16931 - HST High Resolution UV Spectroscopy of the Second Closest Luminous SLSN-IIn

Cycle: 29, Proposal Category: GO/DD

(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	(1) ZTF21ACKXDOS	COS/FUV COS/NUV	1	28-Mar-2022 13:00:12.0	yes
02	(1) ZTF21ACKXDOS	COS/FUV COS/NUV	1	28-Mar-2022 13:00:12.0	yes
03	(1) ZTF21ACKXDOS	STIS/CCD	1	28-Mar-2022 13:00:13.0	yes

3 Total Orbits Used

ABSTRACT

In the nearby Universe (<100\,Mpc), superluminous supernovae with peak luminosities brighter than -20\,magnitude are extremely rare, with only a few in total. Recently, the Zwicky Transient Facility discovered and classified ZTF21ackxdos, the closest and brightest SLSN-IIn in more than

a decade ($z=0.018, 78$\,Mpc). Its current apparent brightness is 14.5 and 17.7\,magnitudes in r and {\it Swift} UVW2 (1928~\AA) respectively. Such high UV fluxes offer a rare and valuable opportunity for high resolution HST/UV spectroscopy. The rich suite of narrow UV emission lines from C, N and O at various ionization states offer the best diagnostics to obtain reliable measurements of CNO abundances and electron density of the circumstellar medium (CSM) ejected from the surface of the SN progenitor star. This type of observations was carried out only once before for a luminous SN IIn, SN\,2010jl at $z=0.01058$ (Fransson et al. 2014). The requested data will determine if the nitrogen in ZTF21ackxdos is highly enriched due to the CNO-cycle, similar to the case for SN\,2010jl, whose progenitor is thought to be a luminous blue variable (LBV). The high resolution COS spectra can resolve the UV lines down to $\la 100 $\,km\,s^{-1} and together with the density provide a measurement of the mass loss rate, crucial for characterising this type of progenitors. ZTF21ackxdos will be visible by {\it HST} on April 7, 2022. We request one epoch of COS and STIS observations before the supernova becomes too faint.

OBSERVING DESCRIPTION

Our science goals require high resolution spectra. Therefore, we request G130M and G160M grating centered at 1309 and 1623A respectively. These two gratings will give a resolution between 20,000 - 24,000, with a wavelength scale of 0.01 - 0.012A per pixel and each resolution elements have 6 - 7 pixels. The STIS G230LB grating will cover the wavelength range of 1685 - 3065A with a resolution of ~700. This spectrum provides great complimentary data to both the far-UV COS and the optical X-shooter data and covers the strong Mg II 2800A doublet as well as the important C III] 1909A and [N II] 2143A lines.

At the time of the writing of this proposal, ZTF21ackxdos was observed by Swift twice, with UVW2 fluxes (1928A) of 17.73 and 17.78 magnitudes on Feb 23 and Feb 28, 2022 respectively. Assuming this declining rate, we anticipate that UVW2 apparent magnitude will be about 0.4 magnitude fainter on April 7, 2022. We use the Exposure Time Calculator (ETC) with the scaled HST COS and STIS spectra of SN 2010jl as the input data for our calculations. Here the scaling factors are derived by matching with the observed Swift broad band UV fluxes for ZTF21akcxdos and including the expected decline of 0.4 magnitude between Feb 23 and April 7, 2022. The results from ETC estimates are shown in Figure 3, where the SNR values for both COS and STIS are based on exposure time of 2500 seconds. The expected SNRs are 4 at 1230A, 6.3 at 1500A and 16.3 at 2500A for the three configurations respectively. We note that for high resolution COS spectra, rebinning can increase SNR by another factor of 2 - 3. The requested spectra should have SNR similar to what have been published for SN 2010jl (Fransson et al. 2014). In summary, we request a total of 3 orbits to obtain one epoch of COS and STIS observations for ZTF21ackxdos as soon as it is visible.

Visit

Proposal 16931, COS visit 1 (01) Mon Mar 28 17:00:13 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BEFORE 20-APR-2022:00:00:00

