15160 - High-resolution imaging of two lensed dusty star-forming galaxies

Cycle: 25, 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) ACT-S-J0116-0004	WFC3/IR	1	27-Jul-2017 13:00:27.0	yes
02	(2) ACT-S-J2029+0120	WFC3/IR	1	27-Jul-2017 13:00:29.0	yes

2 Total Orbits Used

ABSTRACT

Dusty star-forming galaxies (DSFGs) make significant contributions to the star formation history of the universe, but the same dust that powers their luminosity obscures much or all of the rest-UV and optical light that would allow easy study of their dynamical properties and evolutionary states. In this proposal, we request observations of two DSFGs that are among the brightest point sources in three-band mapping with the Atacama Cosmology Telescope (ACT), both of which show incontrovertible evidence of gravitational lensing. From HST imaging, we will extract information about the background sources and lens-plane structures and develop gravitational lens models, thereby gaining insights into the DSFGs' intrinsic sizes, morphologies, and gas masses and kinematics, and into the presence of substructure in the lens plane. This effort will be strengthened by the fact that both of our targets already have highly resolved mid-J CO mapping with the IRAM Northern Extended Millimeter Array; in these cases, each independent velocity channel serves as an independent probe of the lensing potential.

OBSERVING DESCRIPTION

We will use the F160W (~ H) filter on WFC3/IR to maximize sensitivity to the redshifted emission of the background DSFGs in our sample. We will use the standard WFC3-IR-DITHER-BOX-MIN pattern with four positions in order to optimally sample the PSF. The field of view of interest for each target will be well contained within the optimally sampled region. For both targets, there is good evidence for emission in this band from ground-based images. This evidence is clear for ACT-S-J2029+0120 (Roberts-Borsani et al. 2017), while there are hints of spatially extended emission in H-band imaging of ACT-S-J0116-0004.

We estimated the range of surface brightness of the background lensed galaxy using H-band imaging from the VISTA Hemispheric Survey (VHS) for ACT-S-J0116-0004, and SDSS r-band and our own APO Ks-band image for ACT-S-J2029+0120. In each case, the lensed galaxy was modeled using Galfit (Peng et al. 2002, 2010). After the fit converged, the model was subtracted from the data and the residuals were used to estimate a mean and maximum surface brightness for the background galaxy. With estimated lens galaxy magnitudes in the range H = 14.6-17.6 and background galaxy surface brightnesses in the range 19.1-23.2 mag/arcsec^2 (Vega-relative), we need to ensure that the WFC3/IR images have adequate dynamic range, and are therefore using the STEP50 sequence with NSAMP = 11 to obtain eight 299.232s sub-exposures (via two executions of the four-position dither pattern). The resulting integration time per object (2393.856s) should yield a detection signal-to-noise ratio of >10 in a 5x5 pixel box for our faintest expected surface brightness value (23.2 mag/arcsec^2), based on the output of the WFC3/IR imaging ETC for a diffuse source with an elliptical galaxy spectrum and nominal background conditions. This depth will ensure high signal-to-noise over many square arcseconds of the background sources, as required by the proposal's scientific goals, and will allow even higher-S/N characterization of the main lensing galaxies and any satellites in their vicinities.

