16459 - The color-magnitude diagram of an extremely metal-poor globular cluster

Cycle: 28, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) M31-EXT8	WFC3/UVIS	2	30-Nov-2020 17:00:13.0	yes
02	(1) M31-EXT8	WFC3/UVIS	3	30-Nov-2020 17:00:14.0	yes
03	(1) M31-EXT8	WFC3/UVIS	2	30-Nov-2020 17:00:15.0	yes

7 Total Orbits Used

ABSTRACT

We propose to obtain a color-magnitude diagram (CMD) of the globular cluster (GC) EXT8 in M31. With a metallicity of [Fe/H]=-2.9, EXT8 is by far the most metal-poor GC yet identified, and as such it provides us with unique information on CMD morphology at this low metallicity. At the same time, it challenges theories for the formation of GCs in the context of hierarchical galaxy formation. We will image the cluster with WFC3 in the F300X, F606W, and F814W filters and obtain a CMD that reaches below the horizontal branch. The observations will thus provide the first empirical insight into horizontal branch morphology in a GC near [Fe/H]=-3. Photometry of stars on the red giant branch will provide an independent

verification of the spectroscopic metallicity determination and will constrain any metallicity spread present in the cluster (that might be suggestive of an origin as a stripped nucleus).

OBSERVING DESCRIPTION

The extremely metal-poor globular cluster EXT8 in M31 will be imaged with WFC3 for two orbits in F606W, three orbits in F814W, and two orbits in F300X in order to produce a color-magnitude diagram that reaches below the horizontal branch. Each orbit will be split into two dithered sub-exposures. The cluster will be positioned on the UVIS2 detector (which is more sensitive in the UV) at a POS-TARG offset of (-40, 0) arcsec in order to place the cluster closer to the read-out amplifier C and minimize CTE losses.

The observations are divided into three visits, one for each filter. The two-orbit visits (F606W and F300X) will use a four-point dither pattern and the three-orbit visit (F814W) will use a six-point dither patterns. We are using the offsets in ISR WFC 2020-07 and specifying the dither points via POS-TARG offsets (in addition to the (-40, 0) offset mentioned above), rather than predefined dither patterns.

The WFC3 ETC predicts a background level of 10 e- (sky + dark), to which we add FLASH=10 to get to a total of 20. We note that the WFC3 ETC predicts a slightly higher background level than the value computed by APT.

Impact of reduced-gyro operations:
As each visit consists of WFC3 imaging for 2-3 orbits in a single filter, the slight increase in target acquisition time is expected to have a negligible impact on the S/N of our observations. The observations are not time critical and our program requires no specific orientation (apart from all three visits having the same orientation). We therefore expect that the impact of reduced-gyro operations would be small.

Visit

Proposal 16459, M31-EXT8 F606W (01) Mon Nov 30 22:00:15 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Fixed Targets

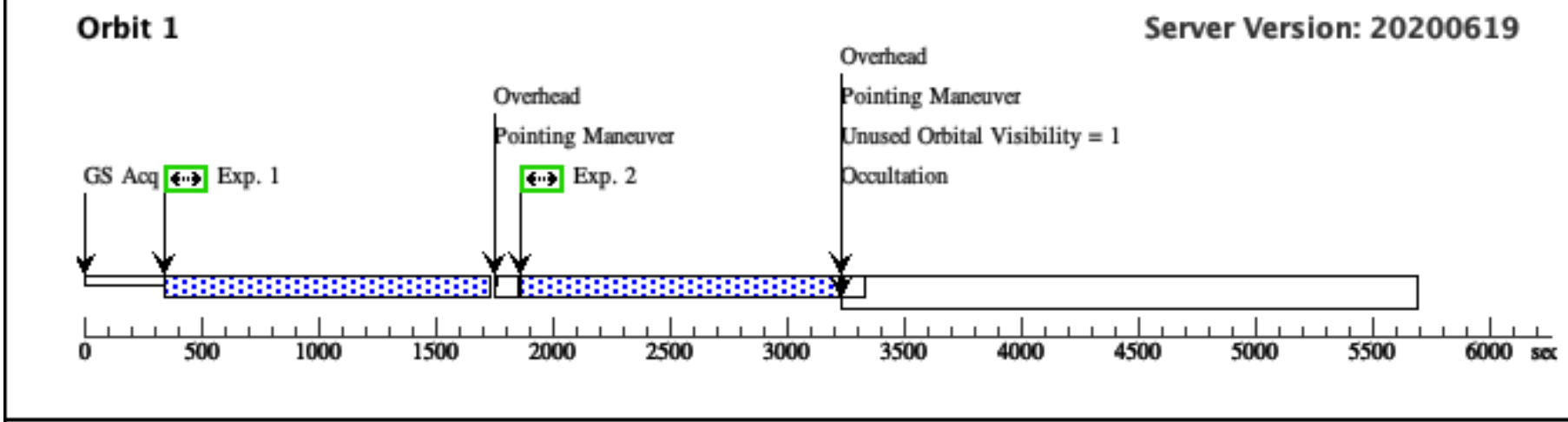
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M31-EXT8	RA: 00 53 14.5300 (13.3105417d) Dec: +41 33 24.50 (41.55681d) Equinox: J2000		V=15	Reference Frame: ICRS

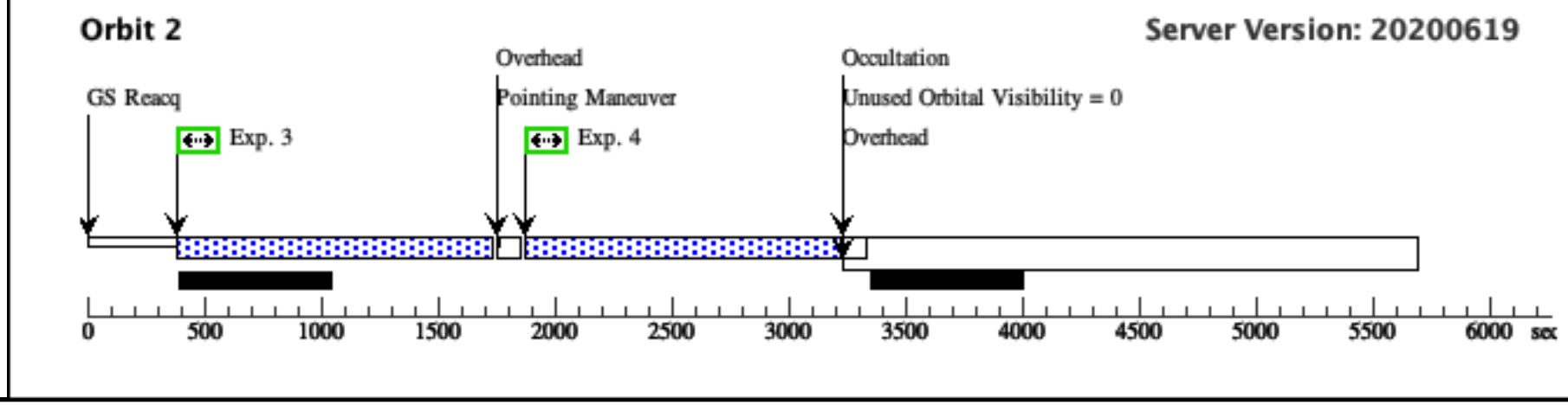
Comments:
Category=STELLAR CLUSTER
Description=[GLOBULAR CLUSTER]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	M31-EXT8-F606W-POS 1	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W		POS TARG -40,0.0		1350 Secs (1359 Secs) *[==>1359.0 Secs]*	 ***[1]***
2	M31-EXT8-F606W-POS 2	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W		POS TARG -39.8215,0.1908		1350 Secs (1359 Secs) *[==>1359.0 Secs]*	 ***[1]***
3	M31-EXT8-F606W-POS 3	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W		POS TARG -39.6827,0.3591		1350 Secs (1355 Secs) *[==>1355.0 Secs]*	 ***[2]***
4	M31-EXT8-F606W-POS 4	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F606W		POS TARG -39.5042,0.5101		1350 Secs (1355 Secs) *[==>1355.0 Secs]*	 ***[2]***

Orbit Structure





Visit

Proposal 16459, M31-EXT8 F814W (02) Mon Nov 30 22:00:15 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Fixed Targets

