14676 - Two New Local Volume Dwarfs Associated with Compact High Velocity Clouds: Distance, Structure and Star Formation History

Cycle: 24, 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	(2) GALFA-DW4	ACS/WFC	1	29-Jul-2016 14:38:53.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
02	(3) GALFA-DW3	ACS/WFC	1	29-Jul-2016 14:38:54.0	yes

2 Total Orbits Used

ABSTRACT

We request two filter HST imaging (F606W and F814W) to study the properties of two faint, isolated dwarf galaxies discovered based on their association with HI compact high velocity clouds -- a potentially new class of young, gas-rich dwarf galaxy. This data will provide crucial information on how low mass galaxies form in isolation (the dwarfs have no plausible neighbor within ~700 kpc), and serve as useful reference objects for interpreting the faint dwarfs in the Local Group. Understanding the numbers, luminosities, and star formation histories of the faintest dwarf galaxies on the outskirts of the Local Group and beyond are a frontier area for comparisons between CDM predictions and observations. With current data, it is clear these dwarfs have ongoing star formation, but we can only constrain their distance to lie between 2.5 < D < 10 Mpc -- we propose HST optical imaging to determine the galaxies' distance, extent, and star formation history. Only HST can provide the resolution and depth necessary to characterize this emerging class of objects, and we will compare and contrast their physical properties with dwarfs in the Local Group and gas-rich dwarf irregulars in the Local Volume.

OBSERVING DESCRIPTION

Our primary science goal is to determine the basic physical properties -- distance, size, luminosity, gas mass, and star formation history -- of our newly discovered dwarfs associated with compact HI gas clouds; the ground based data is clearly not sufficient because it does not resolve stars. However, the entire program can be efficiently completed with HST in two orbits. The most suitable instrument is ACS/WFC thanks to its higher sensitivity in the selected optical bands. Optical magnitudes and colors (F606W, F814W) will let us measure distances via the tip of the red giant branch method, as well as a star formation history. These filters were chosen not only because of their excellent sensitivity with ACS, but also because the two other Local Volume UCHVC dwarfs were imaged in the same filter set. These optical bands will be used to precisely measure the size (i.e. half light radius, using a maximum likelihood code; Martin et al. 2008, Sand et al. 2012) and morphology of the dwarfs.

Required Depth: We are confident that GALFA-Dw3 and Dw4 are between ~2.5--10 Mpc based on their velocities and measured properties, with GALFA-Dw3 likely to be on the low end of this distance range based on ground-based imaging. With ~1100 s per filter (or one full orbit per dwarf), assuming the most distant estimated value, we will have a S/N~5 at the tip of the red giant branch (assuming M_I=-4.0 and M_V=-2.5 for the TRGB; Da Costa & Armandroff 1990). This is sufficient for a ~10% distance measurement, as we have demonstrated with our Bayesian TRGB distance

methodology (Tollerud et al. submitted; see also McQuinn et al. 2014). Even at our largest expected distances, we have also demonstrated that star formation histories will be measurable, especially for younger stellar populations. If within D<3.0 Mpc, the observations will reach the red clump (M_I~-0.5 and M_V~0) which at that distance is at F814W=26.9 mag and F606W=27.4 mag with a S/N=4, allowing for an even more robust SFH measurement (e.g. Dolphin 2002). The star formation histories will be measured with a CMD fitting technique (MATCH; Dolphin 2002; Weisz et al. 2011).

Exposure Times and Final Orbit Count: With our desired S/N~5 at the TRGB for our most distant dwarf scenario, F814W, F606W=26, 27.5, we require 1100s in exposure time for each band, according to the ACS Exposure Time Calculator. This ensures a ~10% distance measurement via our TRGB methodology (Figure 4) and an outstanding star formation history measurement in the case where one or both of the dwarfs are at D<3 Mpc. A standard dither sequence will be incorporated. Each galaxy fits on a single ACS chip. We have verified that each two-filter observation can be accomplished in a single orbit. Overall, we require 2 orbits of ACS imaging (one orbit per dwarf, split between F606W and F814W).

