the presence/absence of features that are indicative of galaxy interactions (e.g. extended tidal features) among group galaxies found around these paired QSO sightlines.

Exposure Time Estimation:

We aim to reach an imaging depth required to uncover extended low surface brightness features of these galaxies. The estimate of the required depth is guided by known photometric properties of the spectroscopically-confirmed foreground galaxies in our sample. Specifically, the majority of our galaxies have a range of i-band magnitudes (equivalent of the F775W filter) and mean surface brightnesses of AB(i)=22-24 and mu(i)=24-25, respectively.The exposure time necessary to reach the above goals is estimated based on the results of a Monte Carlo simulation study of Hubble Ultra Deep Field (HUDF) images as well as the latest estimates from the ACS exposure time calculator. We find that a total exposure time of 1 orbit with ACS/WFC and the F814W filter is sufficient to recover the extended low surface brightness regions and faint tidal features seen around z~1 galaxies. Using the ACS/WFC ETC we estimate that the 3-sigma limiting surface brightness of the resulting stack images is mu(F814W)= 24.7, over a 3x3 pixel aperture, confirming that a 1-orbit visit per field is required for our imaging program.

Observing Strategy:

For each visit with the ACS/WFC, a four-point ACS-WFC-DITHER-BOX pattern will be used along with an additional sub-pixel shift added to each dithering step. The four-point dithering scheme will help with cosmic-ray and hot pixel removals, and the sub-pixel shifts will improve the final point spread function in the stacked images. We estimate that the total overhead time for each 1-orbit visit is 18 minutes. For an average orbital visibility of 54 minutes (true for all five targeted fields), this leaves a total exposure time of 36 minutes, split into 4 identical-length exposures of 9 minutes each.

Visit

Proposal 14667, Visit 01, implementation Fri Jul 29 18:33:26 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.171 Line Spacing=0.171	Coordinate Frame=POS-TARG Pattern Orientation=30.16 Angle Between Sides=145.82 Center Pattern=false		(1)

Fixed Targets

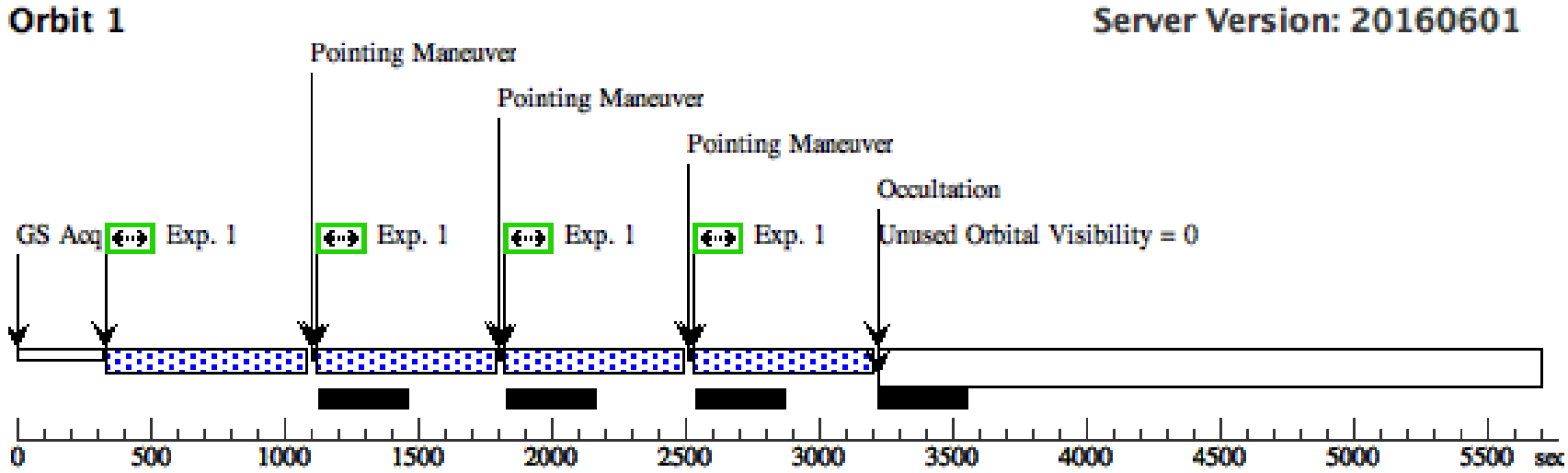
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J080932.70+193847.2	RA: 08 09 32.7113 (122.3862971d) Dec: +19 38 47.38 (19.64649d) Equinox: J2000		V=(?) g=18.93	Reference Frame: SIMBAD

