



15110 - A Study of the UV Environment for Three Small Planets Transiting a Nearby M-Dwarf

Cycle: 25, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) UCAC4-443-054906	COS/FUV COS/NUV	6	02-Oct-2017 14:01:10.0	yes

6 Total Orbits Used

ABSTRACT

We propose to measure the ultraviolet (UV) spectrum of the M-dwarf K2-3. This nearby system hosts three transiting super-Earths, including one that is a possible candidate to host life. All three planets are excellent targets for atmospheric study, and raise the exciting prospect of comparative planetology with the newly discovered seven planet TRAPPIST-1 system.

However, M-dwarfs are bright and active in the UV, which can push their planets' atmospheres out of chemical equilibrium and drive atmospheric mass loss. Some of the most strongly affected molecules, including water, methane, and ozone, are key diagnostics of the planets' formation history, habitability, and even inhabitation. Our measurement of K2-3's UV spectrum will allow us to characterize the impact of photochemistry and mass loss on the planets' atmospheres, thus providing an essential foundation for future investigations of this benchmark system.

OBSERVING DESCRIPTION

We will observe the spectrum of the M0-dwarf K2-3 with COS over the wavelength range 1150 - 3200 Angstroms. We will use a combination of the G130M, G160M, and G230L gratings with a range of central-wavelength settings to acquire the complete spectrum. All data will be obtained in TIME-TAG mode so that we can constrain the star's flaring activity. We will use the FLASH=YES setting to maximize exposure time on target. These observations are based on the successful set-up used by the MUSCLES program to measure M-dwarf spectra (GO Programs 12464, 13640). We calculated exposure times needed to achieve a signal-to-noise $SNR > 5$ for major stellar emission lines in each grating (CII for G130M, C IV for G160M, and Mg II for G230L). We based our calculations on measurements of the spectrum of GJ 832 (an M-dwarf with the closest spectral type to K2-3) from the MUSCLES program (France et al. 2016). To estimate NUV exposure times, we scaled GJ 832 spectrum by K2-3's relative NUV brightness measurements from GALEX (K2-3 is 14x fainter). K2-3 was not detected by GALEX in the FUV band, so for the FUV exposure times, we assumed that K2-3 has the same intrinsic flux as GJ 832 and scaled the expected signal by the distance to the star (K2-3 is 9x more distant than GJ 832, so we expect a roughly 80x smaller signal). The MUSCLES spectrum for GJ 832 has SNR of 75, 40, and 180, for the C IV, CII, and Mg II lines. These data were obtained with exposure times of 15119, 7671, and 2756s using the G160M, G160M, and G230L gratings, respectively. Based on these results and our expectations for the brightness of K2-3, we require 5376, 9600, and 170 s in G130M, G160M, and G230L for a total of 6 orbits accounting for time to acquire the target.

There are transiting planets in the system, but the expected signal from the planets is small compared to our photon-noise limited uncertainties. Just to be safe, we include a phase constraint so that the observations do not coincide with the transit of the innermost planet, which is the most likely to have an evaporating exosphere with UV line emission.

