18042 - Deep UVIS imaging of the Leo II dwarf spheroidal galaxy: deciphering the evolution of a unique Milky Way satellite

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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Dr. Yumi Choi (CoI)	NOIRLab - (AZ)

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) LEO-II ANY	ACS/WFC WFC3/UVIS	2	15-Aug-2025 14:00:31.0	yes
02	(1) LEO-II ANY	ACS/WFC WFC3/UVIS	2	15-Aug-2025 14:00:32.0	yes
03	(1) LEO-II ANY	ACS/WFC WFC3/UVIS	2	15-Aug-2025 14:00:33.0	yes

6 Total Orbits Used

ABSTRACT

We propose to obtain deep photometric imaging of the Milky Way (MW) satellite galaxy Leo II. Leo II has unique properties within the MW galactic ecosystem and has great potential to deepen our understanding of the Local Group history. Leo II is the only known MW satellite to have quenched at intermediate ages (6 Gyr ago), bridging the gap between the two main groups of early-quenched and late-quenched satellites. Additionaly, Leo II is one of the most distant MW satellites and is in a low-eccentricity orbit, making it a precious tracer of the properties of the outer MW halo. Yet, this is the only long-known Local Group galaxy that lacks deep photometry and it is readily accessible by HST.

The exquisite precision of our proposed observations will enable us to derive an updated, high-resolution, star formation history for this galaxy and investigate the presence of multiple episodes of star formation. Characterizing the frequency, amplitude, and timescales of star formation activity in Leo II will help address open questions connected to the formation and evolution of dwarf spheroidal galaxies, assessing the relative importance of ubiquitous (stellar feedback, interaction with the host) versus stochastic (mergers, gas accretion) drivers of star formation. In addition, we will determine a precise quenching epoch for Leo II which, when combined with state-of-the-art orbital calculations, will allow us to constrain the efficiency of ram pressure stripping at large Galactocentric radii, with implications for the density of the Milky Way circum-galactic medium and the total mass contained in the hot corona of our Galaxy.

OBSERVING DESCRIPTION

This proposal will obtain deep UVIS photometry of the Milky Way satellites Leo II. The goal is to construct a deep color-magnitude diagram so that: i) the presence of multiple main sequence turn-offs can be established; ii) an accurate quenching time can be derived for Leo II. This in turn will put constrain on dwarf spheroidal galaxy formation models and on the density of the Milky Way outer circum-galactic medium.

The observations are split into 3 identical visits, consisting of 2 orbits each. Each orbit will obtain 1 UVIS F606W and 1 UVIS F814W exposures (with no CR splits). We are also obtaining similar F606W/F814W exposures with ACS/WFC, in parallel. Due to the presence of parallels, the visits have been set up with the SAME_ORIENT requirement. For each orbit of this program, we have applied POS_TARG offsets to obtain a 6-point subpixel dither pattern, following the recommendations of WFC3 ISR 2023-05 (3 2-point dithers, each spaced by ~1 arcsec).

Visit

Proposal 18042, Visit 01, implementation

Fri Aug 15 18:00:33 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Fixed Targets