Comments: This object was generated by the target selector and retrieved from the SIMBAD database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SDSS-J080932.70+193847.2	ACS/WFC, ACCUM, WFC2-FIX	F814W			Pattern 2, Exps 1-1 in Visit 01 (2)	600 Secs (2194 Secs) *[==>549.0 Secs (Pattern 1)]* *[==>548.0 Secs (Pattern 2)]* *[==>549.0 Secs (Pattern 3)]* *[==>548.0 Secs (Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 14667, Visit 02, implementation Fri Jul 29 18:33:26 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=30.16		
	Number Of Points=4	Angle Between Sides=145.82		
	Point Spacing=0.171	Center Pattern=false		
	Line Spacing=0.171			

Fixed Targets

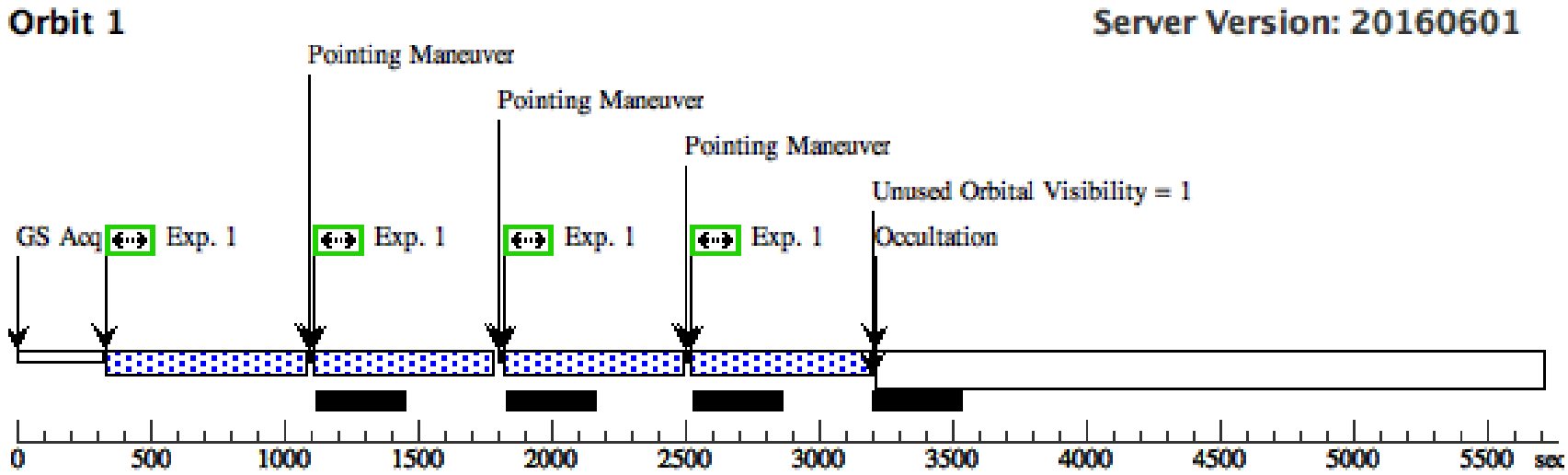
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SDSS-J082046.2+035741	RA: 08 20 46.2527 (125.1927196d)		V=(?)	Reference Frame: SIMBAD
		Dec: +03 57 42.13 (3.96170d)		g=19.19	
		Equinox: J2000			