Fixed Targets

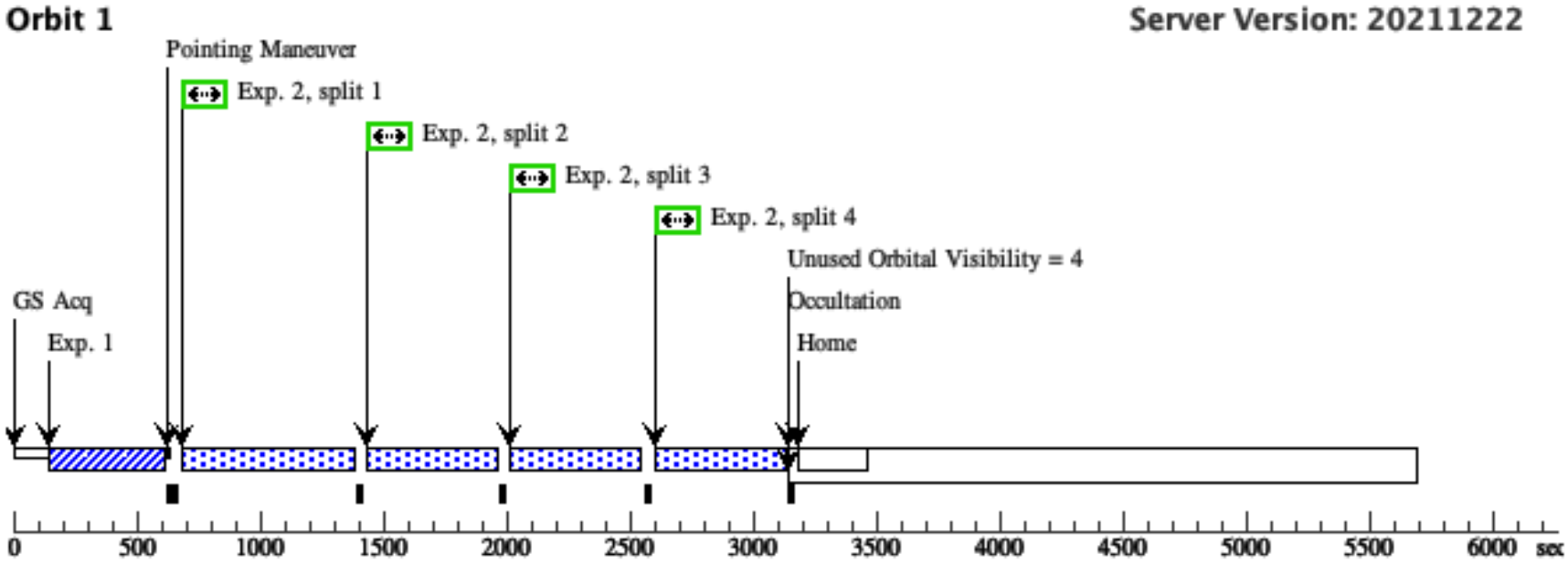
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ZTF21ACKXDOS	RA: 11 48 6.9500 (177.0289583d) Dec: -12 38 41.79 (-12.64494d) Equinox: J2000	Proper Motion RA: 0.0 mas/yr Proper Motion Dec: 0.0 mas/yr Epoch of Position: 2000.0	V=15.0	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA TYPE II]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acquisition (cos.ta.1741619)	(1) ZTF21ACKXDOS	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				80 Secs (80 Secs) *[==>]*	*[1]*
2	COS FUV 2 (1720716)	(1) ZTF21ACKXDOS	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FP-POS=ALL; FLASH=YES; BUFFER-TIME=6400			478 Secs (1912 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16931, COS visit 2 (02) Mon Mar 28 17:00:14 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

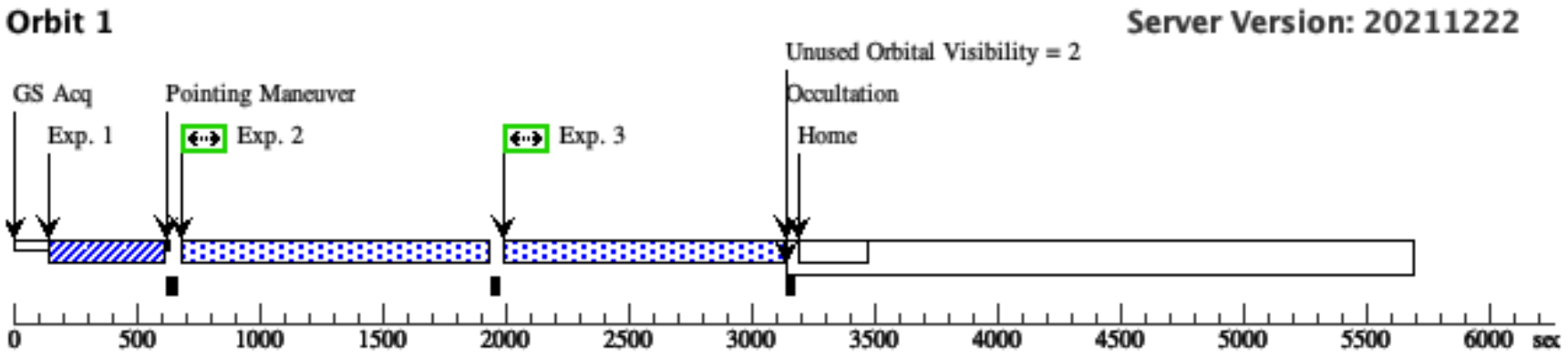
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ZTF21ACKXDOS	RA: 11 48 6.9500 (177.0289583d) Dec: -12 38 41.79 (-12.64494d) Equinox: J2000	Proper Motion RA: 0.0 mas/yr Proper Motion Dec: 0.0 mas/yr Epoch of Position: 2000.0	V=15.0	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA TYPE II]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acquisition (cos.ta.1741608)	(1) ZTF21ACKXDOS	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				80 Secs (80 Secs) *[==>]*	*[1]*
2	COS FUV 1 (1720717)	(1) ZTF21ACKXDOS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; BUFFER-TIME=6400; FP-POS=3; SEGMENT=BOTH			1083 Secs (1083 Secs) *[==>]*	*[1]*
3	COS FUV 1 (1720717)	(1) ZTF21ACKXDOS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; BUFFER-TIME=6400; FP-POS=4; SEGMENT=BOTH			1083 Secs (1083 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16931, STIS visit 3 (03) Mon Mar 28 17:00:14 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ZTF21ACKXDOS	RA: 11 48 6.9500 (177.0289583d) Dec: -12 38 41.79 (-12.64494d) Equinox: J2000	Proper Motion RA: 0.0 mas/yr Proper Motion Dec: 0.0 mas/yr Epoch of Position: 2000.0	V=15.0	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA TYPE II]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acquition (stis.ta.1742837)	(1) ZTF21ACKXDOS	STIS/CCD, ACQ, F28X50LP	MIRROR				20 Secs (20 Secs) *[==>]*	*[1]*
2	STIS NUV (1720556)	(1) ZTF21ACKXDOS	STIS/CCD, ACCUM, 52X0.2	G230LB 2375 A	CR-SPLIT=2			2180 Secs (2180 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	*[1]*

Orbit Structure