Visit

Proposal 15160, Visit 01, implementation Thu Jul 27 17:00:30 GMT 2017

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

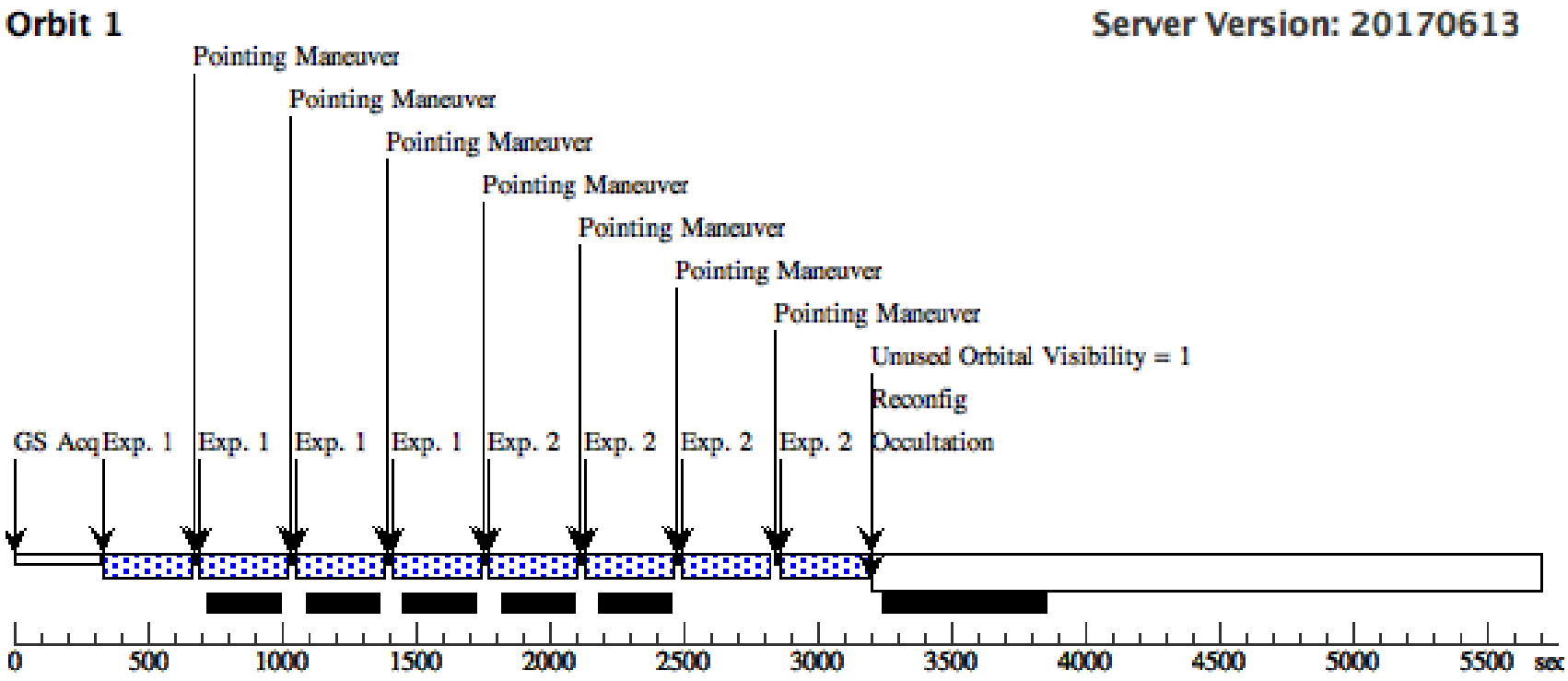
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ACT-S-J0116-0004	RA: 01 16 40.1400 (19.1672500d) Dec: -00 04 53.60 (-.08156d) Equinox: J2000		V=(?) J = 18.4, H = 17.6, Ks = 17.2	Reference Frame: ICRS

Comments: Coordinates based on NOEMA imaging. The star nearest to the DSFG is farther away than our adopted dither pattern steps, so image persistence will not be a problem in the vicinity of our science target.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J0116-1	(1) ACT-S-J0116-0004	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP50; NSAMP=11		Pattern 1, Exps 1-1 in Visit 01 (1)	299.232481 Secs (1196.93 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	J0116-2	(1) ACT-S-J0116-0004	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP50; NSAMP=11		Pattern 1, Exps 2-2 in Visit 01 (1)	299.232481 Secs (1196.93 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 15160, Visit 02 Thu Jul 27 17:00:30 GMT 2017

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)	ACT-S-J2029+0120	RA: 20 29 55.5000 (307.4812500d) Dec: +01 20 58.90 (1.34969d) Equinox: J2000		V=(?) J = 15.5, H = 14.6, Ks = 14.3	Reference Frame: ICRS

Comments: Target coordinates based on NOEMA imaging. The star nearest to the DSFG is farther away than our adopted dither pattern steps, and the nearest very bright star (2MASS J20295151+0120417, with J = 10.29, H = 10.032, K = 10.0) is 62" away near the edge of the FOV, so image persistence will not be a problem in the vicinity of our science target.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J2029-1	(2) ACT-S-J2029+0120	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP50; NSAMP=11		Pattern 1, Exps 1-1 in Visit 02 (1)	299.232481 Secs (1196.93 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	J2029-2	(2) ACT-S-J2029+0120	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP50; NSAMP=11		Pattern 1, Exps 2-2 in Visit 02 (1)	299.232481 Secs (1196.93 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure