



16085 - Atmospheric escape in the young transiting planet DS Tuc A b

Cycle: 27, 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) HD-222259 WAVE	STIS/CCD STIS/FUV-MAMA	5	12-May-2020 10:00:18.0	yes

5 Total Orbits Used

ABSTRACT

The recent discovery of the transiting young (45 Myr) planet DS Tuc A b around a bright and nearby solar-type star provides a unique opportunity to study the role of atmospheric escape in the early lives of warm Neptunes. One of the explanations for the lack of hot Neptune-sized planets is atmospheric escape, which is expected to be most important during the first 100 Myr after formation. In this program, we aim to detect and interpret

the atmospheric escape of DS Tuc A b using Lyman-alpha transmission spectroscopy. Owing to its strong irradiation at a young age, we estimate that the escape rate of this planet is orders of magnitude larger than other warm Neptunes with previous detections. The stellar Lyman-alpha emission can be readily observed by HST/STIS due to the short distance of the star and its young age. The outcomes of this program will provide the first observational constraints for atmospheric escape models in young Neptune-sized exoplanets, as well as the lower-atmosphere composition of DS Tuc A b. The results will also be fundamental to future efforts in characterizing the planet using JWST and ground-based facilities.

OBSERVING DESCRIPTION

We will observe one transit of DS Tuc A b using HST/STIS with the G140M grating centered on 122.2 nm. Since DS Tuc is a binary (separation = 5 arcsec = 100 pixels), it is imperative to insert the correct star in the slit. We already verified that, for most of the remaining time of Cycle 27, it is impossible to set the ORIENT constraint so that we have both stars in the slit. The target DS Tuc A is approximately 1 magnitude brighter than DS Tuc B at visible wavelengths, so the telescope should automatically center the correct target assuming everything goes well. There is also another bright star 3 arcmin east of the DS Tuc system. We will use the narrowest slit width (0.05") to minimize airglow contamination as much as possible. We understand that this choice can introduce slit losses, but we can correct for these losses when analyzing the data (on the other hand, the extra noise introduced by the airglow cannot be corrected).

The ACQ exposure is performed following the recommendations from the ETC. Our target star is very bright, so we always get warnings for the ACQ/PEAK when running it in the ETC. We decided to use the same ACQ/PEAK configuration as in program GO#13820 (similarly bright star, similar science case and same instrumental configuration). We set the timing constraints in the SCIENCE exposure to match an observing window of 10 hours around the exoplanet transit midcenter (period = 8.138268 days), which roughly corresponds to 5 orbits and some "wobble room" for flexibility; this timing constraint covers the transit and the baseline flux of the star in the most reliable, yet flexible way. We set the schedulability constraint to 100 in order to maximize observation opportunities.

We understand that simultaneous observations of HST with other telescopes is not guaranteed, thus we do not include the following as a timing constraint. However, this program would significantly benefit from performing the HST visit at the same time as the ground-based facilities that we have access to in La Silla, Chile. Our plan is to use these facilities to measure the stellar activity index of DS Tuc A during the transit of the planet, as well as wide-band photometry. We will use these data to correct for potential stellar activity effects that can be present in the FUV data obtained with HST and create spurious planetary signals. If it is not possible to accommodate this request, another possibility is to execute the HST visit between July 4 and August 26 2020, since our target is going to be in the TESS field and we can obtain simultaneous space-based photometry. The potential

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impacts of not performing simultaneous observations or having bad weather in La Silla are: i) The interpretation of the results can be more complicated in case the stellar activity modulation is as strong as a planetary signal in UV (in the order of a few percent or more) -- neither of these are known at the moment; ii) In case the results render only a tentative detection, we may need to apply for another HST transit to repeat the experiment and draw a more definitive conclusion. With these considerations in mind, even if we cannot perform simultaneous observations, the objectives of this program can still be attained to the extent that previous Lyman-alpha transits did in the past.

If possible we request that the observations are carried out in one of these windows (times are in UT):

25 Jul 2020 21:46 - 26 Jul 2020 07:46; priority 1 (full transit visible from La Silla and TESS)

03 Aug 2020 01:05 - 03 Aug 2020 11:05; priority 1 (full transit visible from La Silla and TESS)

07 Jun 2020 01:52 - 07 Jun 2020 11:52; priority 2 (full transit visible from La Silla)

20 Sep 2020 21:00 - 21 Sep 2020 07:00; priority 2 (full transit visible from La Silla)

29 Sep 2020 00:19 - 29 Sep 2020 10:19; priority 2 (full transit visible from La Silla)

11 Aug 2020 04:24 - 11 Aug 2020 14:24; priority 3 (partial transit visible from La Silla and full from TESS)

15 Jun 2020 05:11 - 15 June 2020 15:11; priority 4 (partial transit visible from La Silla)

Any time between 4 Jul 2020 to 26 Aug 2020; priority 5 (full transit visible from TESS)

