



18336 - A Multiwavelength Campaign to Characterize the Astrosphere of a Nearby Debris Disk Hosting Star

Cycle: 34, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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Dr. Hans Moritz Guenther (CoI)	Massachusetts Institute of Technology
Dr. Scott J. Wolk (CoI)	Smithsonian Institution Astrophysical Observatory

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) HD61005	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	3	17-Aug-2026 13:00:57.0	yes
02	(1) HD61005	STIS/CCD STIS/FUV-MAMA	2	17-Aug-2026 13:00:58.0	yes

5 Total Orbits Used

ABSTRACT

Stellar mass loss is a ubiquitous property of stars, as are planets and circumstellar dusty debris disks. In the case of our own star, the Sun, the unique properties of its particle wind shape the structure of our debris disks, dictate the thermal and chemical structure of planetary atmospheres, and ultimately push against the confining plasma of our surrounding interstellar medium, producing the heliosphere. The detection of astrospheres, the result of the relatively weak winds of solar-like, cool, stars can be made with high-resolution spectra of Lyman-alpha, a unique capability of HST. Charge exchange in the interaction zone of stellar winds with their surrounding interstellar medium produces detectable HI Lyman-alpha absorption, where the amount of absorption allows for a determination of the mass loss rate. A well-known nearby young debris disk, HD61005, (also known as The Moth due to the captivating morphology of the scattered light of its disk) was recently discovered to have extended X-ray emission that is associated with its astrosphere. We propose UV spectroscopy in order measure Lyman-alpha profile and detect or constrain the astrospheric signature of hot, excess hydrogen at the interface of the astrosphere and local interstellar medium. These observations would provide a comprehensive view of HD61005's astrosphere and provide a valuable model for our own Sun's heliosphere early in its main-sequence lifetime.

OBSERVING DESCRIPTION

Desired Spectral Coverage and Resolution: The high spectral resolution capabilities of STIS are necessary to adequately model potentially blended LISM absorption line profiles and resolve the critical DI line. We propose to use the E230H (R ~ 110,000) grating, in the 2574-2851 Å wavelength range, which encompasses MgII h & k near 2800 Å and FeII at 2600 Å to resolve the velocity structure of the ISM along the line of sight. Because the hydrogen at the astrospheric interface is hot ($T \sim 100,000$ K), it has a broad absorption profile, and does not necessarily require the highest spectral resolution. To maximize the S/N we plan to use the E140M setting.

Desired Signal-to-Noise and Exposure Times: Estimating the S/N for our planned spectra requires first estimating the expected Lyman-alpha and MgII fluxes of HD61005. Chromospheric line fluxes (such as MgII and Lyman-alpha) are correlated to X-ray fluxes. Lyman-alpha spectra of similar stars are used as the comparison stars for our purposes here, scaled by their X-ray flux. After acquisition, pickup, and observational overhead are considered, we expect at least 28 minutes to be available in the first orbit for the E230H exposure. We expect a S/N of ~25 per resolution element at MgII. We expect at least 41 minutes of exposure time to be available in the second orbit for the E140M exposure, and 48 minutes in subsequent orbits. For 4 orbits we expect to reach $S/N > 15$ in the Lyman-alpha profile, which is sufficient to detect astrospheric absorption.

Brightness Limits: HD61005 has been previously observed at medium resolution (E230M) which is insufficient to detect and model interstellar or

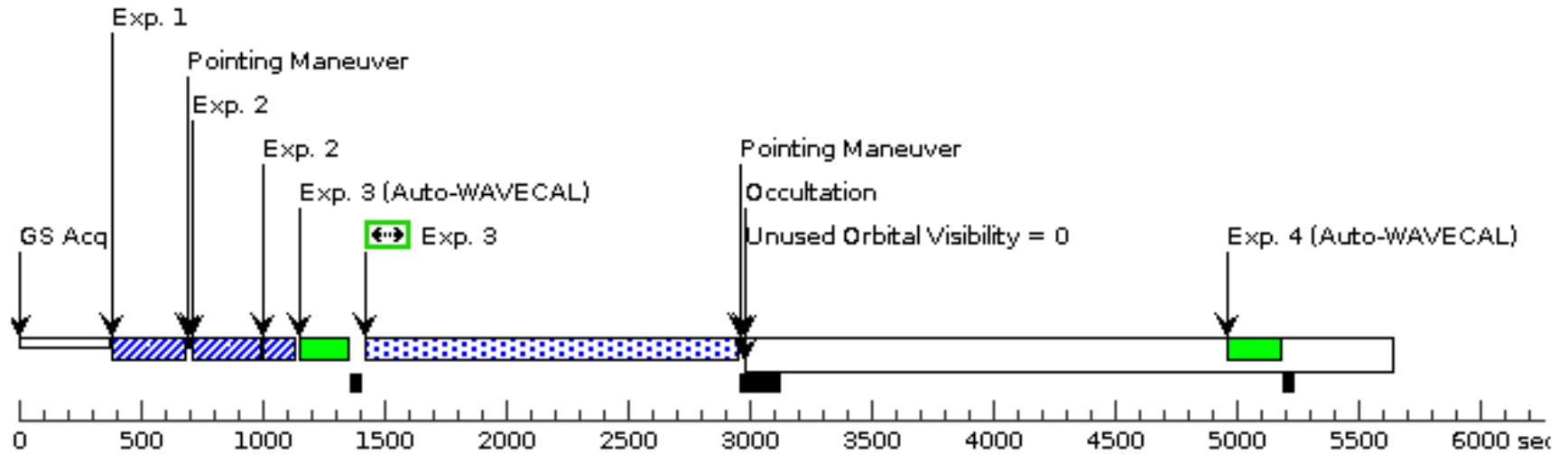
circumstellar absorption but provides an excellent basis to evaluate the brightness limit at MgII. The global count rate is only 1,900 counts per second, about 100 times less than the global brightness limit. The two emission lines of interest in the HST observations (Lyman-alpha and MgII) are also the brightest, and the procedure given above for estimating the S/N is also used to test for brightness limit violations. In the strongest lines, the brightest pixel only generates 0.1 counts per second.

Proposal 18336 - Visit 01 - A Multiwavelength Campaign to Characterize the Astrosphere of a Nearby Debris Disk Hosting Star

Visit	Proposal 18336, Visit 01										Mon Aug 17 17:00:59 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA											
	Special Requirements: BETWEEN 25-JUN-2026:00:00:00 AND 26-FEB-2027:00:00:00; BETWEEN 25-JUN-2027:00:00:00 AND 26-FEB-2028:00:00:00; BETWEEN 25-JUN-2028:00:00:00 AND 26-FEB-2029:00:00:00											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	HD61005	RA: 07 35 47.4624 (113.9477600d) Dec: -32 12 14.05 (-32.20390d) Equinox: J2000			Proper Motion RA: -55.05 mas/yr Proper Motion Dec: 74.319 mas/yr Parallax: 0.0274344" Epoch of Position: 2000		V=8.22	Reference Frame: ICRS			
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.											
	SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.											
	Category=STAR Description=[DISK, EMISSION LINE STAR, G 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.236 5785)	(1) HD61005	STIS/CCD, ACQ, F25ND3		MIRROR	ACQTYPE=POINT			1.7 Secs (1.7 Secs)		
										[==>]		[1]
	Comments: SNR = 152.6861 Brightest Pixel = 9,707.79 e											
	2	(STIS.ta.236 5876)	(1) HD61005	STIS/CCD, ACQ/PEAK, 0.2X0.09		G430L 4300 A				0.5 Secs (0.5 Secs)		
										[==>]		[1]
	Comments: SNR = 80.0255 Brightest Pixel = 2,855.23 e Global Source Counts = 14,130.055 e											
	3	(STIS.sp.23 65907)	(1) HD61005	STIS/NUV-MAMA, TIME-TAG, 0.2X0.09		E230H 2713 A	BUFFER-TIME=10 20			1515 Secs (1515 Secs)		
										[==>]		[1]
	Comments: SNR = 31.9650 Brightest Pixel = 451.46 e											
	4	(STIS.sp.23 65908)	(1) HD61005	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2		E140M 1425 A	BUFFER-TIME=17 770			2577 Secs (2577 Secs)		
										[==>]		[2]
Comments: SNR = 13.8863 Brightest Pixel = 94.44 e												
5	(STIS.sp.23 65908)	(1) HD61005	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2		E140M 1425 A	BUFFER-TIME=17 770			2577 Secs (2577 Secs)			
									[==>]		[3]	
Comments: SNR = 13.8863 Brightest Pixel = 94.44 e												

