11674 - A STIS NUV Search for Shocked-Interstellar and Circumstellar Gas towards the Debris Disk System, HD 61005

Cycle: 17, 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) HD-61005	STIS/CCD STIS/NUV-MAMA	2	19-Dec-2008 21:21:55.0	yes

2 Total Orbits Used

ABSTRACT

Circumstellar debris disks provide the principle window for investigating planet formation and evolution on timescales of 10-100 Myr. Unlike their younger counterparts, debris disks no longer contain primordial material. The dust observed in these objects is instead produced by collisional erosion of larger parent bodies in the developing planetary system. Currently, only five confirmed debris disks have detected circumstellar gas,

studied primarily through UV absorption spectroscopy. The exact production mechanisms for this replenished gas are presently poorly constrained. However, the few objects studied so far have revealed a wide range of intruiging properties, including a stable Keplerian gas disk maintained by its high carbon abundance (Beta Pic), and a rapidly expelled population of gas produced in collisions between unstable planetesimals (Sigma Her). To add to this important set of observations, we propose to obtain NUV STIS spectroscopy of the debris disk host, HD 61005, a nearly edge-on debris disk notable for its swept asymmetric morphology. These observations allow the likely detection of circumstellar gas, making HD 61005 the first solar-type debris disk host with gas detected in this way. Thus, the proposed observations provide the unique opportunity to study gas in a debris disk analogous to our early solar system. In addition to potentially detecting circumstellar gas associated with this system, HD 61005 offers the possibility of tracing interstellar bow-shocked gas. HD 61005 is a unique debris disk in terms of its significant interaction with the interstellar medium. The proposed observations will, therefore, be the first to directly probe the interaction between a debris disk and its surrounding interstellar material. STIS is ideally suited for this experiment, providing sensitive NUV spectra with the required balance between spectral resolution and wavelength coverage.

OBSERVING DESCRIPTION

The primary goal of our observation is to search for shocked-interstellar and circumstellar gas towards the debris disk host, HD 61005, a G8V V=8.22 mag star. We propose to use STIS with the NUV-MAMA detector and the E230M grating with a slit width of 0.2"x0.2". This mode was chosen to provide optimal sensitivity and spectral resolution of the weakest lines so far observed in debris disks, combined with the primary constraint of broad wavelength coverage to maximize the multiplex advantage of STIS. Our orbit request is based on STIS ETC calculations, which estimate a total exposure time of 4680 s is needed to achieve a minimum signal-to-noise ratio of S/N~20 at the central wavelength observed. This sensitivity requirement is chosen to match that in previous UV absorption spectroscopy studies of debris disks. We note that the source is much fainter than the V-band magnitude limit for a G8V star, for an observation with the E230M grating. The target has V=8.22 mag, whereas the bright object limit as listed in Table 13.44 in the STIS Instrument handbook is V=4.0 mag. There are no optically-detected comparably bright stars within 5" of HD 61005, as deduced from unpublished ACS F606W coronagraphic imaging. We have also checked that HD 61005 can not be hiding a dangerously hot white dwarf companion; using the STIS ETC in conjunction with the white dwarf cooling curves from Fontaine et al. (2001) for this ~90 Myr old system, the maximum possible count rate contributed by such a companion in the brightest pixel is 4 counts/s/pixel, much fainter than the bright object limits given in Table 7.8. The listed target coordinates and proper motions are derived from the Hipparcos Output Catalog. The

listed radial velocity is from the Geneva-Copenhagen survey of F and G dwarfs in the solar neighborhood. After guide star acquisition, the target will be located using the point-source ACQ procedure with the STIS/CCD. This is the only necessary acquisition procedure since our slit is larger than 0.1" in both dimensions. Using the STIS/ACQ exposure time calculator, a signal-to-noise of ~160 can be achieved in a 3.0 s exposure with the F28X50OII filter.

Visit

Proposal 11674, Visit 01, implementation Sat Dec 20 02:21:59 GMT 2008

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

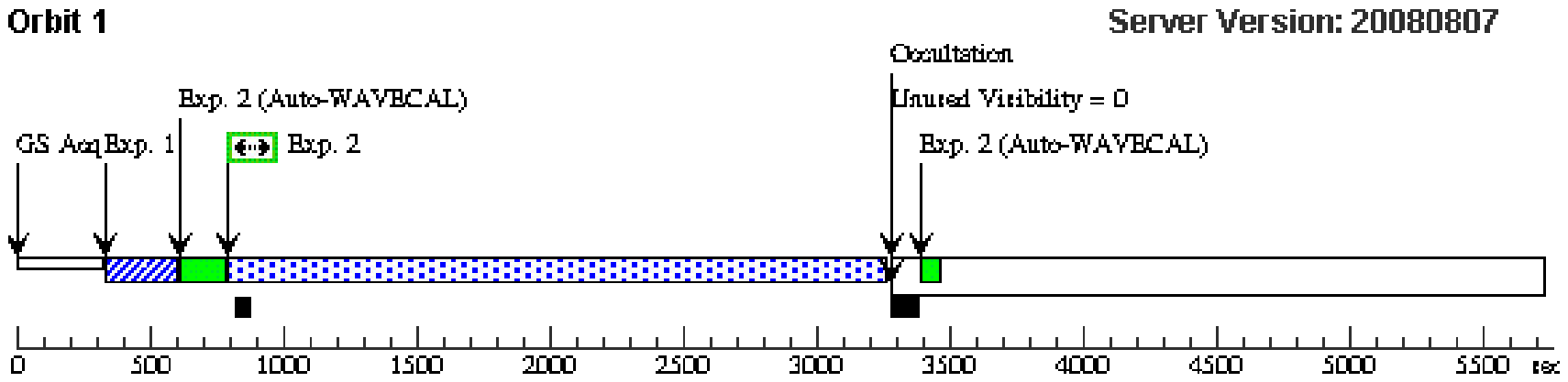
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-61005	RA: 07 35 47.4617 (113.9477571d) Dec: -32 12 14.04 (-32.20390d) Equinox: J2000	Proper Motion RA: -0.00441920s/yr Proper Motion Dec: 0.07453"/yr Parallax: 0.02895" Epoch of Position: 2000 Radial Velocity: 22.3 km/sec	V=8.22 B=8.93	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) HD-61005	STIS/CCD, ACQ, F28X50OII	MIRROR				3.0 Secs	
								[==>]	***[1]***
2		(1) HD-61005	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2415 A				2380.0 Secs	
								[==>2454.0 Secs]	***[1]***
3		(1) HD-61005	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2415 A				2380.0 Secs	
								[==>3058.0 Secs]	***[2]***

Orbit Structure



Orbit Structure (continued)