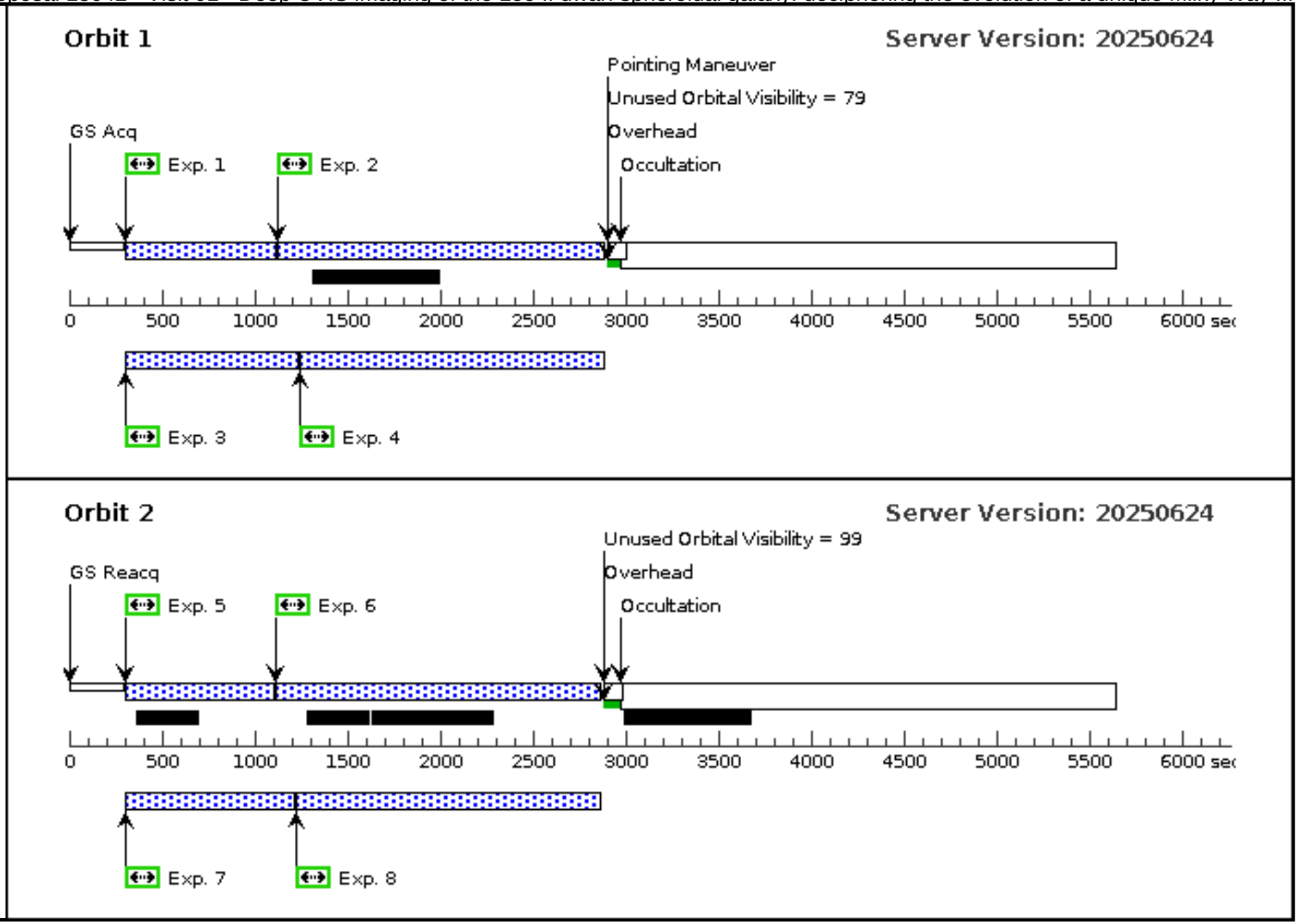
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-II	RA: 11 13 28.1300 (168.3672083d) Dec: +22 09 10.10 (22.15281d) Equinox: J2000	Proper Motion RA: 7.4859337523641905E-6 sec of time/yr Proper Motion Dec: -3.300006028439384E-5 arcsec/yr Epoch of Position: 2015.5	V=25	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F606W	CR-SPLIT=NO	POS TARG 0,0; GS ACQ SCENARIO ONEB1O3	Prime + Parallel Group up 1-4 in Visit 01	667 Secs (667 Secs) *[==>]*	 ***[1]***
2		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F814W	CR-SPLIT=NO	POS TARG 0,0	Prime + Parallel Group up 1-4 in Visit 01	1737 Secs (1737 Secs) *[==>]*	 ***[1]***
3		ANY	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Prime + Parallel Group up 1-4 in Visit 01	728 Secs (728 Secs) *[==>]*	 ***[1]***
4		ANY	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO		Prime + Parallel Group up 1-4 in Visit 01	1457 Secs (1457 Secs) *[==>]*	 ***[1]***
5		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F606W	CR-SPLIT=NO	POS TARG 0.17859, 0.06987	Prime + Parallel Group up 5-8 in Visit 01	662 Secs (662 Secs) *[==>]*	 ***[2]***
6		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F814W	CR-SPLIT=NO	POS TARG 0.17859, 0.06987	Prime + Parallel Group up 5-8 in Visit 01	1731 Secs (1731 Secs) *[==>]*	 ***[2]***
7		ANY	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Prime + Parallel Group up 5-8 in Visit 01	731 Secs (731 Secs) *[==>]*	 ***[2]***
8		ANY	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO		Prime + Parallel Group up 5-8 in Visit 01	1462 Secs (1462 Secs) *[==>]*	 ***[2]***