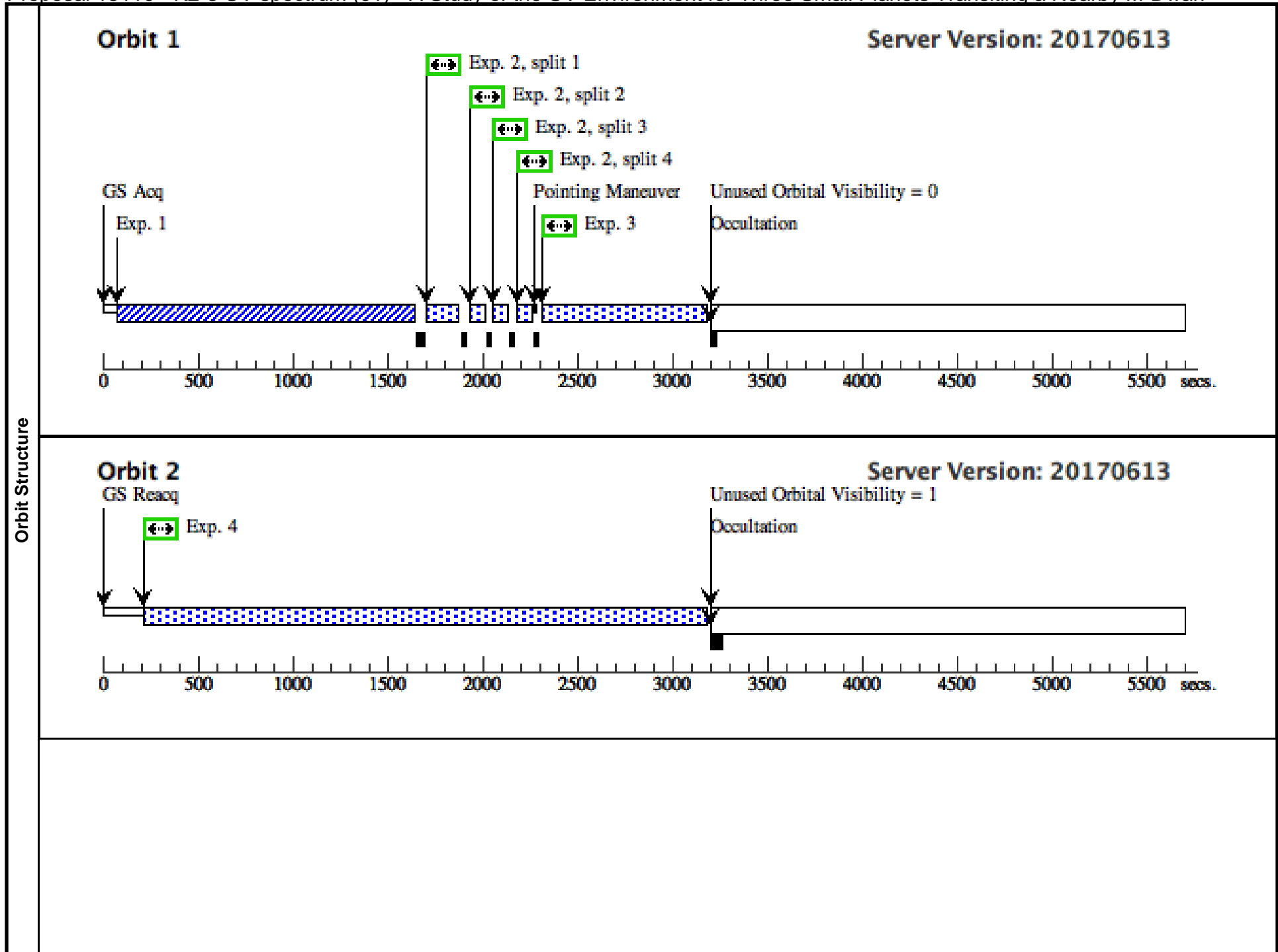
Proposal 15110 - K2-3 UV spectrum (01) - A Study of the UV Environment for Three Small Planets Transiting a Nearby M-Dwarf

Mon Oct 02 18:01:11 GMT 2017

Visit	Proposal 15110, K2-3 UV spectrum (01), implementation Diagnostic Status: Warning Scientific Instruments: COS/FUV, COS/NUV Special Requirements: Period 10.05465988 D AND ZERO-PHASE HJD2457627.8435051					
	(K2-3 UV spectrum (01)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details. (K2-3 UV spectrum (01)) Warning (Form): If the target coordinates are not known to 0.4" (or better), an ACQ/SEARCH should precede the ACQ/IMAGE. (K2-3 UV spectrum (01)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE (K2-3 UV spectrum (01)) Warning (Orbit Planner): REFERENCE-FRAME MUST BE ICRS OR GSC1 FOR SMALL APERTURE					
Diagnostics						
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	UCAC4-443-054906	RA: 11 29 20.3760 (172.3349000d) Dec: -01 27 17.33 (-1.45481d) Equinox: J2000	Proper Motion RA: 88.3 mas/yr Proper Motion Dec: -73.6 mas/yr Epoch of Position: 2000	V=12.17	Reference Frame: SIMBAD
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=NO						

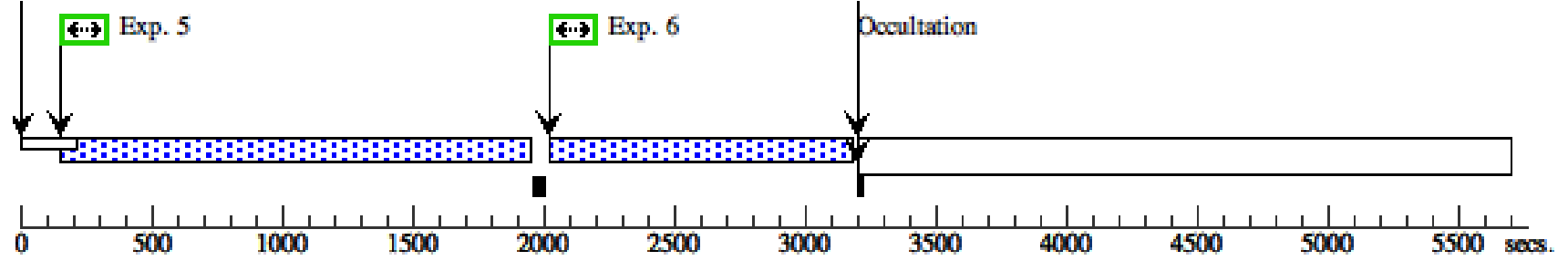
Proposal 15110 - K2-3 UV spectrum (01) - A Study of the UV Environment for Three Small Planets Transiting a Nearby M-Dwarf

