11336 - X-RAY AND UV PHOTOION IZATION AND PHOTOEXCITATION OF PRE-MAIN-SEQUENCE STAR TRANSITIONAL DISKS

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Alexander Brown (PI)	**University of Colorado at Boulder**	**ab@casa.colorado.edu**
Ms. Joanna M. Brown (CoI)	California Institute of Technology	jmb@astro.caltech.edu
Dr. Gregory J. Herczeg (CoI)	California Institute of Technology	gregoryh@astro.caltech.edu
Dr. Frederick M. Walter (CoI)	State University of New York at Stony Brook	fwalter@astro.sunysb.edu
Dr. Thomas R. Ayres (CoI)	University of Colorado at Boulder	ayres@casa.colorado.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) GM-AUR	ACS/SBC	3	18-Jan-2008 07:49:15.0	yes

3 Total Orbits Used

ABSTRACT

Transitional disks are one of the most crucial and important stages of the evolution of pre-main-sequence stars and protoplanetary systems. These disks have transformed most of the dust and gas in their inner regions into planetesimals and show clear inner ``holes" that almost certainly harbor infant planetary systems. We propose to observe 3 young stars with transitional disks (T Cha, GM Aur, LkHa 330) using ACIS-S to measure their X-ray radiation field and coronal emission properties and HST ACS-SBC to image the fluorescently excited molecular hydrogen in these systems to

determine if the gas distribution follows the behavior seen in the dust distribution. [Only observations of GM Aur were approved.]Our broader goal is to model the X-ray/UV photoionization and photoexcitation of the disks and study their photochemistry.

OBSERVING DESCRIPTION

We shall obtain ACS-SBC imaging of the circumstellar H_2 emission surrounding the pre-main-sequence star GM Aur. Based on our previous UV spectroscopic observations there is strong evidence that extended H_2 emission is present associated with the star's circumstellar disk and that the SBC spatial resolution can provide spatially-resolved images of the emission. The STIS G140L UV spectrum of GM Aur was observed by Bergin et al. (2004, ApJ, 614, L133).

The star will be imaged using the ACS SBC detector and the F140LP and F165LP filters. The ACS exposures will require three HST orbits to obtain the SBC longpass images of GM Aur. This observing procedure is identical to that which we used to observe the young star T Tau in Cycle 14 (GO 10489), except that a 4-point dither pattern has been used. Three orbits provide cumulative exposures of 5.0 ksec and 2.5 ksec for F140LP and F165LP respectively.

When an F165LP image is subtracted from an F140LP image, a well-defined, effective passband of 1350 - 1650 A results, and the off-star signal is dominated by H_2 emission. The F165LP image is an important control to characterize the presence of any reflection nebulosity and other confusing (non-H_2) features. 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 H_2 lines. The F165LP passband contains only a small amount of H_2 flux. At the 140 pc distance of the Taurus-Auriga star formation region [GM Aur] 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 PMS star, that is difficult to observe any other way. The PSF is measured to be 0.12 arcsec FWHM in our T Tau images, which is small compared to structures such as the 0.3 arcsec hole (Calvet et al. 2005, ApJ, 630, 185) in the GM Aur disk. GM Aur should not violate the ACS MAMA bright limits even for the pixels containing the stellar point source. The nearest other comparable star is located 28 arcsec away. We are able to derive reliable signal-to-noise estimates for GM Aur, because it already has suitable UV spectra. The on-source image will have 16 ct/sec/pixel for F140LP and 5 ct/sec/pixel for F165LP; such count rates are at levels of less that 1/3 of the local bright limit. The observed spectral flux from GM Aur is almost identical to that of T Tau (actually a few percent lower), so we expect no saftety issues based on our previous successful imaging of T Tau.

Visit

Proposal 11336, Visit 01, implementation Fri Jan 18 12:49:21 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3)

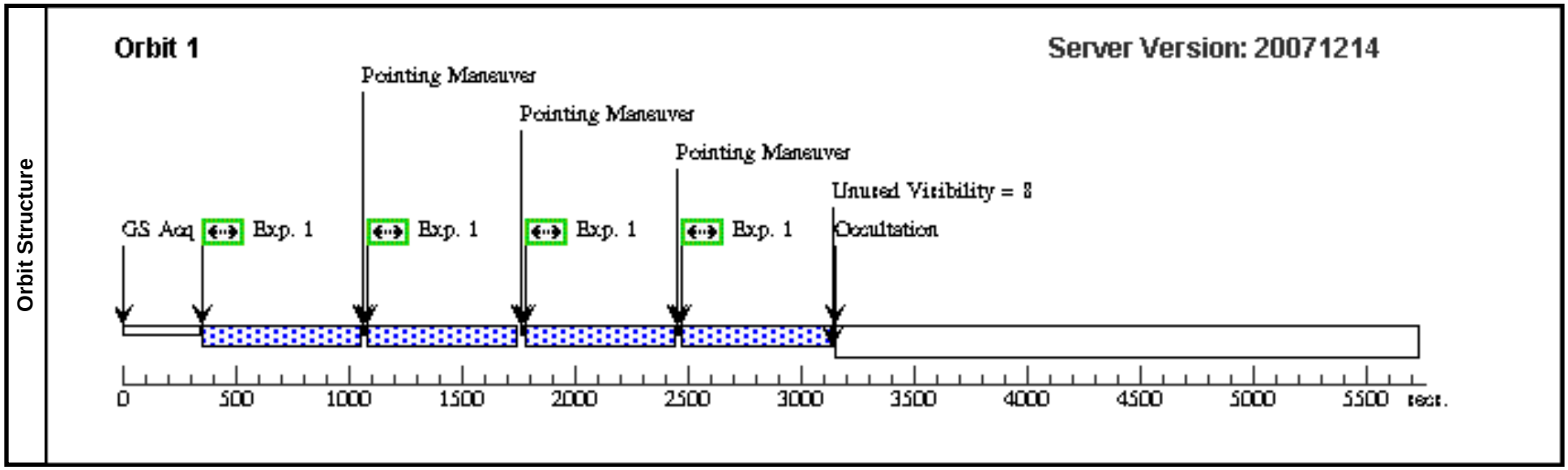
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GM-AUR	RA: 04 55 10.9770 (73.7957375d) Dec: +30 21 59.38 (30.36649d) Equinox: J2000		V=12.19	Reference Frame: ICRS

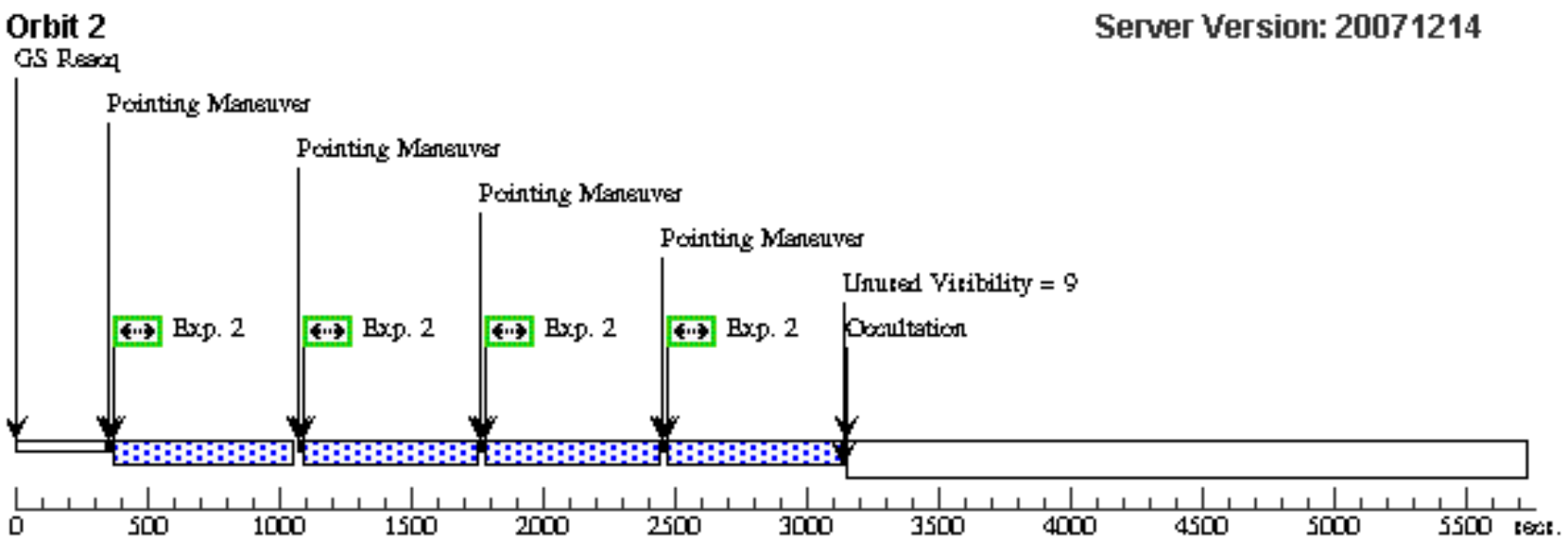
Comments: Coordinates taken from "Pre-main Sequence star proper Motion Catalogue" (Ducorant et al. 2005, A&A, 438, 769).

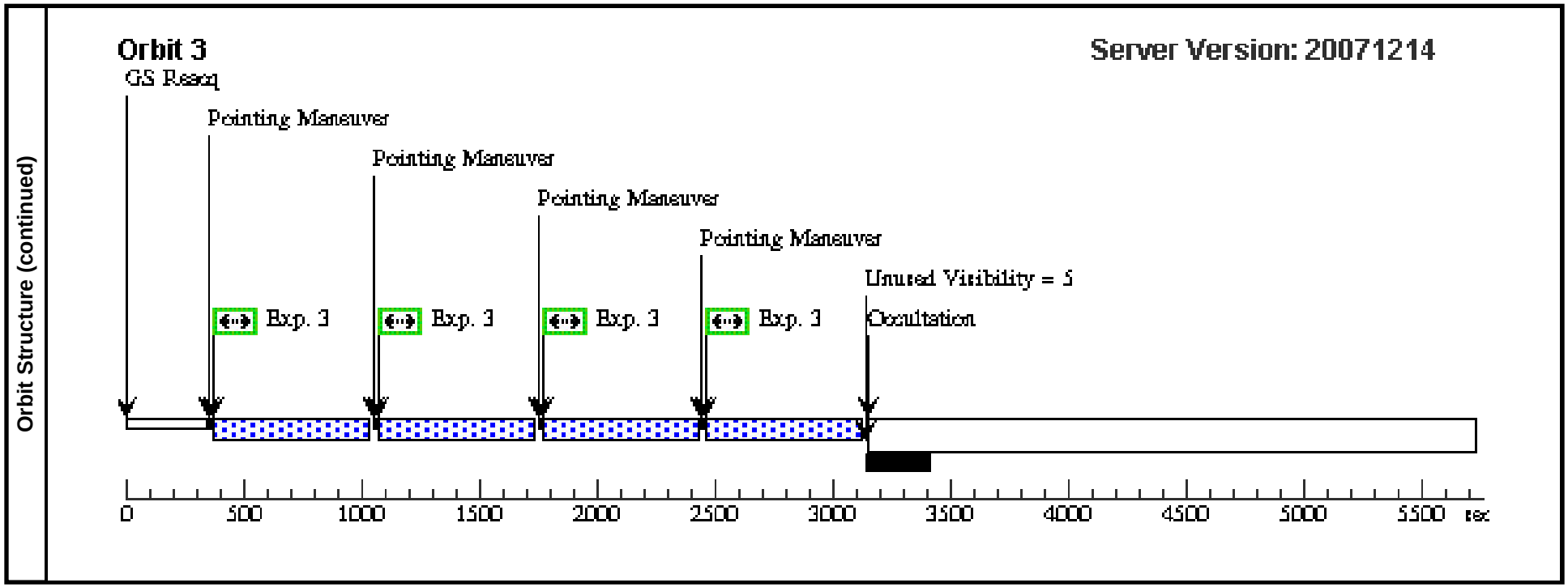
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	GMAUR_F165LP	(1) GM-AUR	ACS/SBC, ACCUM, SBC	F165LP			Pattern 1-1 (1)	632.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	GMAUR_F140LPa	(1) GM-AUR	ACS/SBC, ACCUM, SBC	F140LP			Pattern 2-2 (1)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	GMAUR-F140LPb	(1) GM-AUR	ACS/SBC, ACCUM, SBC	F140LP			Pattern 3-3 (1)	638.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***


Orbit Structure
Orbit 1
Server Version: 20071214
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 8
GS Acq
Exp. 1
Exp. 1
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec.

Orbit Structure (continued)




Orbit Structure (continued)
Orbit 3
Server Version: 20071214
GS Reacq
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 5
Occultation
Exp. 3
Exp. 3
Exp. 3
Exp. 3
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec