14906 - UV irradiation of the Earth-sized planets orbiting TRAPPIST-1

Cycle: 24, Proposal Category: GO

(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) TRAPPIST-1	STIS/CCD STIS/FUV-MAMA	3	20-Feb-2017 21:00:54.0	yes

3 Total Orbits Used

ABSTRACT

The remarkable discovery of a system of three Earth-sized potentially-habitable planets transiting the ultra-cool dwarf TRAPPIST-1 provides an unprecedented opportunity for detailed study of the atmospheres of terrestrial exoplanets. Our analysis of an archival XMM-Newton observation of the star revealed XUV radiation that was fifty times stronger than assumed in a theoretical study of the planetary atmospheres, with enough XUV irradiation to profoundly modify and perhaps entirely strip those atmospheres. Here we propose a longer XMM-Newton observation that will cover a full spin cycle of the star and more accurately define the XUV irradiation of the exoplanets. This is an essential step in assessing the habitability of

these and similar exoplanets around ultra-cool dwarfs.

OBSERVING DESCRIPTION

Our goal is to detect high-excitation UV emission lines from the chromosphere and corona of the exoplanet host star TRAPPIST-1. This is a very late type M dwarf (M8) that is host to potentially-habitable Earth-sized exoplanets. A joint analysis with our coordinated XMM-Newton X-ray observation will allow us to reconstruct the complete extreme-ultraviolet spectrum of the star and hence the high-energy irradiation of the planets in this system.

We are particularly interested in detecting the SiIV lines at 1394 and 1403A, and the CIV lines at 1550A. We can also hope to detect SiIII 1207A, OV 1218A and/or NV 1240A, although these are close to Lyman-alpha and may suffer contamination by airglow emission.

In order to maximise our sensitivity away from airglow lines we select the relatively wide 0.5arcsec slit. Because we expect the lines to be weak and close to the detection limit, we also chose the D1 pseudo-aperture in order to minimise dark current in the detector.

We request that our three orbits are scheduld as a single visit that is simultaneous with one of our XMM-Newton observations. This will avoid ambiguity in our analysis related to stellar variability. We have put the visit on hold awaiting the coordination of HST and XMM scheduling. The XMM program consists of a series of 3 visits, each lasting 12 hours, and separated by about 2 days. The XMM visits will be scheduled in coordination with HST in one of two visibility windows: either May/June 2017 (when we note the visibility for HST is poor) or in Nov/Dec 2017 (when the visibility for HST is good).

Visit

Proposal 14906, Trappist-1 FUV spectroscopy (01) Tue Feb 21 02:00:55 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: ON HOLD

On Hold Comments: The HST visit should be carried out simultaneously, or as close in time as possible, with one of the visits of our XMM program. The XMM program consists of a series of 3 visits, each lasting 12 hours, and separated by about 2 days. The XMM visits will be scheduled in coordination with HST in one of two visibility windows: either May/June 2017 (when we note the visibility for HST is poor) or in Nov/Dec 2017 (when the visibility for HST is good).

