# 17798 - Two new isolated, faint dwarf galaxies beyond the Local Group

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**

| *Name* | *Institution* |
|---|---|
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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) CETUSB | ACS/WFC | 1 | 15-Aug-2024 09:00:55.0 | yes |
| 02 | (2) HYDRUSA | ACS/WFC | 1 | 15-Aug-2024 09:00:55.0 | yes |

2 Total Orbits Used

**ABSTRACT**

The Local Group satellite dwarf galaxies are often used as benchmarks for testing galaxy formation and evolution theories on the smallest scales because they are the lowest-mass galaxies for which detailed observations are available. However, most of these dwarfs have been affected by the Local Group environment. If we want to understand the physical mechanisms driving the evolution of low-mass galaxies, we must study pristine isolated dwarf galaxies beyond the Local Group as a control sample. Unfortunately, identifying such galaxies in the field is extremely challenging due to their extreme faintness. To date, Tucana B is the only known isolated, ultra-faint dwarf galaxy that is independent of group dynamics but close enough at 1.4 Mpc to be studied with resolved stars. With only one system, it is challenging to draw broad conclusions about the lowest-mass galaxies evolving in isolation.

We request two orbits of HST/ACS imaging (F606W+F814W) to follow up two new nearby isolated faint dwarf galaxies (Cetus B and Hydrus A) discovered in ground-based surveys. The galaxies are likely just beyond the edge of the Local Group, with apparent morphologies and colors strikingly similar to Tucana B. HST imaging is essential to the determination of high-precision distances, measurement of basic physical properties, and measurement of star formation histories of these two newly discovered faint dwarfs. The requested observations will put these two galaxies into context with other dwarf galaxies in and beyond the Local Group, providing a rare opportunity to assess the impact of environment on low-mass systems.

**OBSERVING DESCRIPTION**

The observations are going to be performed with ACS/WFC (primary) and WFC3/UVIS (parallel) to match previous observations of faint dwarfs beyond the Local Group (e.g. Weisz et al. 2014, Hargis et al. 2020, Danieli et al. 2017, Bennet et al. 2019, Crnojevic et al. 2019, Mutlu-Pakdil et al 2022). We request imaging in F606W and F814W filters (broad V and I) for both instruments, in order to compute accurate TRGB distances for our targets and characterize their stellar content, while optimizing the exposure times. The parallel pointings will allow us to observe a field region next to our targets. We will thus be able to estimate more precisely the number of background/foreground contaminants present in our ACS fields.

Given the small size of each target (<1 arcmin), one pointing is sufficient to cover the entire spatial extent of each galaxy. Each dwarf will be placed on one of the ACS/WFC chips, and small dithers between exposures will remove detector defects and improve the PSF sampling. Given that the possible distance range for our targets is ~1-3 Mpc, we use existing HST ACS data of Local Volume dwarfs at <3 Mpc (NGC253 dwarfs [GO-14259, GO-15938], CenA dwarfs [GO-13856], MADCASH dwarfs [GO-15228]) to guide our observational request and ensure that the depth is sufficient for the science goals of this proposal.

The archival ACS data for similar limiting magnitudes were obtained with 2 CR-SPLIT exposures of 1200 sec in F606W and 900 sec in F814W. The required exposure times nicely fit into one orbit per object after taking into account realistic overheads. With these exposures, the achieved SNR given by the ACS ETC is ~10 at 1 mag below the TRGB for both bands (assuming a distance of 3~Mpc), with a limiting magnitude of ~27 in F814W, thus fulfilling our requirements. This translates into only a total of three orbits for our three dwarfs. We have checked that the charge transfer efficiency losses of ACS do not significantly affect our observations (at most 10% loss of flux). Our visits are 1-orbit, and we have no ORIENT requirements. Nor does this program have time constraints (other than the baseline excitement of the science!).

## Visit

**Proposal 17798, CetusB (01), implementation** Thu Aug 15 13:00:56 GMT 2024

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=ACS-WFC-DITHER-LINE<br>Purpose=DITHER<br>Number Of Points=2<br>Point Spacing=0.364<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=47.23<br>Angle Between Sides=<br>Center Pattern=false | | (1), (2) |

