14108 - The Intriguing Case of the (Almost) Dark Galaxy AGC 229385

Cycle: 23, 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) AGC-229385	ACS/WFC	2	20-Aug-2015 21:04:40.0	yes

2 Total Orbits Used

ABSTRACT

The ALFALFA blind HI survey has catalogued tens of thousands of HI sources over 7000 square degrees of high Galactic latitude sky. While the vast majority of the sources in ALFALFA have optical counterparts in existing wide-field surveys like SDSS, a class of objects has been identified that have no obvious optical counterparts in existing catalogs. Dubbed "almost dark" galaxies, these objects represent an extreme in the continuum of

galaxy properties, with the highest HI mass-to-optical light ratios ever measured. We propose to use HST to observe AGC 229385, an "almost dark" object found in deep WIYN imaging to have an ultra-low surface brightness stellar component with extremely blue colors. AGC 229385 falls well off of all galaxy scaling relationships, including the Baryonic Tully-Fisher relation. Ground-based optical and HI data have been able to identify this object as extreme, but are insufficient to constrain the properties of its stellar component or its distance -- for this, we need HST. Our science goals are twofold: to better constrain the distance to AGC 229385, and to investigate the stellar population(s) in this mysterious object. The requested observations will not only provide crucial insight into the properties and evolution of this specific system but will also help us understand this important class of ultra low surface brightness, gas-rich galaxies. The proposed observations are designed to be exploratory, yet they promise to pay rich dividends for a modest investment in observing time.

OBSERVING DESCRIPTION

Observing Strategy and Photometric Depth:

The goal of our observing program is to discern whether AGC 229385 contains both a young and an old stellar population, and to constrain the distance to the galaxy. The most suited ACS filters are the F606W and F814W bands; the broad F606W filter is preferred over the narrower Johnson V F555W filter as depth is favored over color sensitivity for this work. For low-metallicity environments in galaxies, RGB stars have a V-I color of ~1.0 mag. Thus, our observing strategy focuses on reaching a photometric depth in F606W ~1 mag deeper than F814W.

Given the current distance estimate range of 8-28 Mpc, we explored different scenarios in the ACS exposure time calculator (ETC) to ensure a robust result within this parameter space. We assumed a Bruzual synthetic spectrum of a K2III star and 1 orbit per filter. At the closest distance, the photometric depth reached will be F814W = -2.5 mag and F606W = -1.5 mag, with a S/N = 5 in each filter. This depth will be sufficient to detect both a young and an older stellar population and constrain the distance, even if the RGB is not fully populated. At the farthest distance, the photometric depth reached will be F814W = -3.5 mag and F606W = -2.5 mag, with a S/N~3 in each filter. Given that the stellar mass will be higher if the galaxy is farther, we would anticipate a different population of stars in the CMD. While only the most luminous RGB stars will be detected, our expectation is that a more massive galaxy with blue colors will have a more fully populated main sequence and post-main sequence (i.e., helium burning sequences). As stressed above, this would allow us to constrain the distance, placing AGC 229385 behind the Virgo cluster. Given the angular size of AGC 229385, the full extent of the stellar disk will be imaged within the ACS footprint. The observations will be dithered to facilitate the removal of cosmic rays and hot pixels. The execution of the observations is straightforward and poses no difficulties for HST scheduling.

Data Processing:

We will perform photometry on the ACS images using the software DOLPHOT, an optimized version of HSTphot with an ACS module (Dolphin 2000). Completeness will be measured using artificial star tests with the same software. If AGC 229385 is located at the closer end of our distance range, we will use a maximum-likelihood (ML) technique optimized for determining the location of the TRGB. This approach is well-suited for measuring the TRGB in photometry reaching ~1 mag below the TRGB (Makarov et al. 2006) and includes photometric errors and completeness (measured by artificial star tests).

Visit

Proposal 14108, Visit 1 (01), implementation Fri Aug 21 01:04:42 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 55D TO 105 D; ORIENT 235D TO 280 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AGC-229385	RA: 12 32 10.9100 (188.0454583d) Dec: +20 25 22.98 (20.42305d) Equinox: J2000		V=19.2	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) AGC-229385	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-1 in Visit 1 (01) (1)	500 Secs (2510 Secs) *[==>1255.0 Secs (Pattern 1)]* *[==>1255.0 Secs (Pattern 2)]*	***[1]***
2		(1) AGC-229385	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 2-2 in Visit 1 (01) (1)	500 Secs (2648 Secs) *[==>1324.0 Secs (Pattern 1)]* *[==>1324.0 Secs (Pattern 2)]*	***[2]***

Orbit Structure