16186 - The extremely peculiar globular cluster system of UDG GAMA-526784 and its implications

Cycle: 28, 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	(2) GAL-085709-005835	WFC3/UVIS	1	19-Oct-2020 12:00:14.0	yes
02	(2) GAL-085709-005835	ACS/WFC	2	19-Oct-2020 12:00:15.0	yes

3 Total Orbits Used

ABSTRACT

Recent observations of Ultra-Diffuse Galaxies (UDGs, which have the luminosities of dwarfs but sizes of giant galaxies) have picked up a lot of attention by the community. Two nagging problems that are being discussed in the context of UDGs, are 1) the apparent lack of dark matter of some UDGs, and 2) their anomalously abundant-and-bright globular cluster systems. The former is difficult to reconcile with a LCDM model of structure formation, while the latter is contrary to what we observe in essentially any other galaxy system. We have recently discovered a UDG candidate, that

may provide valuable insight towards solving both problems. This object has very similar properties to typical UDGs, apart from a widely spread population of compact star-forming regions. Our ground-based photometry indicates that these regions have stellar masses similar to globular clusters (GCs), and at least three have radial profiles that are unresolved by our ground based imaging - in line with expectations for young massive clusters. The HST brings the high spatial resolution, and imaging capability in the near-UV, that are required to better constrain the physical sizes and formation ages of these compact regions. Interestingly and coincidentally, some properties of this galaxy are strikingly similar to those hypothesised by Silk 2019, who predicts the simultaneous formation of massive GCs, and links this to the formation of UDGs that lack dark matter and exhibit extreme GC systems. This UDG may just provide us a very rare local view on such processes in action.

OBSERVING DESCRIPTION

This is an HST imaging program of a single ultra-diffuse galaxy in three filters: ACS/WFC F606W and F814W, and WFC3/UVIS F275W. Data will be combined to measure fluxes and sizes of candidate globular clusters (expected to be borderline resolved at HST spatial resolution) in this galaxy.

One orbit is allocated to each of three filters. Each orbit is split in 4 exposures with offset positions of half-pixel plus several pixels (i.e. the standard DITHER BOX option for both instruments) so that the individual frames can be interlaced and combined in the reduction. This is to improve the spatial sampling of the PSF and to facilitate CR and hot pixel removal. The chip gap does not have to be filled, so those small dithers suffice.

ORIENT constraints: The galaxy will fall on WFC3/UVIS chip 2 and ACS/WFC chip 1 (aperture UVIS2 and WFC1). The galaxy is strongly elliptical (PA ~35 degrees from North Eastwards) and we intend to align the major axis with the x-axes of both chips, to be able to probe all star clusters in this galaxy. We allow a tolerance of 20 degrees between the major axis and the x-axis of UVIS chip1, and the whole configuration can be flipped by 180 degrees. To ensure a maximum overlap between the WFC3 and ACS imaging, also for the second chips, we impose a 10 degrees tolerance between the x-axes of UVIS2 and WFC1. Given how the detectors are placed in the HST FoV, we split the orbits over two HST visits. We believe these ORIENT constraints strike a good balance between maximising science return and schedulability.

NOTE Oct 2020: To increase schedulability, we had to relax the ORIENT constraints listed above.

TARGET POSITION: The galaxy is off-set towards the readout amplifier on the UVIS chip 2 to reduce CTI problems (-20" in Y direction). Accordingly, we shift the target on the ACS/WFC chip 1 (-50" in X direction and -20" in Y direction) to maximise spatial overlap between the WFC3 and ACS data sets.

We will apply a post-flash level of 19 electrons to the UVIS chips. Including the ~2 electrons of background per pixel we expect with our exposure times, this meets the updated recommended total background level of at least 20 electrons to reduce CTI problems.

In the event of Reduced Gyro mode, our program would need a minor reduction of exposure times to accommodate a longer initial target acquisition.

There are no bright sources in the field of view and there are no limitations for using WFC3/UVIS and ACS/WFC.