Orbit Structure



Visit

Proposal 18042, Visit 02, implementation

Fri Aug 15 18:00:34 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: SAME ORIENT AS 01

Fixed Targets

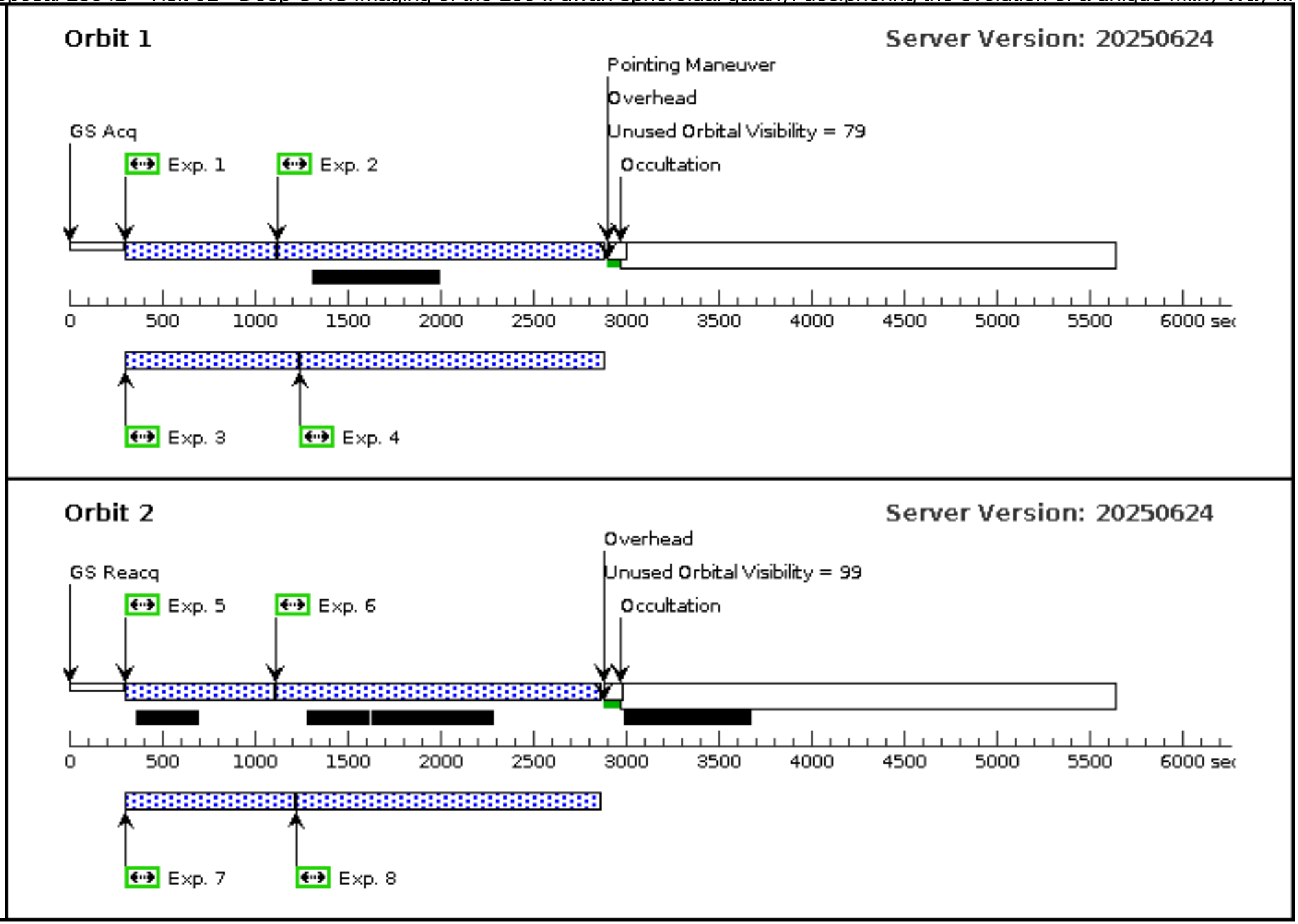
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-II	RA: 11 13 28.1300 (168.3672083d) Dec: +22 09 10.10 (22.15281d) Equinox: J2000	Proper Motion RA: 7.4859337523641905E-6 sec of time/yr Proper Motion Dec: -3.300006028439384E-5 arcsec/yr Epoch of Position: 2015.5	V=25	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F606W	CR-SPLIT=NO	POS TARG 1,1; GS ACQ SCENARIO ONEB1O3	Prime + Parallel Group 1-4 in Visit 02	667 Secs (667 Secs) *[==>]*	 ***[1]***
2		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F814W	CR-SPLIT=NO	POS TARG 1,1	Prime + Parallel Group 1-4 in Visit 02	1737 Secs (1737 Secs) *[==>]*	 ***[1]***
3		ANY	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Prime + Parallel Group 1-4 in Visit 02	728 Secs (728 Secs) *[==>]*	 ***[1]***
4		ANY	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO		Prime + Parallel Group 1-4 in Visit 02	1457 Secs (1457 Secs) *[==>]*	 ***[1]***
5		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F606W	CR-SPLIT=NO	POS TARG 1.17859, 1.06987	Prime + Parallel Group 5-8 in Visit 02	662 Secs (662 Secs) *[==>]*	 ***[2]***
6		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F814W	CR-SPLIT=NO	POS TARG 1.17859, 1.06987	Prime + Parallel Group 5-8 in Visit 02	1731 Secs (1731 Secs) *[==>]*	 ***[2]***
7		ANY	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Prime + Parallel Group 5-8 in Visit 02	731 Secs (731 Secs) *[==>]*	 ***[2]***
8		ANY	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO		Prime + Parallel Group 5-8 in Visit 02	1462 Secs (1462 Secs) *[==>]*	 ***[2]***

