



# 17498 - The Ultra-faint Dwarf Galaxy System of NGC300 -- A New Frontier and Analog to the Large Magellanic Cloud

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Prof. David J. Sand (PI) (Contact)</b>	<b>University of Arizona</b>
Dr. Alex Drlica-Wagner (CoI)	Fermi National Accelerator Laboratory (FNAL)
Dr. David Martinez-Delgado (CoI) (ESA Member)	Instituto de Astrofisica de Andalucia (IAA)
Mr. Giuseppe Donatiello (CoI) (ESA Member)	Unione Astrofili Italiani - UAI
Dr. Jeffrey L Carlin (CoI)	NOIRLab - Vera C. Rubin Operations (AZ)
Dr. Michael Gordon Jones (CoI)	University of Arizona
Dr. Burcin Mutlu-Pakdil (CoI)	Dartmouth College
Dr. Denija Crnojevic (CoI)	University of Tampa
Dr. Ananthan Karunakaran (CoI) (CSA Member)	University of Toronto
Dr. Kristine Spekkens (CoI) (CSA Member)	Royal Military College of Canada
Dr. Paul Bennet (CoI)	Space Telescope Science Institute
Dr. Catherine Fielder (CoI)	University of Arizona

## VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) NGC300DW1	ACS/WFC	1	28-Jun-2024 15:00:46.0	yes
02	(2) NGC300DW2 ANY	ACS/WFC WFC3/UVIS	1	28-Jun-2024 15:00:47.0	yes

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
03	(3) NGC300DW3 ANY	ACS/WFC WFC3/UVIS	1	28-Jun-2024 15:00:47.0	yes

3 Total Orbits Used

### **ABSTRACT**

We request three orbits of HST/ACS imaging (F606W+F814W) of three new ultra-faint dwarf galaxy candidates around NGC300 (D=2 Mpc), a nearby analog to the Large Magellanic Cloud (LMC). The faint end of the galaxy luminosity function is a strong probe of dark matter physics and galaxy formation models, but can only be studied in the most constraining "ultra-faint" regime in the nearby universe. Of particular interest are the dwarf satellite properties of lower mass LMC-like galaxies because these systems will experience weaker tidal fields and ram pressure environments in comparison to those of the Local Group, possibly leading to dwarfs with different physical properties.

A search for dwarf satellites around the isolated LMC-analog NGC300 has uncovered three strong ultra-faint dwarf galaxy candidates, ranging in luminosity between  $M_V = -5.8$  to  $-7$  mag ( $\log(M_{\text{star}}) \sim 4.5$ – $5$ ). Two out of three of these discoveries are observed near the viral radius of NGC300, potentially probing its ram pressure environment. These candidate dwarf galaxy satellites represent the faintest population ever found outside the Local Group. HST imaging will allow us to measure the distance, luminosity, structure and approximate star formation history/metallicity of these dwarf candidates, and place them in context with similar ultra-faint dwarf galaxies near the Milky Way and LMC that have been discovered in the last ~20 years.

### **OBSERVING DESCRIPTION**

The observations will be performed with ACS/WFC (primary) and WFC3/UVIS (parallel). We request imaging in the F606W and F814W filters (broad V and I) for both instruments in order to compute accurate color-magnitude diagram based distances for our targets while characterizing their stellar content (e.g. star formation histories and metallicities) and structural parameters. 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.

Our main target dwarf galaxies will be placed in the center of a chip -- we will use the WFC1 aperture. For each band we will use a two point ditherline pattern to mitigate hot pixels, cosmic rays, etc. We will not try to cover the chip gap as each dwarf fits well on a single chip.