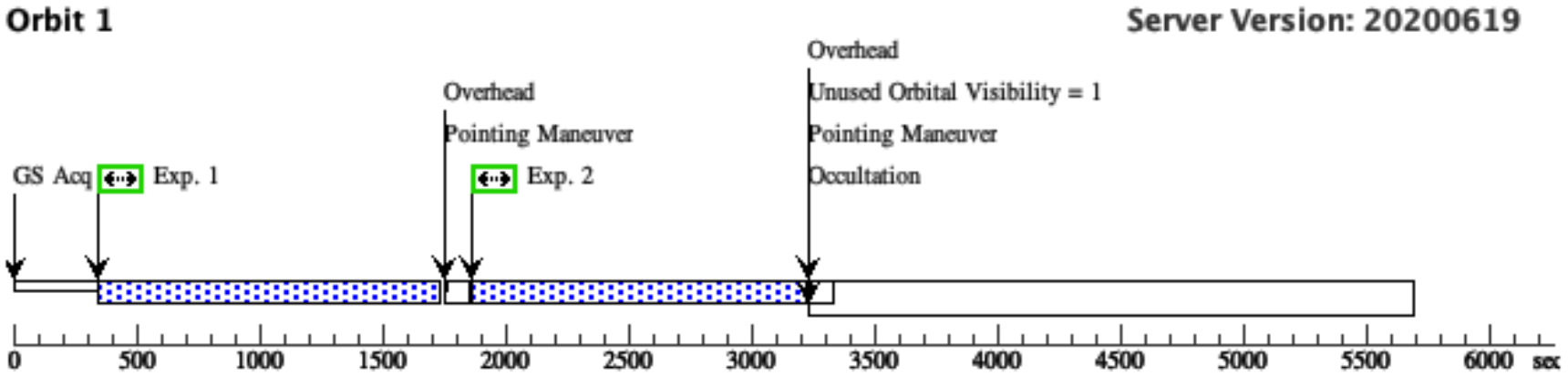
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M31-EXT8	RA: 00 53 14.5300 (13.3105417d) Dec: +41 33 24.50 (41.55681d) Equinox: J2000		V=15	Reference Frame: ICRS

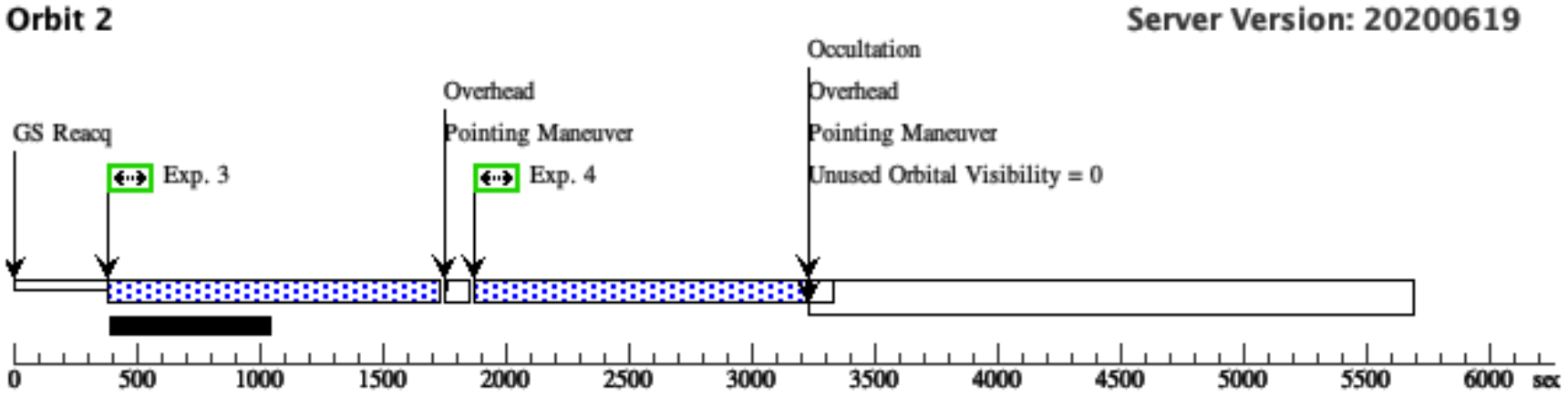
Comments:
Category=STELLAR CLUSTER
Description=[GLOBULAR CLUSTER]

