13465 - Alpha Cen: Climbing out of a Coronal Recession? (year 3 continuation)

Cycle: 21, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Thomas R. Ayres (PI) (Contact)	**University of Colorado at Boulder**	**thomas.ayres@colorado.edu**

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
10	(1) HD128620 (2) HD128621-1	STIS/CCD STIS/FUV-MAMA	2	20-Aug-2013 21:27:28.0	yes
11	(1) HD128620 (3) HD128621-2	STIS/CCD STIS/FUV-MAMA	2	20-Aug-2013 21:27:42.0	yes

4 Total Orbits Used

ABSTRACT

Nearby Alpha Centauri contains the two best characterized G and K dwarfs, next to the Sun itself, thanks to the accurate orbit, resolved angular diameters, and well understood co-evolutionary state. Alpha Cen A & B also have the best studied stellar X-ray activity cycles, extending back to the 1970's. Present proposal is to continue tracking the evolving multi-decadal high-energy narrative of Alpha Cen with semiannual HRC-I pointings in Cycles 13-15, as solar twin A is expected to be rising to cycle maximum following an extended coronal recession. STIS E140M spectra will support and leverage the broad-band X-ray measurements by probing subcoronal dynamics and providing a low-T boundary condition for DEM modeling, with connection to the X-rays through the FUV Fe XII coronal forbidden line.

OBSERVING DESCRIPTION

The STIS observations are straightforward. Alpha Cen falls in the HST Continuous Viewing Zone numerous times during the year, allowing the two stars to be captured in a single visit of just two orbits. Two such visits (four orbits total), about six months apart, are contemplated for Cycle 21, compatible with the semiannual pointings by Chandra. There is no need to strictly coordinate the FUV and X-ray visits, because the FUV Fe XII coronal forbidden line can tie the STIS observation into the X-ray framework.

In each HST/STIS visit, the binary companions are observed sequentially, beginning with Alp Cen A, the brighter of the two stars. The target is acquired with the CCD and F25ND5, followed by a 4.3 ks exposure with the E140M-1425 medium-res echelle through the photometric slot (0.2x0.2), which delivers R=40,000 and good sensitivity (peak S/N=60 per resol at the tops of the important Si IV and C IV resonance lines). The observation is split into three subexposures to mitigate instrumental drifts. The exposure depth is sufficient to capture the key Fe XII 1242 coronal forbidden line, which as mentioned earlier is used to tie the STIS FUV measurements into the X-ray timeline. Following the E140M exposure, a ~5" offset manuever is performed to Alp Cen B, and a peak-up is performed in dispersed light (G430L) with the 0.3x0.05ND filtered slit to precisely locate the target. This particular slit was chosen because the default peak-up sweeps out a sufficient area (0.3"x0.3") to capture the B component, given that the time-dependent separation of the binary companions is accurately known (to the 0.1" level; based on five years of measurements by Chandra HRC-I). After the peak-up, a second 4.3 ks E140M exposure through the photometric aperture is obtained on B. Given that the AB orbital separation is changing relatively rapidly in the present epoch, Alp Cen B was specified as two separate targets, with different offsets, to reflect the orbital evolution over the six months between the two STIS visits.

Visit

Proposal 13465, Visit 10, implementation Wed Aug 21 01:27:51 GMT 2013

Diagnostic Status: No Diagnostics

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

Special Requirements: CVZ; BETWEEN 12-FEB-2014:00:00:00 AND 13-FEB-2014:23:59:59

Comments: This is first CVZ opportunity roughly 6 months after final Visit of program 13060 (of which this is a third year continuation)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD128620	RA: 14 39 29.3800 (219.8724167d)	Proper Motion RA: -3.82 arcsec/yr	V=-0.1+/-0.1	Reference Frame: ICRS
	Alt Name1: ALP-CEN-A	Dec: -60 49 58.40 (-60.83289d)	Proper Motion Dec: +0.31 arcsec/yr	FUV peak fluxes are 5E-12 per Angstrom (excluding Lyman-alpha, which is ~ 8E-11)	
		Equinox: J2000	Parallax: 0.747"		
			Epoch of Position: 2013.480		
			Radial Velocity: 24 km/sec		

Comments: The target coords for epoch 2013.480 were obtained from a global fit to high-precision Chandra HRC images, and includes the parallactic shift at that time. The effective proper motion of Alpha Cen A was determined from the best-fit Center-of-Mass proper motion of the system, based on eight years of Chandra HRC-I measurements, accounting for parallax in each epoch; together with a orbital solution from a recent ephemeris modified slightly to better fit the HRC relative orbit in recent years: Alpha Cen AB are moving toward a close approach (on the sky) in 2016, consequently the orbital motion of A has a significant influence on its apparent proper motion.

(2)	HD128621-1	Offset from HD128620		V=1.33+/-0.1	Offset Position (HD128621-1)
	Alt Name1: ALP-CEN-B	RA Offset: -0.587 Secs			
		Dec Offset: 0.603 Arcsec			

Comments: Offset of B relative to A determined from the slightly modified ephemeris, which closely matches the relative orbit as recorded by Chandra HRC in recent years.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.235462)	(1) HD128620	STIS/CCD, ACQ, F25ND5	MIRROR		GS ACQ SCENARIO BASE1B3		0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***

Comments: Castelli and Kurucz Models:G2V;Time to Saturation (for a single exposure) = 2.3 seconds ; Optimum SNR = 179

2	(STIS.sp.235468)	(1) HD128620	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				1425 Secs X 3 (4275 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[1]***

Comments: input=StarCAT ETC file for ALP-CEN-A; Exposure time= 4.3 ks at wavelength 1393.80 Å gives: SNR = 58 (per resol); Brightest Pixel (at 1215.40 Å)= 1.8 cps; peak S/N~200 at Lyman-alpha

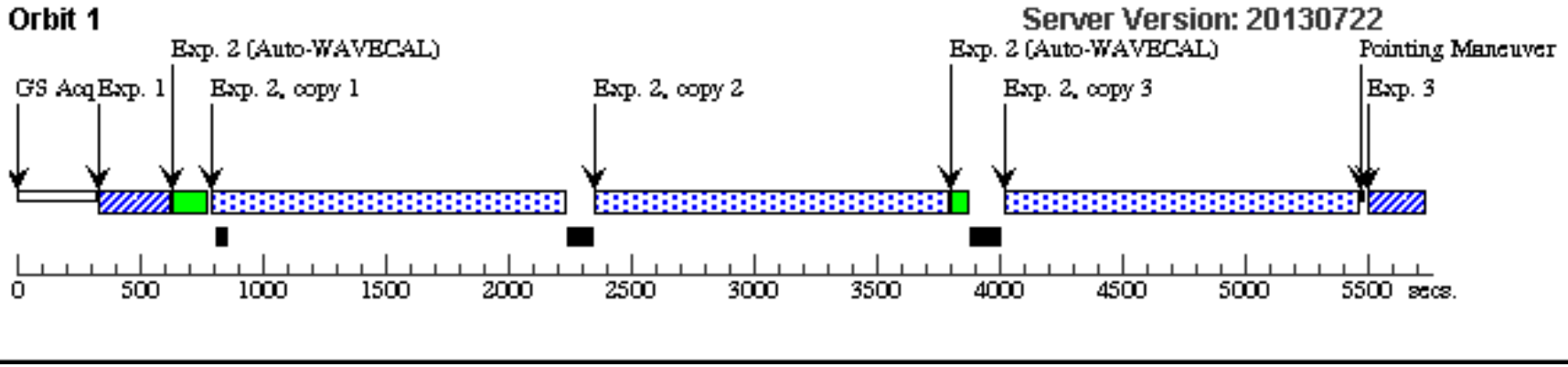
3	(STIS.sp.235634)	(2) HD128621-1	STIS/CCD, ACQ/PEAK, 0.3X0.05ND	G430L 4300 A				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***

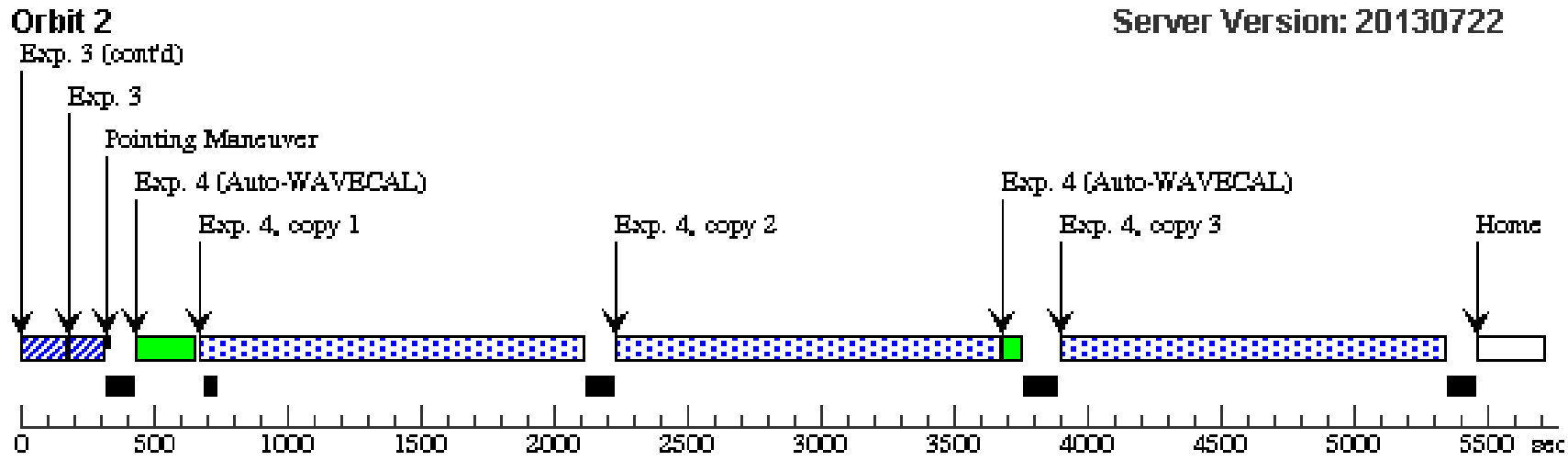
Comments: dispersed light peak-up assuming Castelli-Kurucz Models K0V, V=1.33 mag: at wavelength 5000 Å in 0.1 s, SNR ~ 15 (per resol); Time to Saturation (for a single exposure) ~ 60 seconds. ETC calculation done with 52x0.05 slit, then scaled to 0.3x0.05ND aperture by factor 0.001 (ND=3), as verified by comparing throughputs indicated by separate ETC TARG ACQ runs (without disperser) with ND ap and clear apertures.

4	(STIS.sp.235468)	(2) HD128621-1	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				1425 Secs X 3 (4275 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[2]***

Comments: ETC run is for ALP-CEN-A, which has very similar spectrum to ALP-CEN-B in observed flux densities

Orbit Structure





Visit

Proposal 13465, Visit 11, implementation Wed Aug 21 01:27:53 GMT 2013

Diagnostic Status: No Diagnostics

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

Special Requirements: CVZ; BETWEEN 24-JUL-2014:00:00:00 AND 27-JUL-2014:23:59:59

Comments: This is next available CVZ opportunity roughly six months after first Visit.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD128620 Alt Name1: ALP-CEN-A	RA: 14 39 29.3800 (219.8724167d) Dec: -60 49 58.40 (-60.83289d) Equinox: J2000	Proper Motion RA: -3.82 arcsec/yr Proper Motion Dec: +0.31 arcsec/yr Parallax: 0.747" Epoch of Position: 2013.480 Radial Velocity: 24 km/sec	V=-0.1+/-0.1 FUV peak fluxes are 5E-12 per Angstrom (excluding Lyman-alpha, which is ~ 8E-11)	Reference Frame: ICRS

Comments: The target coords for epoch 2013.480 were obtained from a global fit to high-precision Chandra HRC images, and includes the parallactic shift at that time. The effective proper motion of Alpha Cen A was determined from the best-fit Center-of-Mass proper motion of the system, based on eight years of Chandra HRC-I measurements, accounting for parallax in each epoch; together with a orbital solution from a recent ephemeris modified slightly to better fit the HRC relative orbit in recent years: Alpha Cen AB are moving toward a close approach (on the sky) in 2016, consequently the orbital motion of A has a significant influence on its apparent proper motion.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	HD128621-2 Alt Name1: ALP-CEN-B	Offset from HD128620 RA Offset: -0.558 Secs Dec Offset: 0.974 Arcsec		V=1.33+/-0.1	Offset Position (HD128621-2)

Comments: Offset of B relative to A determined from the slightly modified ephemeris, which closely matches the relative orbit as recorded by Chandra HRC in recent years.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.235462)	(1) HD128620	STIS/CCD, ACQ, F25ND5	MIRROR		GS ACQ SCENARIO BASE1B3		0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***

Comments: Castelli and Kurucz Models:G2V;Time to Saturation (for a single exposure) = 2.3 seconds ; Optimum SNR = 179

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	(STIS.sp.235468)	(1) HD128620	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				1425 Secs X 3 (4275 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[1]***

Comments: input=StarCAT ETC file for ALP-CEN-A; Exposure time= 4.3 ks at wavelength 1393.80 Å gives: SNR = 58 (per resol); Brightest Pixel (at 1215.40 Å)= 1.8 cps; peak S/N~200 at Lyman-alpha

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
3	(STIS.sp.235634)	(3) HD128621-2	STIS/CCD, ACQ/PEAK, 0.3X0.05ND	G430L 4300 A				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***

Comments: dispersed light peak-up assuming Castelli-Kurucz Models K0V, V=1.33 mag: at wavelength 5000 Å in 0.1 s, SNR ~ 15 (per resol); Time to Saturation (for a single exposure) ~ 60 seconds. ETC calculation done with 52x0.05 slit, then scaled to 0.3x0.05ND aperture by factor 0.001 (ND=3), as verified by comparing throughputs indicated by separate ETC TARG ACQ runs (without disperser) with ND ap and clear apertures.

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
4	(STIS.sp.235468)	(3) HD128621-2	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				1425 Secs X 3 (4275 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[2]***

Comments: ETC run is for ALP-CEN-A, which has very similar spectrum to ALP-CEN-B in observed flux densities

Orbit Structure