Proposal 17498 (STScI Edit Number: 1, Created: Friday, June 28, 2024 at 2:00:48 PM Eastern Standard Time) - Overview

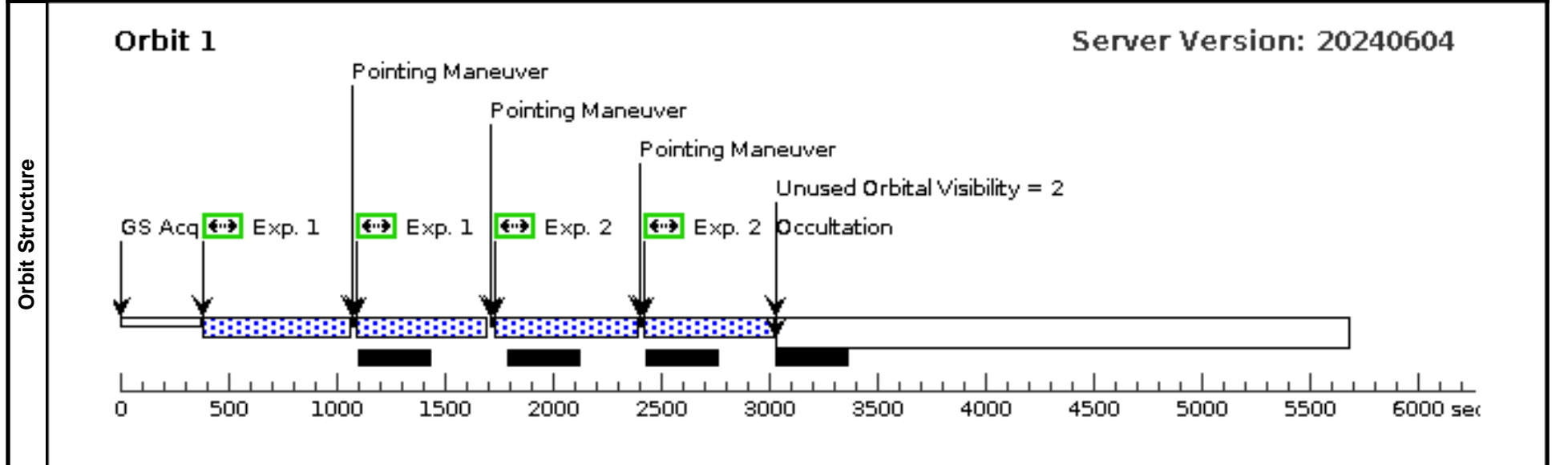
This program is resilient to two-gyro mode. Our visits are 1-orbit, and we have no ORIENT requirements. Nor does this program have time constraints (other than the baseline excitement of the science!). We can also achieve our science goals with a longer acquisition time, if necessary.

<b>Visit</b>	<b>Proposal 17498, NGC300Dw1 (01), implementation</b>		
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: (none)		

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

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	NGC300DW1	RA: 01 08 31.0000 (17.1291667d) Dec: -36 03 54.00 (-36.06500d) Equinox: J2000		V=22	Reference Frame: ICRS
	<i>Comments:</i> Category=GALAXY Description=[DWARF SPHEROIDAL] Extended=YES					

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) NGC300DW1	(1) NGC300DW1	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-1 in NGC300Dw1 (01) (1)	600 Secs (954 Secs) [=>477.0 Secs (Pattern 1)] [=>477.0 Secs (Pattern 2)]	[1]
	2	(1) NGC300DW1	(1) NGC300DW1	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 2-2 in NGC300Dw1 (01) (1)	600 Secs (954 Secs) [=>477.0 Secs (Pattern 1)] [=>477.0 Secs (Pattern 2)]	[1]