Orbit Structure



Visit

Proposal 18042, Visit 03, implementation

Fri Aug 15 18:00:34 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: SAME ORIENT AS 01

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-II	RA: 11 13 28.1300 (168.3672083d) Dec: +22 09 10.10 (22.15281d) Equinox: J2000	Proper Motion RA: 7.4859337523641905E-6 sec of time/yr Proper Motion Dec: -3.300006028439384E-5 arcsec/yr Epoch of Position: 2015.5	V=25	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F606W	CR-SPLIT=NO	POS TARG -1,-1; GS ACQ SCENARIO ONEB1O3	Prime + Parallel Group up 1-4 in Visit 03	667 Secs (667 Secs) *[==>]*	 ***[1]***
2		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F814W	CR-SPLIT=NO	POS TARG -1,-1	Prime + Parallel Group up 1-4 in Visit 03	1737 Secs (1737 Secs) *[==>]*	 ***[1]***
3		ANY	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Prime + Parallel Group up 1-4 in Visit 03	728 Secs (728 Secs) *[==>]*	 ***[1]***
4		ANY	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO		Prime + Parallel Group up 1-4 in Visit 03	1457 Secs (1457 Secs) *[==>]*	 ***[1]***
5		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F606W	CR-SPLIT=NO	POS TARG -1.17859,-1.06987	Prime + Parallel Group up 5-8 in Visit 03	662 Secs (662 Secs) *[==>]*	 ***[2]***
6		(1) LEO-II	WFC3/UVIS, ACCUM, UVIS	F814W	CR-SPLIT=NO	POS TARG -1.17859,-1.06987	Prime + Parallel Group up 5-8 in Visit 03	1731 Secs (1731 Secs) *[==>]*	 ***[2]***
7		ANY	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Prime + Parallel Group up 5-8 in Visit 03	731 Secs (731 Secs) *[==>]*	 ***[2]***
8		ANY	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO		Prime + Parallel Group up 5-8 in Visit 03	1462 Secs (1462 Secs) *[==>]*	 ***[2]***

Orbit Structure