Fixed Targets

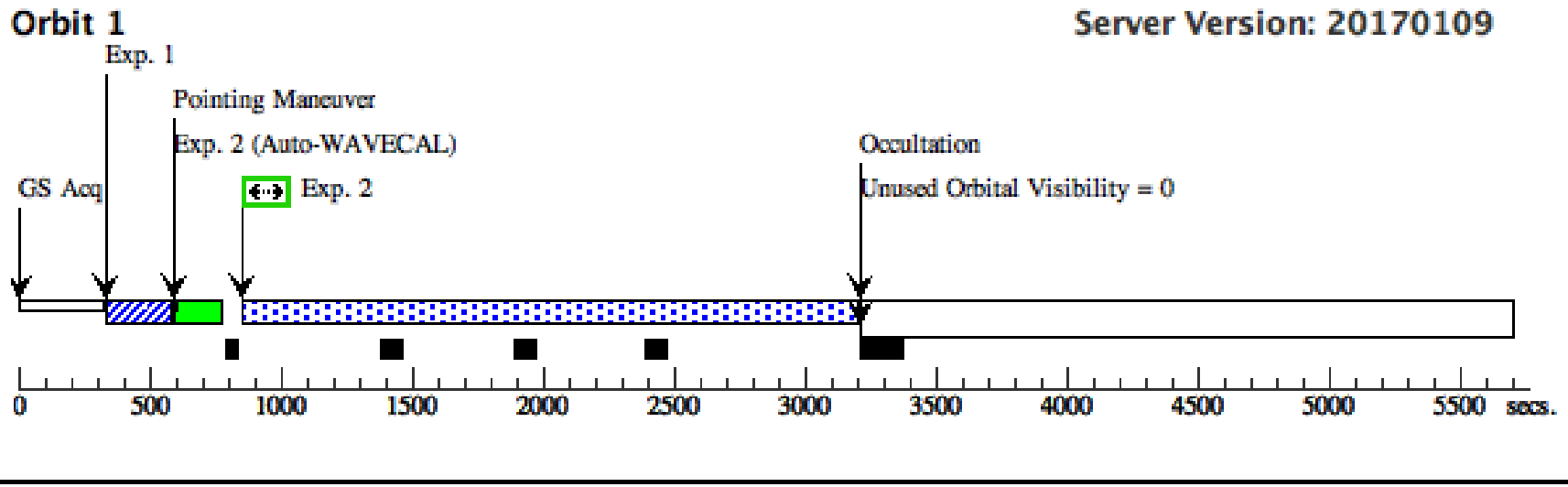
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1 Alt Name1: 2MASSJ23062928-0502285	RA: 23 06 30.3400 (346.6264167d) Dec: -05 02 36.44 (-5.04346d) Equinox: J2000	Proper Motion RA: 922.1 mas/yr Proper Motion Dec: -471.9 mas/yr Parallax: 0.08258" Epoch of Position: 2015.86 Radial Velocity: -51.688 km/sec	V=18.80+/-0.08 R=16.47+-0.07, I=14.0+-0.1, J=11.35+-0.02, K=10.30+-0.02	Reference Frame: ICRS

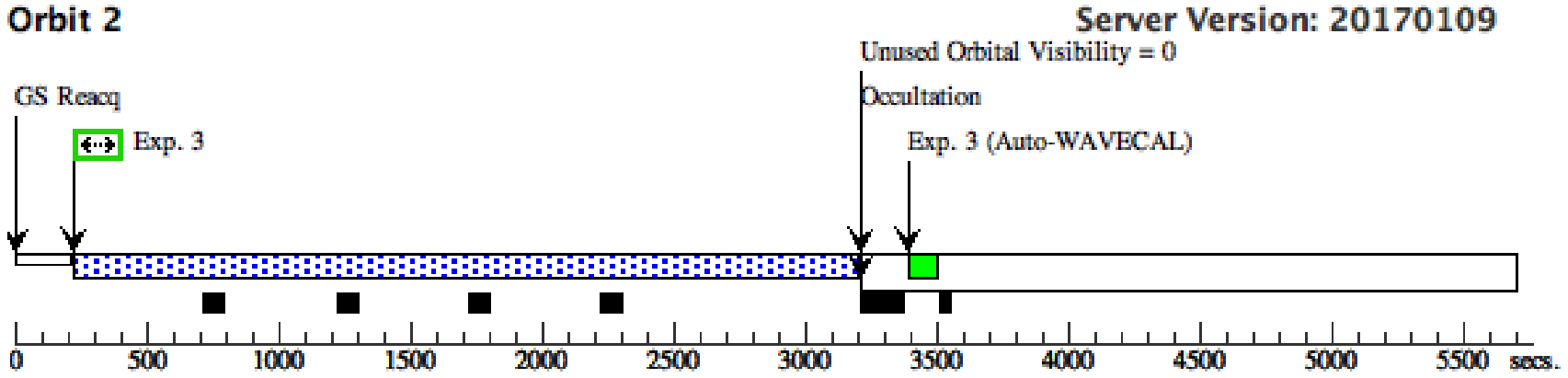
Comments: This position was measured using 2015 TRAPPIST images, and was used for the successful STIS obervations of programs 14493 and 14900.
Radial velocity comes from Barnes et al. 2014
Extended=NO

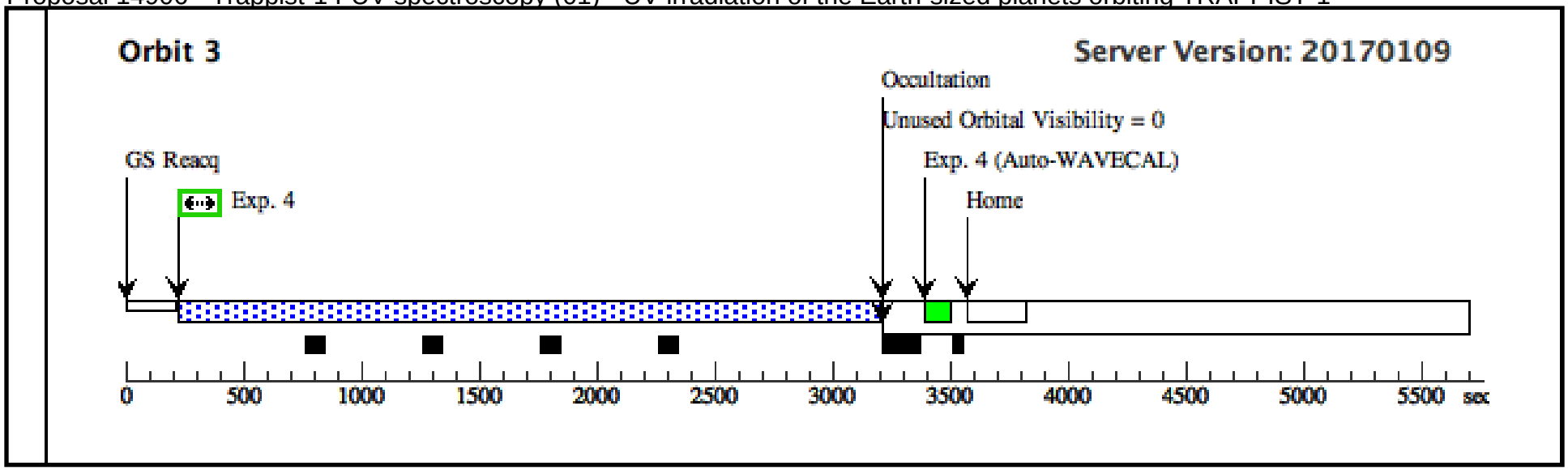
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target acquisition (STIS.ta.904754)	(1) TRAPPIST-1	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs) *[==>]*	 ***[1]***
Comments: The target has been acquired with STIS using the default setup before as part of HST program 14493, here we use the same parameters.									
2	G140L spectroscopy (STIS.sp.904142)	(1) TRAPPIST-1	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140L 1425 A	BUFFER-TIME=500			2293 Secs (2293 Secs) *[==>]*	 ***[1]***
3	G140L spectroscopy (STIS.sp.904142)	(1) TRAPPIST-1	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140L 1425 A	BUFFER-TIME=500			2963 Secs (2963 Secs) *[==>]*	 ***[2]***
4	G140L spectroscopy (STIS.sp.904142)	(1) TRAPPIST-1	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140L 1425 A	BUFFER-TIME=500			2921 Secs (2921 Secs) *[==>]*	 ***[3]***

Orbit Structure






Orbit 3
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Occultation
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GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
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5500
sec