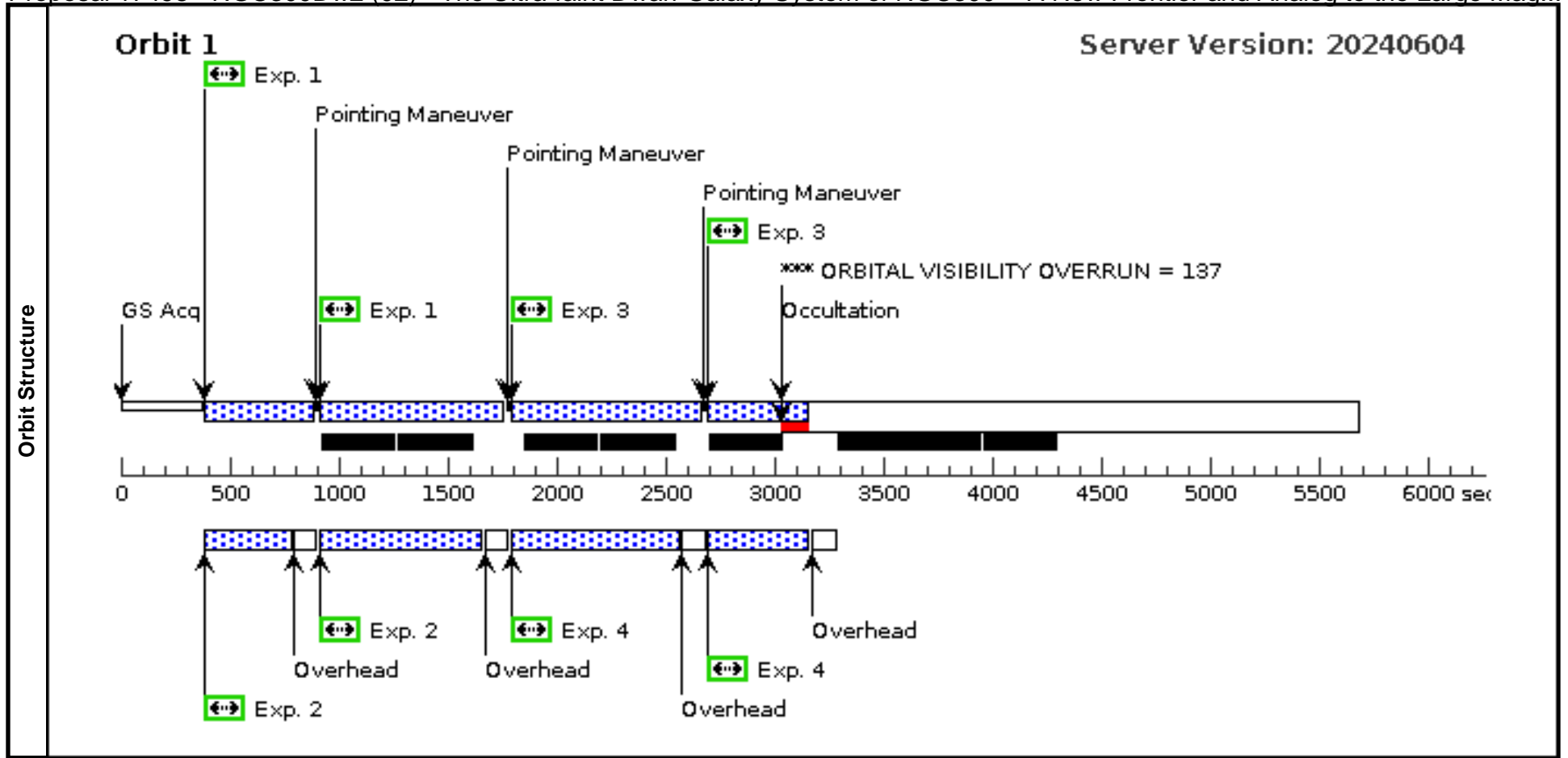
Proposal 17498 - NGC300Dw2 (02) - The Ultra-faint Dwarf Galaxy System of NGC300 -- A New Frontier and Analog to the Large Mag...