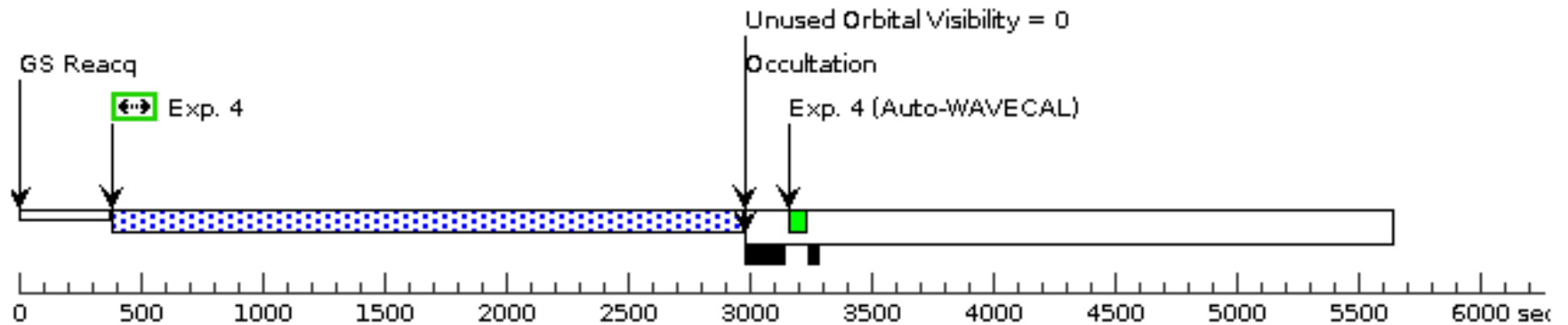
Orbit 1

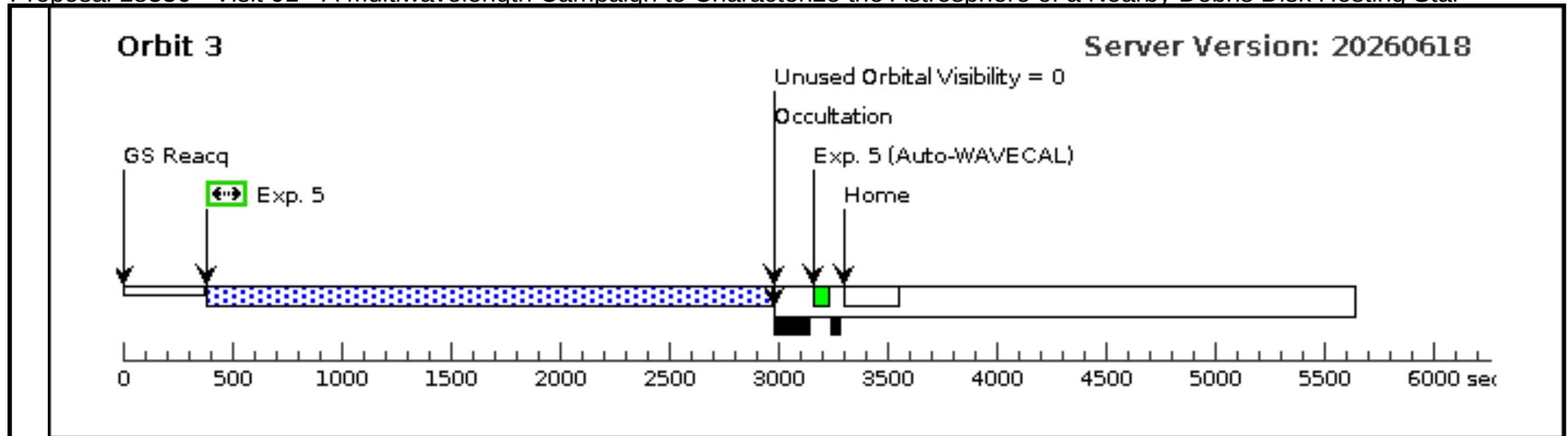
Server Version: 20260618



Orbit 2

Server Version: 20260618



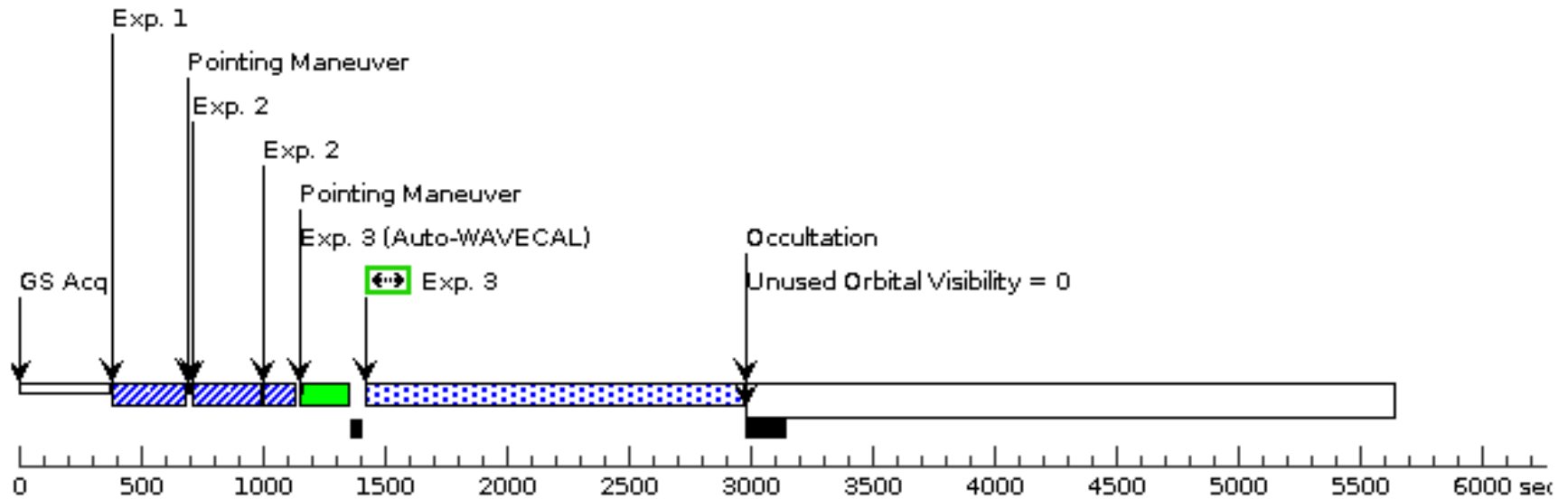


Proposal 18336 - Visit 02 - A Multiwavelength Campaign to Characterize the Astrosphere of a Nearby Debris Disk Hosting Star

Visit	Proposal 18336, Visit 02										Mon Aug 17 17:00:59 GMT 2026
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA										
Special Requirements: BETWEEN 25-JUN-2026:00:00:00 AND 26-FEB-2027:00:00:00; BETWEEN 25-JUN-2027:00:00:00 AND 26-FEB-2028:00:00:00; BETWEEN 25-JUN-2028:00:00:00 AND 26-FEB-2029:00:00:00											
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	HD61005	RA: 07 35 47.4624 (113.9477600d)		Proper Motion RA: -55.05 mas/yr		V=8.22		Reference Frame: ICRS		
			Dec: -32 12 14.05 (-32.20390d)		Proper Motion Dec: 74.319 mas/yr						
			Equinox: J2000		Parallax: 0.0274344"						
					Epoch of Position: 2000						
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.											
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.											
Category=STAR											
Description=[DISK, EMISSION LINE STAR, G 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.236 5785)	(1) HD61005	STIS/CCD, ACQ, F25ND3	MIRROR	ACQTYPE=POINT			1.7 Secs (1.7 Secs)		
									[==>]		[1]
	Comments: SNR = 152.6861										
	Brightest Pixel = 9,707.79 e										
	2	(STIS.ta.236 5876)	(1) HD61005	STIS/CCD, ACQ/PEAK, 0.2X0.09	G430L				0.5 Secs (0.5 Secs)		
					4300 A				[==>]		[1]
	Comments: SNR = 80.0255										
	Brightest Pixel = 2,855.23 e										
	Global Source Counts = 14,130.055 e										
3	(STIS.sp.23 65909)	(1) HD61005	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M	BUFFER-TIME=17			1532 Secs (1532 Secs)			
				1425 A	770			[==>]		[1]	
Comments: SNR = 10.7068											
Brightest Pixel = 56.14 e											
4	(STIS.sp.23 65908)	(1) HD61005	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M	BUFFER-TIME=17			2577 Secs (2577 Secs)			
				1425 A	770			[==>]		[2]	
Comments: SNR = 13.8863											
Brightest Pixel = 94.44 e											

Orbit 1

Server Version: 20260618



Orbit 2

Server Version: 20260618