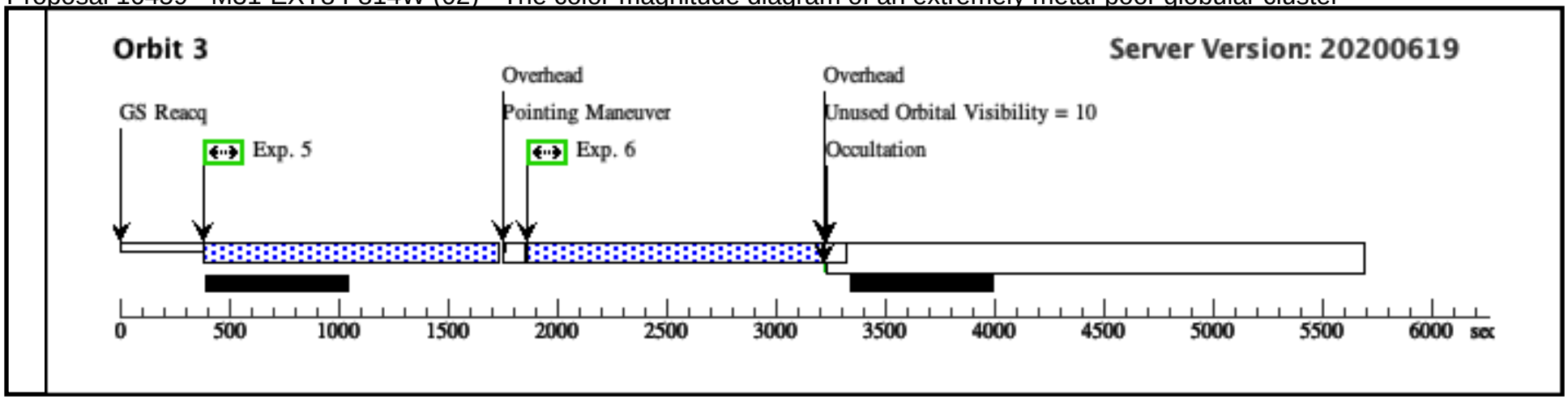
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	M31-EXT8-F814W-POS 1	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F814W		POS TARG -40,0.0		1350 Secs (1359 Secs) *[==>1359.0 Secs]*	 ***[1]***
2	M31-EXT8-F814W-POS 2	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F814W		POS TARG -39.9073,0.3376		1350 Secs (1359 Secs) *[==>1359.0 Secs]*	 ***[1]***
3	M31-EXT8-F814W-POS 3	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F814W		POS TARG -39.8149,0.1978		1350 Secs (1355 Secs) *[==>1355.0 Secs]*	 ***[2]***
4	M31-EXT8-F814W-POS 4	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F814W		POS TARG -39.7618,0.5130		1350 Secs (1355 Secs) *[==>1355.0 Secs]*	 ***[2]***
5	M31-EXT8-F814W-POS 5	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F814W		POS TARG -39.6695,0.3732		1350 Secs (1350 Secs) *[==>]*	 ***[3]***
6	M31-EXT8-F814W-POS 6	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F814W		POS TARG -39.4976,0.5171		1350 Secs (1350 Secs) *[==>]*	 ***[3]***

Orbit Structure



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GS Reacq
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Overhead
Pointing Maneuver
Exp. 6
Overhead
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Occultation
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16459, M31-EXT8 F300X (03) Mon Nov 30 22:00:15 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(M31-EXT8-F300X-POS1 (03.001)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(M31-EXT8-F300X-POS2 (03.002)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(M31-EXT8-F300X-POS3 (03.003)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(M31-EXT8-F300X-POS4 (03.004)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Fixed Targets

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(1)	M31-EXT8	RA: 00 53 14.5300 (13.3105417d) Dec: +41 33 24.50 (41.55681d) Equinox: J2000		V=15	Reference Frame: ICRS

Comments:
Category=STELLAR CLUSTER
Description=[GLOBULAR CLUSTER]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	M31-EXT8-F300X-POS1	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F300X	FLASH=10	POS TARG -40,0.0		1350 Secs (1356 Secs) *[==>1356.0 Secs]*	 ***[1]***
Comments: ETC gives a background of 10 e-/pixel, to which a FLASH of another 10 is added to reach 20 e-/pixel									
2	M31-EXT8-F300X-POS2	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F300X	FLASH=10	POS TARG -39.8215,0.1908		1350 Secs (1356 Secs) *[==>1356.0 Secs]*	 ***[1]***
3	M31-EXT8-F300X-POS3	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F300X	FLASH=10	POS TARG -39.6827,0.3591		1350 Secs (1351 Secs) *[==>1351.0 Secs]*	 ***[2]***
4	M31-EXT8-F300X-POS4	(1) M31-EXT8	WFC3/UVIS, ACCUM, UVIS2-FIX	F300X	FLASH=10	POS TARG -39.5042,0.5101		1350 Secs (1351 Secs) *[==>1351.0 Secs]*	 ***[2]***

Orbit Structure