17900 - Exploring dust in the star forming region towards Cyg X-1

Cycle: 32, 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-226868 CCDFLAT	STIS/CCD STIS/NUV-MAMA	1	13-Mar-2025 15:02:29.0	yes

1 Total Orbits Used

ABSTRACT

Cyg X-1 is a bright nearby source, located in a complex dusty region. Its dust grains and gas characteristics differ from the average of the diffuse medium, providing unique insights into dust in a star and planets forming site. Using the high-resolution of XMMNewton-RGS we will characterise the chemistry, size and abundance of interstellar dust around the oxygen spectral region, fundamental to determine the silicate contribution to the dust composition. Using the joint HST-STIS observation we will model the extinction curve and carbon features, giving unique insight on the dust size distribution and carbon content along this line of sight.

OBSERVING DESCRIPTION

Note: this HST observation is a joint observation via an
XMM-Newton proposal. The HST observation does not need to be strictly simultaneous
with the XMM observation. A reaction time of 1 week has been proposed, however a longer response time is also doable without loss of science information. A longer response time may be in fact necessary as the visibility windows of HST and XMM do not perfectly overlap.
If the XMM observation is triggered when there is no HST window available, it is fine if the target is observed by HST at the next possible occasion (1-3 months away, depending on when this happens during the cycle).

In the proposal we indicated 1 HST orbit, using G430L, G750L
and G230L. However, the U band=9.38, is too bright for G230L (as written in the
proposal). This will cause the G230L to saturate and instead we need to use
E230M.

For G430L and G750L we take 10 second exposures at 3 nod
positions along the slit (nods needed to fully sample spectrum). SNR here is
200+ per exposure at R=500. Finally, we take CCDFLATs in occultation time to
allow correcting of detector fringing.

For the E230M the central wavelength 2415 A covers 1985 A to
2820 A which includes the 2175 A absorption feature and adjacent continuum.
At the deepest part of the feature (2175A) the SNR is 2.8
per resolution element (R=30000). Binning to R=500 gives SNR 21 per exposure.

Two exposures will be collected with MAMA (two iterations without nodding) so the SNR will be even higher.
Acquisition will take place with neutral density filter to avoid saturation.

Bright Object Limit has been verified with archival SWIFT UVOT photometry. Renormalizing our reddened O9V star model with these photometric points remains safely within the Bright Object Limits for MAMA, even with the brightest observed photometry in Cyg X-1's high-state (0.051 Jy at

2246 Angstrom; https://etc.stsci.edu/etc/results/STIS.sp.1952842/).

Visit

Proposal 17900, Cyg X-1 (01), implementation Thu Mar 13 19:02:30 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: TOO RESPONSE TIME 7.0D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3), (4)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=3	Angle Between Sides=		
	Point Spacing=0.5327175	Center Pattern=false		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-226868	RA: 19 58 21.6757 (299.5903154d) Dec: +35 12 5.78 (35.20161d) Equinox: J2000	Proper Motion RA: -3.8120000000000003 mas/yr Proper Motion Dec: -6.310000048870279 mas/yr Parallax: 4.439E-4" Epoch of Position: 2000 Radial Velocity: -2.70 km/sec	V=8.91 U band=9.38	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=[LMXB]
Extended=NO

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.1945824)	(1) HD-226868	STIS/CCD, ACQ, F25ND3	MIRROR				1 Secs (1 Secs) *[==>]*	*[1]*
	Comments: Note that we are close to saturation on the acquisition with default aperture F28X50LP (t_sat = 0.14 sec and minimum exposure time 0.1 sec). So we use aperture F25ND3 with 1 second integration and S/N = 88 to be on the safe side.								
2	MAMA E230M (STIS.sp.1952840)	(1) HD-226868	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2415 A				223 Secs X 2 (446 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*
	Comments: MAMA saturates in G230L (this grating was originally suggested in the proposal). For this target MAMA can only be used with the high and medium res echelles without having to resort to the ND gratings to prevent saturation in the worst case (brightest) scenarios. The CCD with G230LB would create issues with scattered light from the red end of the spectrum. *We don't need the full spectral resolution so we can use 6x0.2 or 0.2x0.2 apertures. Aperture 0.2x0.2 minimizes order-order contamination. We do not need to PEAKUP with these apertures which saves a lot of time.* *SNR = 10.5 per resolution element per 223s integration time per pointing at 2500A. SNR = 2.8 (per resolution element) at 2175 A (STIS.sp.1952839). Double the amount of integration time in the two iterations.* *We can only fit one wavelength setting in this orbit. So we pick 2415A which covers 2175 A and the adjacent continuum (1985 A to 2820 A).* *Worst case (brightest flux in UV from SWIFT UVOT): https://etc.stsci.edu/etc/results/STIS.sp.1952842/ is still within safe limits.*								
3	CCD G430L (STIS.sp.1945814)	(1) HD-226868	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=2		Pattern 1, Exps 3-3 in Cyg X-1 (01) (1)	10 Secs (30 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]*	*[1]*
	Comments: SNR 192 per 10 second pattern position. With 3 pointings in this pattern we have 30 seconds integration. CR-SPLIT = 2 (default) provides some safety against cosmic ray hits.								
4	CCD G750L (STIS.sp.1945777)	(1) HD-226868	STIS/CCD, ACCUM, 52X2	G750L 7751 A	CR-SPLIT=2		Pattern 1, Exps 4-4 in Cyg X-1 (01) (1)	10 Secs (30 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]*	*[1]*
	Comments: SNR 270 per 10 second pattern position. Total integration time 30 seconds.								
5	CCDFLAT G750L	CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				*[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*
	Comments: CCDFLAT is needed to correct for fringes in the reddest part of G750L and taken during the occultation time with default integration times. A reduced slit width of 52x0.1 is used to be more like a point source. It is unclear if a square aperture would yield even better fringe correction.								

Orbit Structure