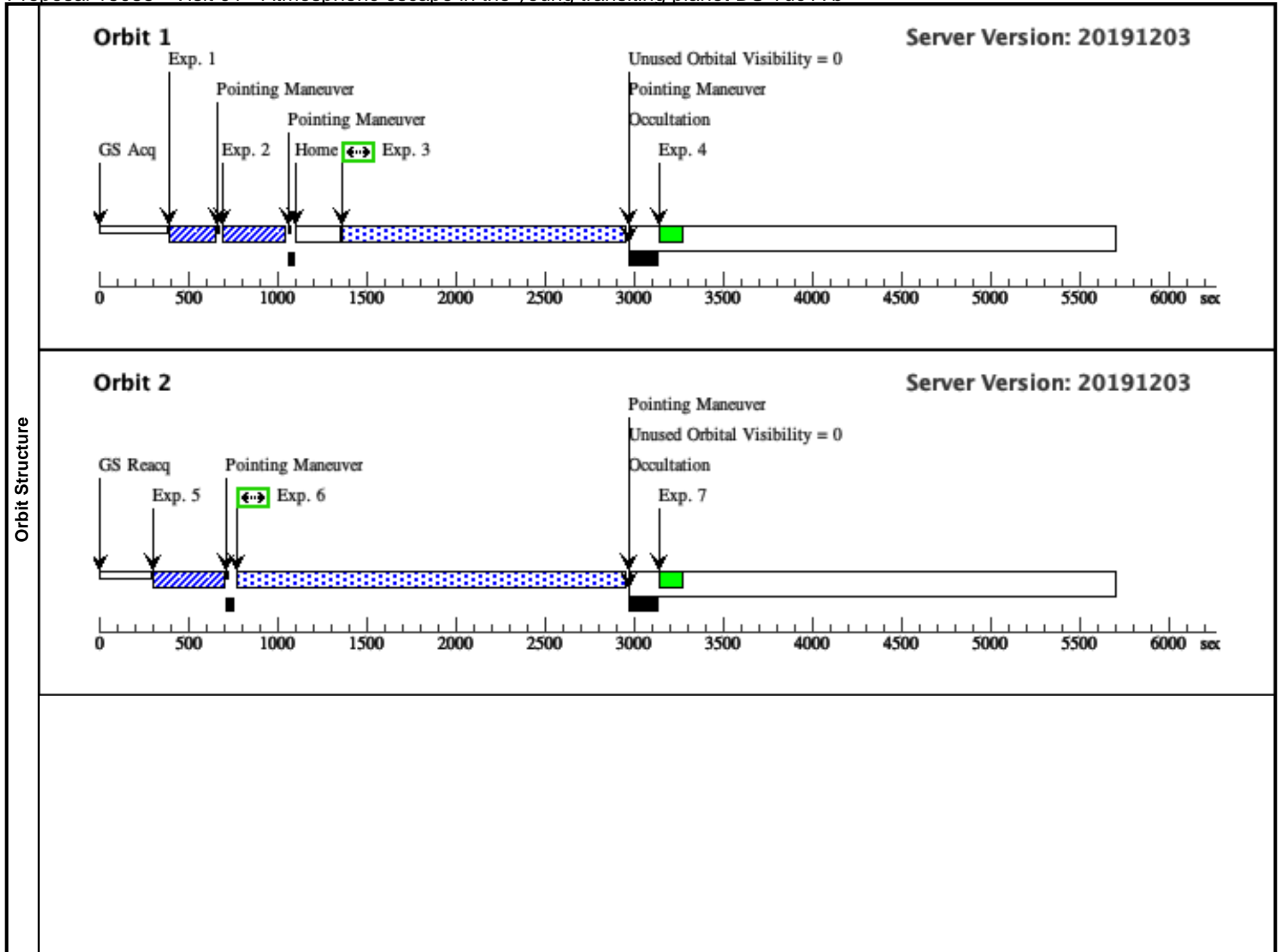
No simultaneous observations; priority 6

Proposal 16085 - Visit 01 - Atmospheric escape in the young transiting planet DS Tuc A b

Visit	Proposal 16085, Visit 01, implementation Tue May 12 14:00:20 GMT 2020 Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: SCHED 100%; Period 8.138268 D AND ZERO-PHASE HJD2458332.30997					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		HD-222259	RA: 23 39 39.4900 (354.9145417d) Dec: -69 11 44.88 (-69.19580d) Equinox: J2000	Proper Motion RA: 79.464 mas/yr Proper Motion Dec: -67.440 mas/yr Epoch of Position: 2015.5 Radial Velocity: 8.05 km/sec	V=8.226	Reference Frame: ICRS
<i>Comments: Coordinates from Tycho-2 database. Proper motion from Gaia DR2. Radial velocity from Newton+2019.</i> Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, G V-IV, REGULAR VARIABLE, RS CVN STAR]						