## Fixed Targets

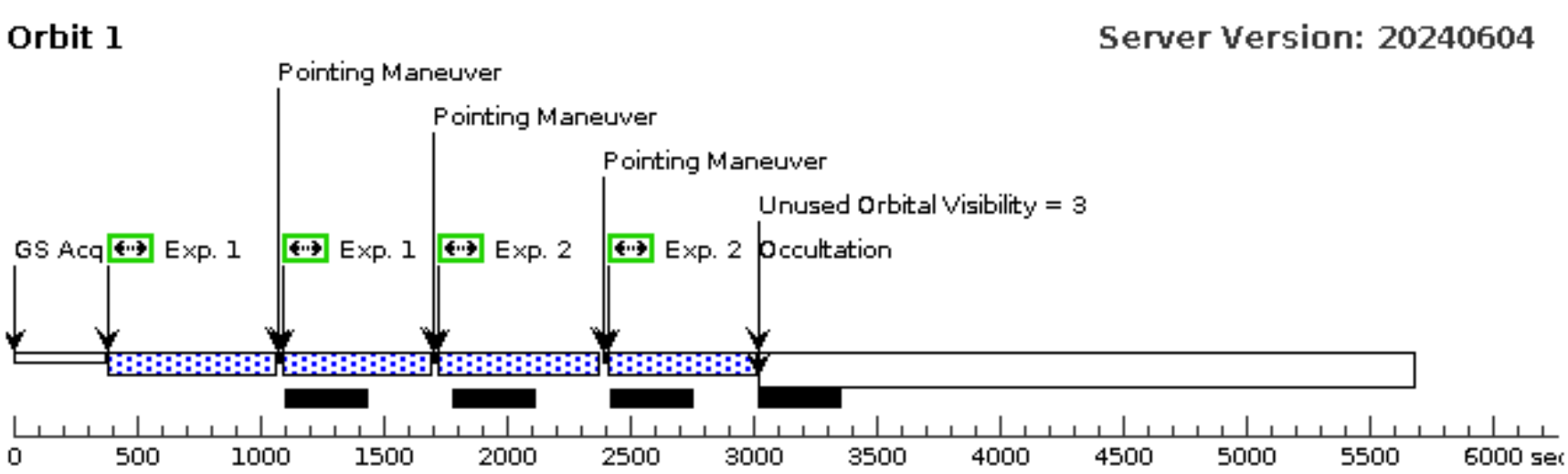
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | CETUSB | RA: 00 40 34.8884 (10.1453683d)<br>Dec: -20 33 21.88 (-20.55608d)<br>Equinox: J2000 | | V=21+/-0.1 | Reference Frame: ICRS |

*Comments:*
*Category=GALAXY*
*Description=[DWARF SPHEROIDAL]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) CETUSB | ACS/WFC, ACCUM, WFC1 | F606W | | | Pattern 1, Exps 1-1 in CetusB (01) (1) | 400 Secs (948 Secs)<br>*[==>474.0 Secs (Pattern 1)]*<br>*[==>474.0 Secs (Pattern 2)]* | *[1]* |
| 2 | | (1) CETUSB | ACS/WFC, ACCUM, WFC1 | F814W | | | Pattern 1, Exps 2-2 in CetusB (01) (1) | 400 Secs (948 Secs)<br>*[==>474.0 Secs (Pattern 1)]*<br>*[==>474.0 Secs (Pattern 2)]* | *[1]* |

## Orbit Structure



## Visit

**Proposal 17798, HydrusA (02), implementation** Thu Aug 15 13:00:56 GMT 2024

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=ACS-WFC-DITHER-LINE<br>Purpose=DITHER<br>Number Of Points=2<br>Point Spacing=0.364<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=47.23<br>Angle Between Sides=<br>Center Pattern=false | | (1), (2) |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | HYDRUSA | RA: 03 44 46.5718 (56.1940492d)<br>Dec: -70 21 17.73 (-70.35492d)<br>Equinox: J2000 | | V=21+/-0.1 | Reference Frame: ICRS |

*Comments:*
*Category=GALAXY*
*Description=[DWARF SPHEROIDAL]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (2) HYDRUSA | ACS/WFC, ACCUM, WFC2 | F606W | | | Pattern 1, Exps 1-1 in HydrusA (02) (1) | 400 Secs (1026 Secs)<br>*[==>513.0 Secs (Pattern 1)]*<br>*[==>513.0 Secs (Pattern 2)]* | *[1]* |
| 2 | | (2) HYDRUSA | ACS/WFC, ACCUM, WFC2 | F814W | | | Pattern 1, Exps 2-2 in HydrusA (02) (1) | 400 Secs (1026 Secs)<br>*[==>513.0 Secs (Pattern 1)]*<br>*[==>513.0 Secs (Pattern 2)]* | *[1]* |

## Orbit Structure