16487 - Testing the apparent steep decline in the chromospheric emission of very late M dwarfs

Cycle: 28, 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) 2MASSJ02530084+1652532 WAVE	STIS/CCD STIS/FUV-MAMA	1	27-Jan-2022 15:00:12.0	yes
02	(2) 2MASSJ15345704-1418486 WAVE	STIS/CCD STIS/FUV-MAMA	1	27-Jan-2022 15:00:12.0	yes
03	(3) 2MASSJ03341218-4953322 WAVE	STIS/CCD STIS/FUV-MAMA	1	27-Jan-2022 15:00:13.0	yes
04	(3) 2MASSJ03341218-4953322 WAVE	STIS/CCD STIS/FUV-MAMA	1	27-Jan-2022 15:00:14.0	yes

4 Total Orbits Used

ABSTRACT

We recently published evidence for a steep decline in chromospheric ultraviolet emission compared with coronal X-ray emission for mid-to-late M dwarfs. Very late M dwarfs appear to be underluminous in the ultraviolet by two orders of magnitude. If confirmed, this chromospheric decline will have profound implications for the habitability of exoplanet systems similar to TRAPPIST-1. The chromospheric decline may also point to a change in stellar dynamo mechanism at the fully convective boundary. We propose XMM-Newton and HST observations of three very late M dwarfs in order to test that the chromospheric decline is a common feature of the class.

OBSERVING DESCRIPTION

We will observe the Lyman alpha emission from our three late M dwarf targets with STIS G140M 1222 CENWAVE. We will use the 0.2" D1 slit to minimize airglow and dark current while maximizing S/N and absolute flux calibration. The only detectable stellar emission expected with this grating setup is Lyman alpha and possibly N V and Si III, so those lines are all that has been included in our science ETCs. We would like our wavecal exposures to occur during eclipse to maximize on-target exposures for these faint stars.

Our science case requires each HST visit be executed as close in time as possible with the corresponding XMM-Newton visit. Simultaneous observations are ideal, and within approximately 1 week of each other is acceptable. We have included here the XMM visibility windows for our three targets to aid in planning:

(1) 2MASS J02530084+1652532 (Teegarden's star) Radial velocity = +63 km/s (Newton+14)
2021 Feb 4 to Feb 23
2021 July 19 to Aug 26
2022 Jan 17 to Feb 23
2022 July 24 to Aug 28

(2) 2MASSJ15345704-1418486 Radial velocity = -71 km/s (Burgasser+15)
2021 Feb 6 to March 3
2021 July 28 to Sept 6

2022 Jan 29 to March 4
2022 July 29 to Sept 6

(3) 2MASSJ03341218 (LEHPM 3396) Radial velocity = +71 km/s (Reiners+09)
2021 Feb 4 to March 7
2021 May 24 to Sept 9
2021 Nov 26 to 2022 March 7
2022 May 24 to Sept 9

We have not imposed time constraints on the visits to further minimize airglow to aid in schedulability. If the scheduling constraints are not too onerous, we would prefer these dates because it would place the airglow emission in the expected ISM attenuation region. This will improve our determinations of the Lyman alpha fluxes of our target stars, and is typically standard for Lyman alpha stellar observations. The preferred date ranges are:

(1) 2MASS J02530084+1652532 (Teegarden's star) Radial velocity = +63 km/s (Newton+14)
March 22 to Sep 23 (any year)

(2) 2MASSJ15345704-1418486 Radial velocity = -71 km/s (Burgasser+15)
October 13 to Feb 25 (any year)

(3) 2MASSJ03341218 (LEHPM 3396) Radial velocity = +71 km/s (Reiners+09)
March 17 to Sep 28

Visit

Proposal 16487, Visit 01, completed Thu Jan 27 20:00:14 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ON HOLD

On Hold Comments: Our science case requires coordinating with the XMM-Newton observations. See observing description.