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	(COS.ta.102 7491)	(1) UCAC4-443-054 906	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		PHASE 0.05 TO 0.9	623.6 Secs (623.6 Secs) [==>]	[1]
	2	(COS.sp.102 7492)	(1) UCAC4-443-054 906	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=17 98.		60.0 Secs (240 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)] [==>(Split 4)]	[1]
	3	(COS.sp.102 7493)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; BUFFER-TIME=57 71.;	FP-POS=3; SEGMENT=BOTH	706 Secs (706 Secs) [==>]	[1]
	4	(COS.sp.102 7496)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; BUFFER-TIME=57 71.;	FP-POS=4; SEGMENT=BOTH	2915 Secs (2915 Secs) [==>]	[2]
	5	(COS.sp.102 7497)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; BUFFER-TIME=57 71.;	FP-POS=3; SEGMENT=BOTH	1682 Secs (1682 Secs) [==>]	[3]
	6	(COS.sp.102 7494)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G160M 1589 A	FLASH=YES; BUFFER-TIME=13 529.;	FP-POS=1; SEGMENT=BOTH	996. Secs (996 Secs) [==>]	[3]
	7	(COS.sp.102 7494)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G160M 1589 A	FLASH=YES; BUFFER-TIME=13 529.;	FP-POS=2; SEGMENT=BOTH	2915. Secs (2915 Secs) [==>]	[4]
	8	(COS.sp.102 7495)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G160M 1589 A	FLASH=YES; BUFFER-TIME=13 529.;	FP-POS=3; SEGMENT=BOTH	2915. Secs (2915 Secs) [==>]	[5]
	9	(COS.sp.102 7495)	(1) UCAC4-443-054 906	COS/FUV, TIME-TAG, PSA	G160M 1589 A	FLASH=YES; BUFFER-TIME=13 529.;	FP-POS=4; SEGMENT=BOTH	2915. Secs (2915 Secs) [==>]	[6]



Orbit 3

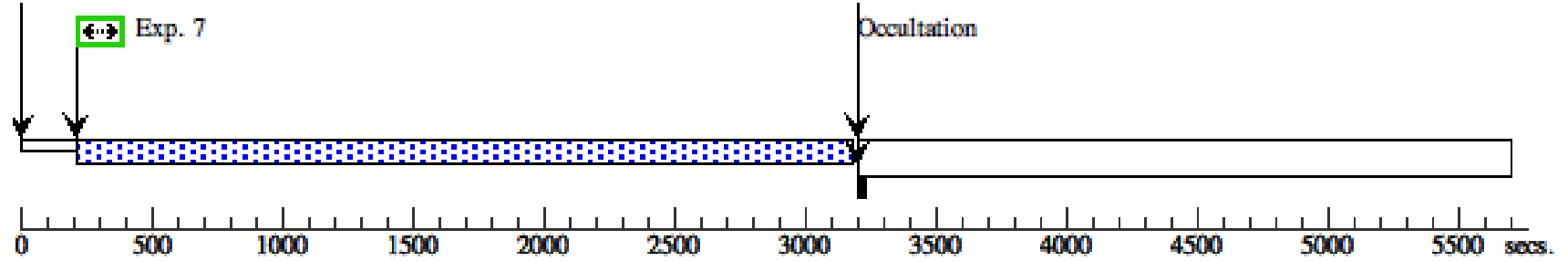
GS Reacq



Server Version: 20170613

Orbit 4

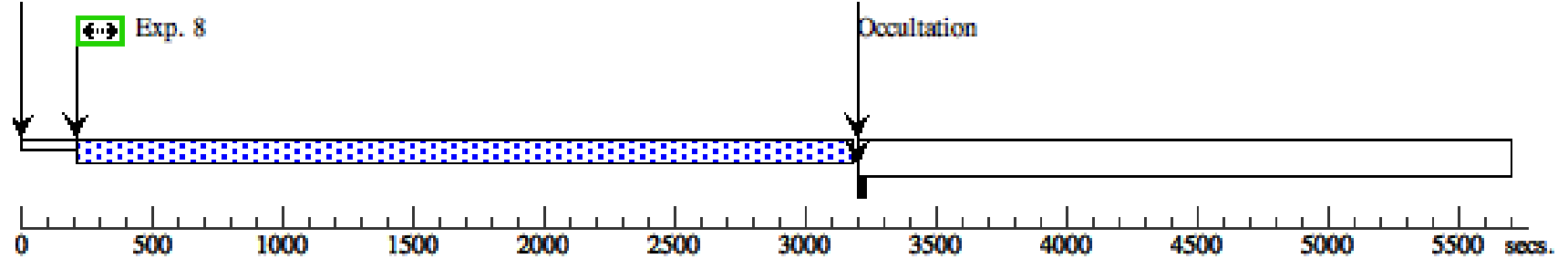
GS Reacq



Server Version: 20170613

Orbit 5

GS Reacq



Server Version: 20170613