Fri Jun 28 19:00:48 GMT 2024

<b>Visit</b>	<b>Proposal 17498, NGC300Dw2 (02), completed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: (none)					
	<b>Diagnosics</b> (NGC300Dw2 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw2 (02))) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser (Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw2 (02))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser					
<b>Patterns</b>	<b>#</b>	<b>Primary Pattern</b>	<b>Secondary Pattern</b>	<b>Exposures</b>		
	(1)	Pattern Type=ACS-WFC-DITHER- LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)		
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>
	(2)	NGC300DW2	RA: 01 06 51.0000 (16.7125000d) Dec: -35 04 39.00 (-35.07750d) Equinox: J2000		V=22	Reference Frame: ICRS
Comments: Category=GALAXY Description=[DWARF SPHEROIDAL] Extended=YES						

Proposal 17498 - NGC300Dw2 (02) - The Ultra-faint Dwarf Galaxy System of NGC300 -- A New Frontier and Analog to the Large Mag...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) NGC300DW2	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in NGC300Dw2 (02) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw2 (02)	650 Secs (1010 Secs) [==>295.0 Secs (Pattern 1)] [==>715.0 Secs (Pattern 2)]	[1]
	2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W	FLASH=1.0		Pattern 1, Exps 1-2 in NGC300Dw2 (02) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw2 (02)	350 Secs (1120 Secs) [==>375 Secs (Pattern 1)] [==>745.0 Secs (Pattern 2)]	[1]
	3		(2) NGC300DW2	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in NGC300Dw2 (02) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in NGC300Dw2 (02)	450 Secs (1026 Secs) [==>687.0 Secs (Pattern 1)] [==>339.0 Secs (Pattern 2)]	[1]
	4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6.0		Pattern 1, Exps 3-4 in NGC300Dw2 (02) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in NGC300Dw2 (02)	360 Secs (1214 Secs) [==>749.0 Secs (Pattern 1)] [==>465.0 Secs (Pattern 2)]	[1]



Proposal 17498 - NGC300Dw3 (03) - The Ultra-faint Dwarf Galaxy System of NGC300 -- A New Frontier and Analog to the Large Mag...

Fri Jun 28 19:00:48 GMT 2024

<b>Visit</b>	<b>Proposal 17498, NGC300Dw3 (03), completed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: (none) <i>Comments: There is a bright star near the center of the dwarf.</i>					
	<b>Diagnosics</b> (NGC300Dw3 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw3 (03))) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser (Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw3 (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser					
<b>Patterns</b>	<b>#</b>	<b>Primary Pattern</b>	<b>Secondary Pattern</b>	<b>Exposures</b>		
	(1)	Pattern Type=ACS-WFC-DITHER- LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)		
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>
	(3)	NGC300DW3	RA: 00 57 52.0000 (14.4666667d) Dec: -35 51 14.00 (-35.85389d) Equinox: J2000		V=22	Reference Frame: ICRS
<i>Comments:</i> Category=GALAXY Description=[DWARF SPHEROIDAL] Extended=YES						

Proposal 17498 - NGC300Dw3 (03) - The Ultra-faint Dwarf Galaxy System of NGC300 -- A New Frontier and Analog to the Large Mag...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) NGC300DW3	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in NGC300Dw3 (03) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw3 (03)	650 Secs (1010 Secs) [==>295.0 Secs (Pattern 1)] [==>715.0 Secs (Pattern 2)]	[1]
	2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W	FLASH=1.0		Pattern 1, Exps 1-2 in NGC300Dw3 (03) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in NGC300Dw3 (03)	350 Secs (1120 Secs) [==>375 Secs (Pattern 1)] [==>745.0 Secs (Pattern 2)]	[1]
	3		(3) NGC300DW3	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in NGC300Dw3 (03) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in NGC300Dw3 (03)	450 Secs (1026 Secs) [==>687.0 Secs (Pattern 1)] [==>339. Secs (Pattern 2)]	[1]
	4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6.0		Pattern 1, Exps 3-4 in NGC300Dw3 (03) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in NGC300Dw3 (03)	360 Secs (1214 Secs) [==>749.0 Secs (Pattern 1)] [==>465.0 Secs (Pattern 2)]	[1]