Fixed Targets

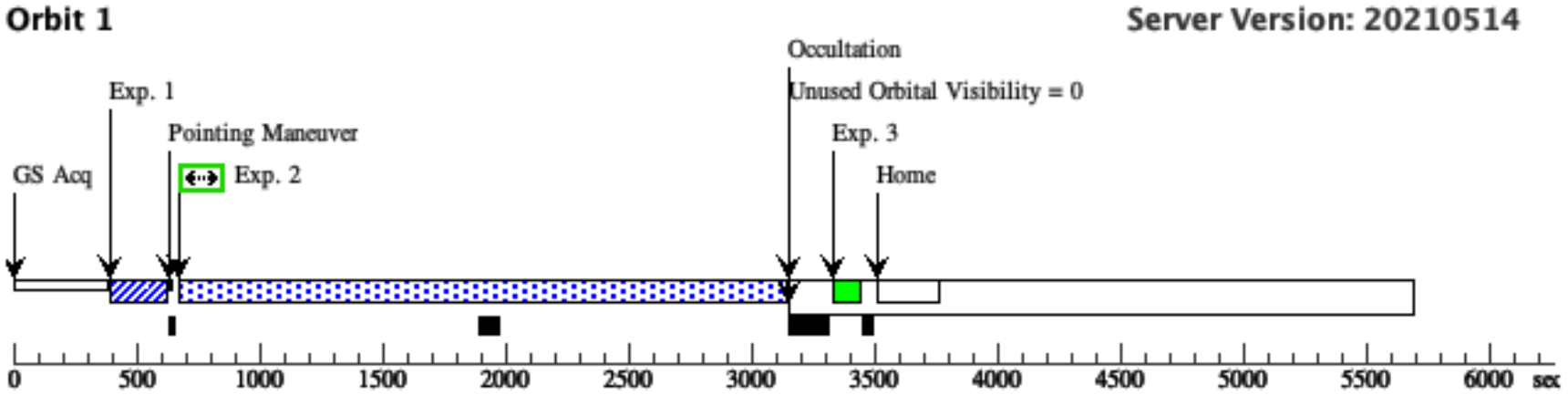
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2MASSJ02530084+1652532 Alt Name1: TEEGARDEN-STAR	RA: 02 53 4.7142 (43.2696425d) Dec: +16 51 51.75 (16.86438d) Equinox: J2000	Proper Motion RA: 3429.0828268077694 mas/yr Proper Motion Dec: -3805.54112273733 mas/yr Parallax: 0.2609884407" Epoch of Position: 2016.0 Radial Velocity: +63 km/sec	V=15.21	Reference Frame: ICRS

Comments:
Category=STAR
Description=[M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1516839)	(1) 2MASSJ02530084+1652532	STIS/CCD, ACQ, F28X50LP	MIRROR				0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.1476442)	(1) 2MASSJ02530084+1652532	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140M 1222 A	BUFFER-TIME=1080; WAVECAL=NO			2315 Secs (2315 Secs) *[==>]*	 ***[1]***
3		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.2	G140M 1222 A				*[==>]*	***[1]***

Orbit Structure



Visit

Proposal 16487, Visit 02, completed Thu Jan 27 20:00:14 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ON HOLD

On Hold Comments: Our science case requires coordinating with the XMM-Newton observations. See observing description.

Fixed Targets

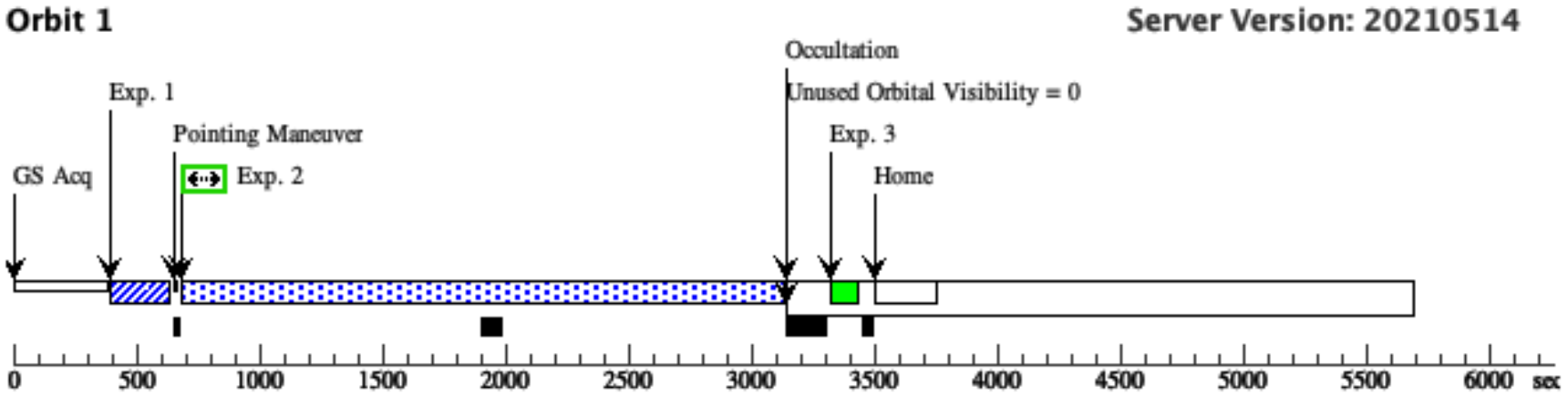
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2MASSJ15345704-1418486	RA: 15 34 55.9209 (233.7330037d) Dec: -14 18 54.54 (-14.31515d) Equinox: J2000	Proper Motion RA: -918.8055661272465 mas/yr Proper Motion Dec: -330.22722596645525 mas/yr Parallax: 0.0914" Epoch of Position: 2016 Radial Velocity: -71 km/sec	V=18.77	Reference Frame: ICRS

Comments:
Category=STAR
Description=[M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1516836)	(2) 2MASSJ15345704-1418486	STIS/CCD, ACQ, F28X50LP	MIRROR				4 Secs (4 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.1476439)	(2) 2MASSJ15345704-1418486	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140M 1222 A	BUFFER-TIME=1080; WAVECAL=NO			2160 Secs (2292 Secs) *[==>2292.0 Secs]*	 ***[1]***
3		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.2	G140M 1222 A				*[==>]*	***[1]***

Orbit Structure



Visit

Proposal 16487, Visit 03, failed

Thu Jan 27 20:00:14 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ON HOLD

On Hold Comments: Our science case requires coordinating with the XMM-Newton observations. See observing description.