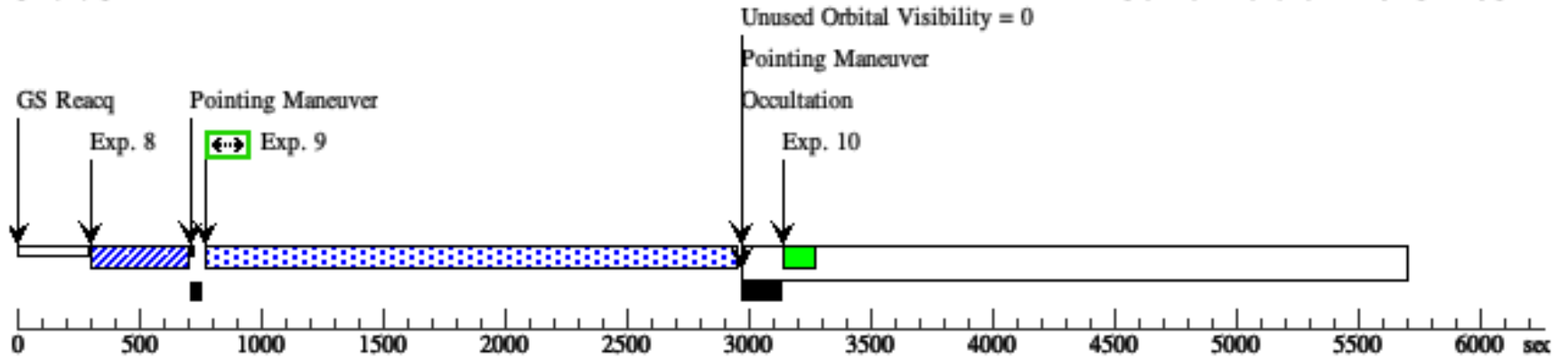
Proposal 16085 - Visit 01 - Atmospheric escape in the young transiting planet DS Tuc A b

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	ACQ (STIS.ta.142 1053)	(1) HD-222259	STIS/CCD, ACQ, F28X500II	MIRROR				Sequence 1-4 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[1]
	2	ACQ/PEAK (STIS.sp.14 41098)	(1) HD-222259	STIS/CCD, ACQ/PEAK, 52X0.05D1	G430L 4300 A				Sequence 1-4 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[1]
	3	SCIENCE (STIS.sp.14 21064)	(1) HD-222259	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A		BUFFER-TIME=9000; WAVECAL=NO	PHASE 0.97440077 749549 TO 0.025599 222504509966	Sequence 1-4 Non-Int in Visit 01	1573 Secs (1403 Secs) [==>1403.0 Secs]	[1]
	4	GO-WAVE CAL	WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A				Sequence 1-4 Non-Int in Visit 01	[==>]	[1]
	5	ACQ/PEAK (1) HD-222259		STIS/CCD, ACQ/PEAK, 52X0.05D1	G430L 4300 A				Sequence 5-7 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[2]
	6	SCIENCE (STIS.sp.14 21064)	(1) HD-222259	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A		BUFFER-TIME=9000; WAVECAL=NO		Sequence 5-7 Non-Int in Visit 01	1573 Secs (2044 Secs) [==>2044.0 Secs]	[2]
	7	GO-WAVE CAL	WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A				Sequence 5-7 Non-Int in Visit 01	[==>]	[2]
	8	ACQ/PEAK (1) HD-222259		STIS/CCD, ACQ/PEAK, 52X0.05D1	G430L 4300 A				Sequence 8-10 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[3]
	9	SCIENCE (STIS.sp.14 21064)	(1) HD-222259	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A		BUFFER-TIME=9000; WAVECAL=NO		Sequence 8-10 Non-Int in Visit 01	1573 Secs (2044 Secs) [==>2044.0 Secs]	[3]
	10	GO-WAVE CAL	WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A				Sequence 8-10 Non-Int in Visit 01	[==>]	[3]
	11	ACQ/PEAK (1) HD-222259		STIS/CCD, ACQ/PEAK, 52X0.05D1	G430L 4300 A				Sequence 11-13 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[4]
	12	SCIENCE (STIS.sp.14 21064)	(1) HD-222259	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A		BUFFER-TIME=9000; WAVECAL=NO		Sequence 11-13 Non-Int in Visit 01	1573 Secs (2044 Secs) [==>2044.0 Secs]	[4]
	13	GO-WAVE CAL	WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A				Sequence 11-13 Non-Int in Visit 01	[==>]	[4]
	14	ACQ/PEAK (1) HD-222259		STIS/CCD, ACQ/PEAK, 52X0.05D1	G430L 4300 A				Sequence 14-16 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[5]
	15	SCIENCE (STIS.sp.14 21064)	(1) HD-222259	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A		BUFFER-TIME=9000; WAVECAL=NO		Sequence 14-16 Non-Int in Visit 01	1573 Secs (2044 Secs) [==>2044.0 Secs]	[5]
16	GO-WAVE CAL	WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A				Sequence 14-16 Non-Int in Visit 01	[==>]	[5]	



Orbit 3

Server Version: 20191203



Orbit 4

Server Version: 20191203