Visit

Proposal 14676, Visit 01, implementation Fri Jul 29 18:38:54 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 260D TO 320 D; ORIENT 100D TO 125 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

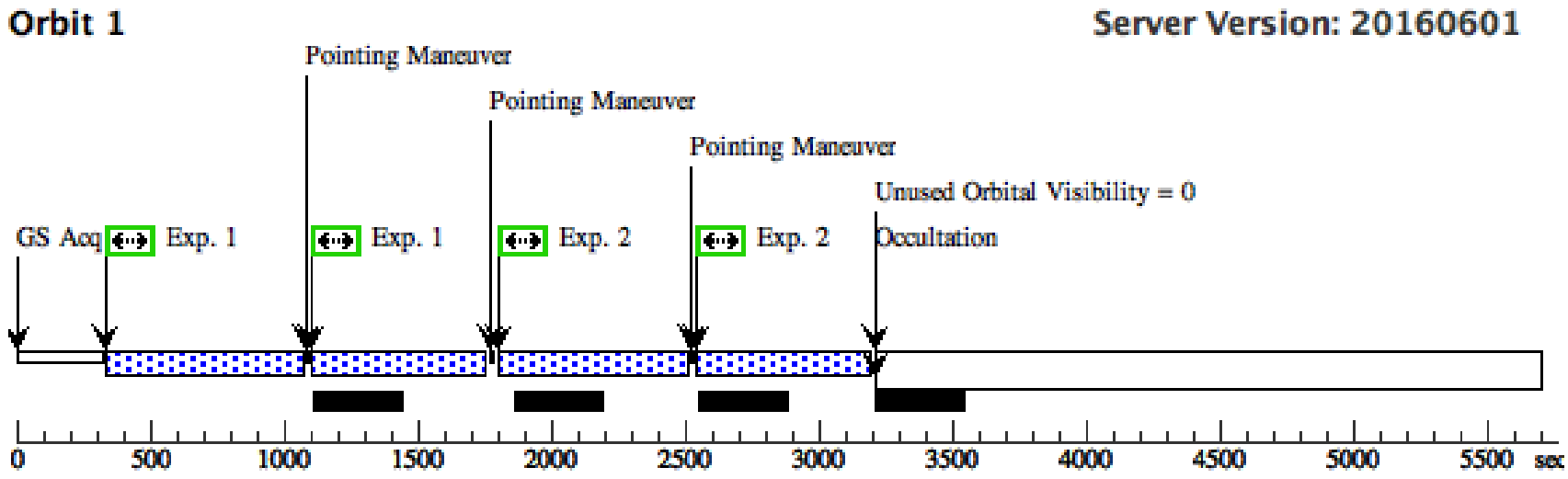
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	GALFA-DW4	RA: 05 45 44.8500 (86.4368750d) Dec: +10 46 14.01 (10.77056d) Equinox: J2000		V=22.+/-0.5	Reference Frame: ICRS

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) GALFA-DW4	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-1 in Visit 01 (1)	500 Secs (1062 Secs) *[==>531.0 Secs (Pattern 1)]* *[==>531.0 Secs (Pattern 2)]*	*[1]*
2		(2) GALFA-DW4	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 2-2 in Visit 01 (1)	500 Secs (1062 Secs) *[==>531.0 Secs (Pattern 1)]* *[==>531.0 Secs (Pattern 2)]*	*[1]*

Orbit Structure



Visit

Proposal 14676, Visit 02, implementation Fri Jul 29 18:38:54 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 250D TO 320 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	GALFA-DW3	RA: 02 58 56.4370 (44.7351542d) Dec: +13 37 48.70 (13.63019d) Equinox: J2000		V=22.0+/-0.5	Reference Frame: ICRS

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) GALFA-DW3	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-1 in Visit 02 (1)	500 Secs (1062 Secs) *[==>531.0 Secs (Pattern 1)]* *[==>531.0 Secs (Pattern 2)]*	*[1]*
2		(3) GALFA-DW3	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 2-2 in Visit 02 (1)	500 Secs (1062 Secs) *[==>531.0 Secs (Pattern 1)]* *[==>531.0 Secs (Pattern 2)]*	*[1]*

Orbit Structure