Fixed Targets

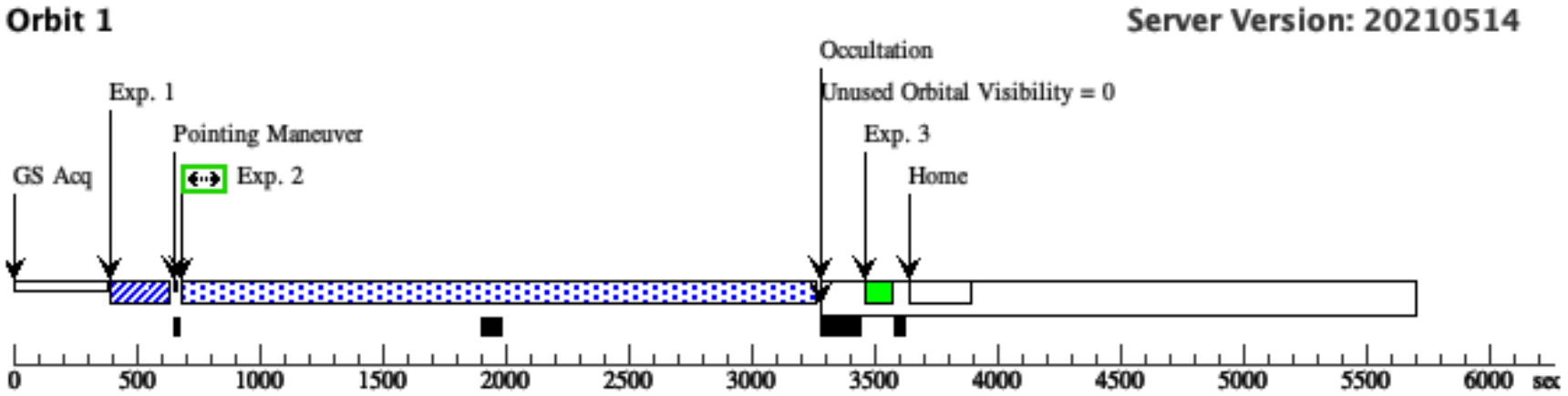
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	2MASSJ03341218-4953322	RA: 03 34 16.1270 (53.5671958d) Dec: -49 53 24.30 (-49.89008d) Equinox: J2000	Proper Motion RA: 2360.5922060078024 mas/yr Proper Motion Dec: 483.1275044783075 mas/yr Parallax: 0.1126" Epoch of Position: 2016 Radial Velocity: +71 km/sec	V=18.86	Reference Frame: ICRS

Comments:
Category=STAR
Description=[M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1516837)	(3) 2MASSJ03341218-4953322	STIS/CCD, ACQ, F28X50LP	MIRROR				4 Secs (4 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.1476438)	(3) 2MASSJ03341218-4953322	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140M 1222 A	BUFFER-TIME=1080; WAVECAL=NO			2160 Secs (2428 Secs) *[==>2428.0 Secs]*	 ***[1]***
3		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.2	G140M 1222 A				*[==>]*	***[1]***

Orbit Structure



Visit

Proposal 16487, HOPR03 (04) Thu Jan 27 20:00:14 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ON HOLD

On Hold Comments: Our science case requires coordinating with the XMM-Newton observations. See observing description.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	2MASSJ03341218-4953322	RA: 03 34 16.1270 (53.5671958d) Dec: -49 53 24.30 (-49.89008d) Equinox: J2000	Proper Motion RA: 2360.5922060078024 mas/yr Proper Motion Dec: 483.1275044783075 mas/yr Parallax: 0.1126" Epoch of Position: 2016 Radial Velocity: +71 km/sec	V=18.86	Reference Frame: ICRS

Comments:
Category=STAR
Description=[M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1516837)	(3) 2MASSJ03341218-4953322	STIS/CCD, ACQ, F28X50LP	MIRROR				4 Secs (4 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.1476438)	(3) 2MASSJ03341218-4953322	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140M 1222 A	BUFFER-TIME=1080; WAVECAL=NO			2160 Secs (2428 Secs) *[==>2428.0 Secs]*	 ***[1]***
3		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.2	G140M 1222 A				*[==>]*	***[1]***

Orbit Structure