Comments: This object was generated by the target selector and retrieved from the SIMBAD database. Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) SDSS-J082046.2 +035741	ACS/WFC, ACCUM, WFC2-FIX	F814W			Pattern 2, Exps 1-1 i n Visit 02 (2)	600 Secs (2182 Secs) *[==>546.0 Secs (Pattern 1)]* *[==>545.0 Secs (Pattern 2)]* *[==>546.0 Secs (Pattern 3)]* *[==>545.0 Secs (Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 14667, Visit 03, implementation Fri Jul 29 18:33:26 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.171 Line Spacing=0.171	Coordinate Frame=POS-TARG Pattern Orientation=30.16 Angle Between Sides=145.82 Center Pattern=false		(1)

Fixed Targets

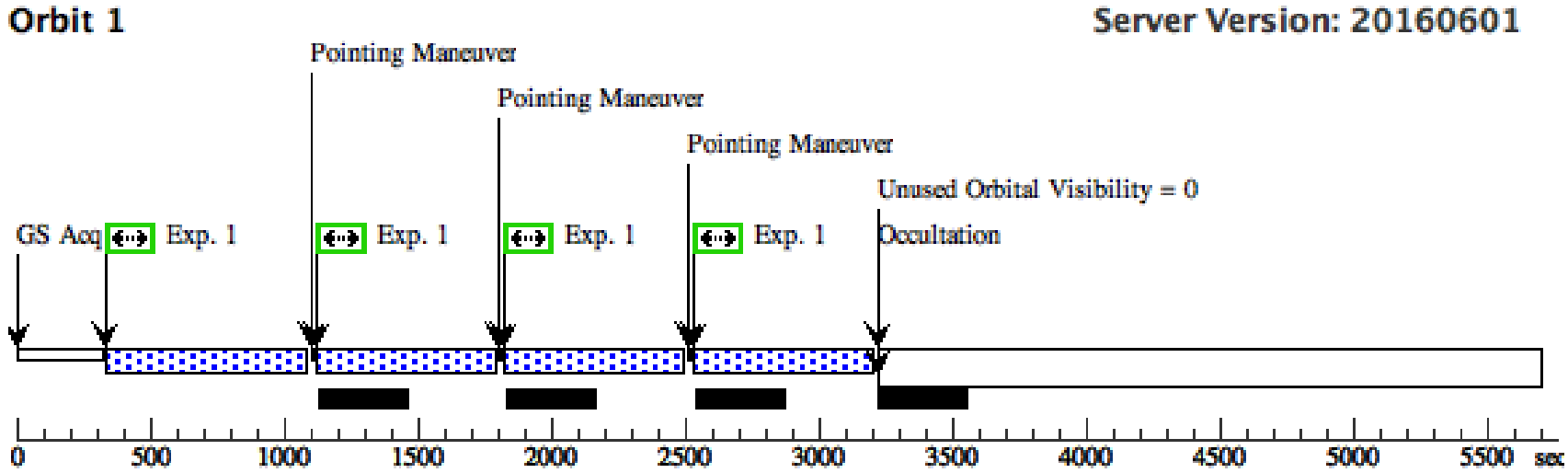
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SDSS-J104143.85+195724.4	RA: 10 41 43.8580 (160.4327417d) Dec: +19 57 24.43 (19.95679d) Equinox: J2000		V=(?) g=19.08	Reference Frame: SIMBAD

Comments: This object was generated by the target selector and retrieved from the SIMBAD database. Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) SDSS-J104143.85+195724.4	ACS/WFC, ACCUM, WFC2-FIX	F814W			Pattern 2, Exps 1-1 in Visit 03 (2)	600 Secs (2194 Secs) *[==>549.0 Secs (Pattern 1)]* *[==>548.0 Secs (Pattern 2)]* *[==>549.0 Secs (Pattern 3)]* *[==>548.0 Secs (Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 14667, Visit 04, implementation Fri Jul 29 18:33:26 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.171 Line Spacing=0.171	Coordinate Frame=POS-TARG Pattern Orientation=30.16 Angle Between Sides=145.82 Center Pattern=false		(1)

Fixed Targets

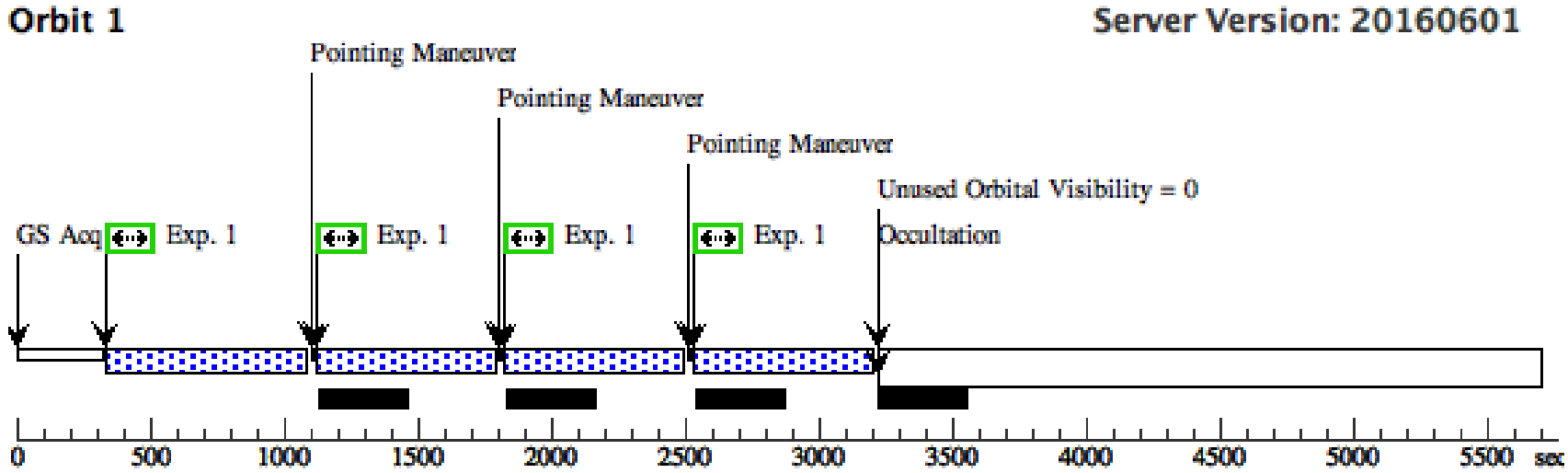
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	SDSS-J132059.73+164405.5	RA: 13 20 59.7330 (200.2488875d) Dec: +16 44 5.59 (16.73489d) Equinox: J2000		V=(?) g=18.90	Reference Frame: SIMBAD

Comments: This object was generated by the target selector and retrieved from the SIMBAD database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) SDSS-J132059.73+164405.5	ACS/WFC, ACCUM, WFC2-FIX	F814W			Pattern 2, Exps 1-1 in Visit 04 (2)	600 Secs (2194 Secs) *[==>549.0 Secs (Pattern 1)]* *[==>548.0 Secs (Pattern 2)]* *[==>549.0 Secs (Pattern 3)]* *[==>548.0 Secs (Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 14667, Visit 05, implementation Fri Jul 29 18:33:26 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.171 Line Spacing=0.171	Coordinate Frame=POS-TARG Pattern Orientation=30.16 Angle Between Sides=145.82 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	SDSS-J142758.9-012131	RA: 14 27 58.8777 (216.9953237d) Dec: -01 21 30.76 (-1.35854d) Equinox: J2000		V=(?) g=19.42	Reference Frame: SIMBAD

Comments: This object was generated by the target selector and retrieved from the SIMBAD database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) SDSS-J142758.9-012131	ACS/WFC, ACCUM, WFC2-FIX	F814W		GS ACQ SCENARIO BASE1B3	Pattern 2, Exps 1-1 in Visit 05 (2)	600 Secs (2182 Secs) *[==>546.0 Secs (Pattern 1)]* *[==>545.0 Secs (Pattern 2)]* *[==>546.0 Secs (Pattern 3)]* *[==>545.0 Secs (Pattern 4)]*	*[1]*

Orbit Structure