Visit

Proposal 16186, Visit 01, implementation Mon Oct 19 16:00:15 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 60D TO 115 D; ORIENT 260D TO 295 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

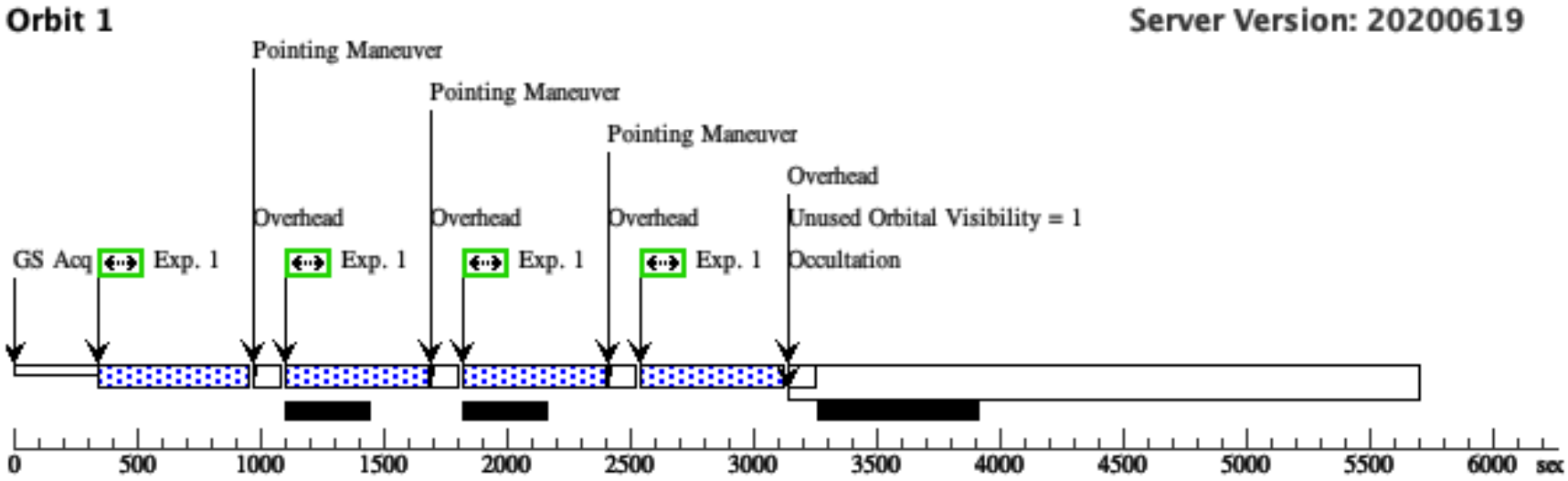
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	GAL-085709-005835 Alt Name1: GAMA-526784-CENTER	RA: 08 57 8.6350 (134.2859792d) Dec: -00 58 34.63 (-.97629d) Equinox: J2000		V=23	Reference Frame: ICRS

Comments: Elliptical UDG/LSB galaxy with major axis ~1 arcmin. Contains at least 10-20 bright clusters/star-forming regions.
Category=GALAXY
Description=[DWARF ELLIPTICAL, LSB, STAR FORMING REGION]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) GAL-085709-005835	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=19	POS TARG null,-20	Pattern 1, Exps 1-1 in Visit 01 (1)	586 Secs (2336 Secs) *[==>584.0 Secs (Pattern 1)]* *[==>584.0 Secs (Pattern 2)]* *[==>584.0 Secs (Pattern 3)]* *[==>584.0 Secs (Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 16186, Visit 02, scheduling Mon Oct 19 16:00:16 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT -7D TO 7D FROM 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=false		(1), (2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	GAL-085709-005835 Alt Name1: GAMA-526784-CENTER	RA: 08 57 8.6350 (134.2859792d) Dec: -00 58 34.63 (-.97629d) Equinox: J2000		V=23	Reference Frame: ICRS

Comments: Elliptical UDG/LSB galaxy with major axis ~1 arcmin. Contains at least 10-20 bright clusters/star-forming regions.
Category=GALAXY
Description=[DWARF ELLIPTICAL, LSB, STAR FORMING REGION]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) GAL-085709-005835	ACS/WFC, ACCUM, WFC1	F814W		POS TARG -50,-10	Pattern 2, Exps 1-1 in Visit 02 (2)	516 Secs (2064 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(2) GAL-085709-005835	ACS/WFC, ACCUM, WFC1	F606W		POS TARG -50,-10	Pattern 2, Exps 2-2 in Visit 02 (2)	520 Secs (2080 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure