



10489 - Imaging Extended UV H₂ Emission Around T Tauri

Cycle: 14, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets</i>	<i>Configurations</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) HD284419	ACS/SBC	3	20-Jun-2005 12:38:00.0	yes

3 Total Orbits Used

ABSTRACT

The interactions between the circumstellar disk, newly-forming star, and bipolar jet outflows play a central role in the process of star formation. These interactions control how disks evolve and dissipate, and, thereby, control the process of planetary system formation. We shall image the UV molecular hydrogen (H₂) emission around the pre-main-sequence binary star T Tauri using the ACS SBC (solar blind channel) MAMA detector, thus determining the spatial properties of the H₂ emitting regions, and deriving important detailed observational information on the disk-star-jet

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interaction on scales of order 5 AU. These images will reveal the degree of collimation and opening angles of the innermost parts of the high velocity jets, the shock structure within the jet outflows, the size and morphology of the circumstellar disks, both in emission and in silhouette, and the conditions inside the polar cavities swept clear by Herbig-Haro flows. Fluorescent H₂ emission lines dominate the UV spectrum of T Tau. Long-slit (1-D) STIS UV spectra of T Tau show H₂ emission with a complex spatial structure extending many arcseconds from the star and the presence of significant shock structures. The H₂ must be warm (approx. 2000 K) for the fluorescence to operate. The molecular emission originates in shocks and, perhaps, also from the surfaces of the inner regions of accretion disks.

OBSERVING DESCRIPTION

We shall obtain ACS-SBC images of the H₂ emission within the T Tau system. Based on our previous UV (STIS, GHRS, IUE) spectroscopic observations, we have good estimates of the extent and brightness of the extended H₂ emission.

The T Tau system will be imaged using the ACS-SBC (Solar Blind Channel) detector and the F140LP and F165LP filters. When the F165LP image is subtracted from the F140LP image, a well-defined, effective passband of 1350 - 1650 Å results, and the off-star signal will be dominated by H₂ emission. The F165LP image is an important control that will be used to characterize the presence of any reflection nebulosity and other confusing (non-H₂) features in the field of view, and mitigate the influence of any filter red leak. The F165LP passband contains only a small (and known) amount of H₂ flux but will reveal any broadband dust scattering. The F165LP will provide a check of the ACS UV point spread function at exactly the same detector locations as the primary F140LP images. At the 140 pc distance of T Tau the 0.032 arcsec SBC pixels have a size equivalent to 4.5 AU; thus the ACS-SBC offers the possibility to explore detailed spatial structure very close to a low mass PMS star, that is difficult to observe any other way. Such size scales are well matched to MHD models of CTT star outflows (see e.g. Figs. 6-8 of Matt, Winglee, & Bohm 2003). Use of the F140LP and F165LP filters maximizes the signal-to-noise because the H Ly alpha and O I geocoronal emission is suppressed, while the selected passband contains the strongest H₂ lines. T Tau does not violate the ACS MAMA bright limits even for the pixels containing the stellar point source, based on existing UV spectra. There are no other bright UV sources within 30 arcseconds of T Tau; this is primarily because of the dark molecular cloud located just behind T Tau.

The requested ACS exposures will fill three HST orbits. Eight 11 minute F140LP exposures can be obtained in two orbits and four 11 minute

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F165LP images in the third orbit. The on-source image will have maximum count rates of 16 ct/sec/pixel for F140LP and 5 ct/sec/pixel for F165LP, corresponding to nominal signal-to-noise (S/N) of 250 and 130 in each individual exposure, respectively. While the higher count rate is within a factor of 3 of the local bright limit, the UV spectrum of T Tau is well known and stable in the wavelength range of interest. Using the bright H2 knot south of T Tau as a test case, for 11 minute exposures each 2x2 pixel resolution element will have a S/N of 9 for F140LP and 2 for F165LP. Thus the combined exposures should have S/N approaching 25 and 4 per resolution element respectively. Therefore, H2 with a surface flux 15% of the brightest knots should be imaged with a S/N of 4 per resolution element, without any binning of the images.

Proposal 10489 - Visit 01 - Imaging Extended UV H2 Emission Around T Tauri

Mon Jun 20 16:38:10 GMT 2005

Visit		Proposal 10489, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/SBC Special Requirements: (none)								
Fixed Targets		# Name (1) HD284419 Alt Name1: T-TAU	Target Coordinates RA: 04 21 59.4345 (65.4976438d) Dec: +19 32 6.43 (19.53512d) Equinox: J2000 Plate Id: (?)	Targ. Coord. Corrections	Fluxes V=9.6	Miscellaneous Coordinate Source: HIPPARCOS/TYCHO_CATALOGUE				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures		# Label Target Config,Mode,Aperture Spectral Els. Opt. Params. Special Reqs. Groups Exp. Time/[Actual Dur.] Orbit	1 (1) HD284419 ACS/SBC, ACCUM, SBC F165LP	670.0 Secs X 4 [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)]	[1]					
2 (1) HD284419 ACS/SBC, ACCUM, SBC F140LP	675.0 Secs X 4 [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)]	[2]								
3 (1) HD284419 ACS/SBC, ACCUM, SBC F140LP	670.0 Secs X 4 [==>682.0 Secs (Copy 1)] [==>682.0 Secs (Copy 2)] [==>682.0 Secs (Copy 3)] [==>682.0 Secs (Copy 4)]	[3]								





