10486 - A Cosmic String Lens Candidate

Cycle: 14, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets*	*Configurations*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CSL-1	ACS/WFC	3	20-Jun-2005 12:16:10.0	yes

3 Total Orbits Used

ABSTRACT

We propose two-band imaging observations with ACS of a cosmic string lens candidate, CSL-1, to look for a feature predicted by the cosmic string model: a low-surface brightness discontinuity in between the two galaxy images.

OBSERVING DESCRIPTION

We were awarded 3 orbits to observe the gravitational lens candidate CSL-1. It is necessary that we either 1) detect the discontinuity in the light profile that would be produced in the scenario where a cosmic string is present, or 2) we recover the light profile expected from 2 elliptical galaxies

(z=0.46) separated by 1.9 arcsec in the scenario where there is no cosmic string. We must expose long enough to image the second scenario, otherwise a non-detection of a discontinuity would not be evidence of the absence of a string.

We used the properties of CSL-1 listed in Sazhin et al. 2003 and calculated the lowest surface brightness in the area between the two galaxies to be around 22 mag arcsec^-2 in the Johnson R band. We therefore desire exposures at least 4200 s and 2000 s long in filters F625W and F775W respectively (calculated using the Exposure Time Calculator on the HST website) using WFC on ACS. These times are calculated to result in a signal to noise slightly better than 10 per 2x2 pixel region, and they were chosen to minimize the exposure time and provide color information. We defined a single visit and placed CSL-1 to fall in a region of the WFC chip that uses a single amplifier (using the POS-TARG offset command.)

We obtained the coordinates of CSL-1 from Alcala et al. (2004, A&A, 428, 339). We packed our orbits using the orbit planner in APT. We decided to split F625W observations into 4 exposures taken over 2 orbits, dithering a box pattern between exposures to reject cosmic rays and hot pixels. The F775W observations were packed with 3 exposures over 1 orbit, dithering with a line pattern. The orbit planner shows a total of 5062 and 2409 seconds exposing our target in F625W and F775W respectively, easily providing the requisite signal to noise.

The visit planner in APT shows CSL-1 being visible for only 2-3 weeks during cycle 14. Our program has no special time requirements. We can therefore split our observations into multiple visits if necessary due to possible scheduling constraints imposed by the limited source visibility.

The data reduction will not require any special processing. We will utilize the cosmic-ray rejection and image combining from the pipeline, carrying out a deconvolution of the images using Tiny Tim, and fit the deconvolved images with (a) a gravitational lens model (using the publicly available code of Chuck Keeton); (b) a cosmic string lens model; and (c) two elliptical galaxy models. We will quantify the statistical significance of each fit with a maximum likelihood analysis, and determine at what confidence we can reject the gravitational lens and two-elliptical galaxy models (assuming predicted cosmic-string edge shows up in the data). In the two-elliptical galaxy fit, we will extract parameters such as central brightness, ellipse axis sizes and orientations. The string model predicts that the galaxies should be clones, (i.e. the same in both images, with the same parity.) If the parameter fits rule out the images being the same within errors, we can rule out the string. On the other hand, if the images are consistent with being the same to interesting precision, it is evidence for a string even if the discontinuity is not seen. That would be grounds for a followup proposal to find the edge.

Visit

Proposal 10486, Visit 01 Mon Jun 20 16:16:20 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.1 Center Pattern=true		(1)
(2)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.3 Angle Between Sides= Center Pattern=false		(2)

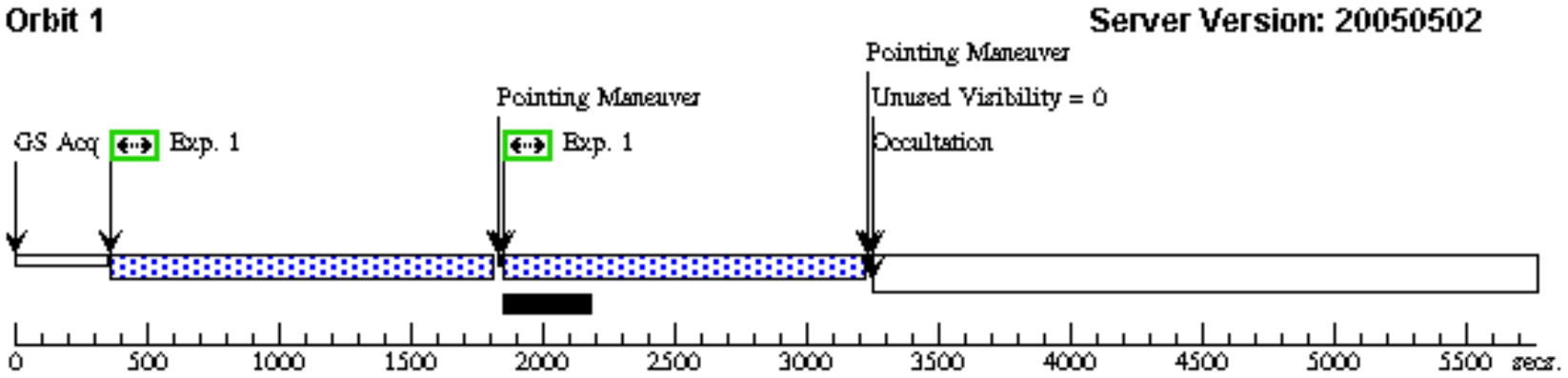
Fixed Targets

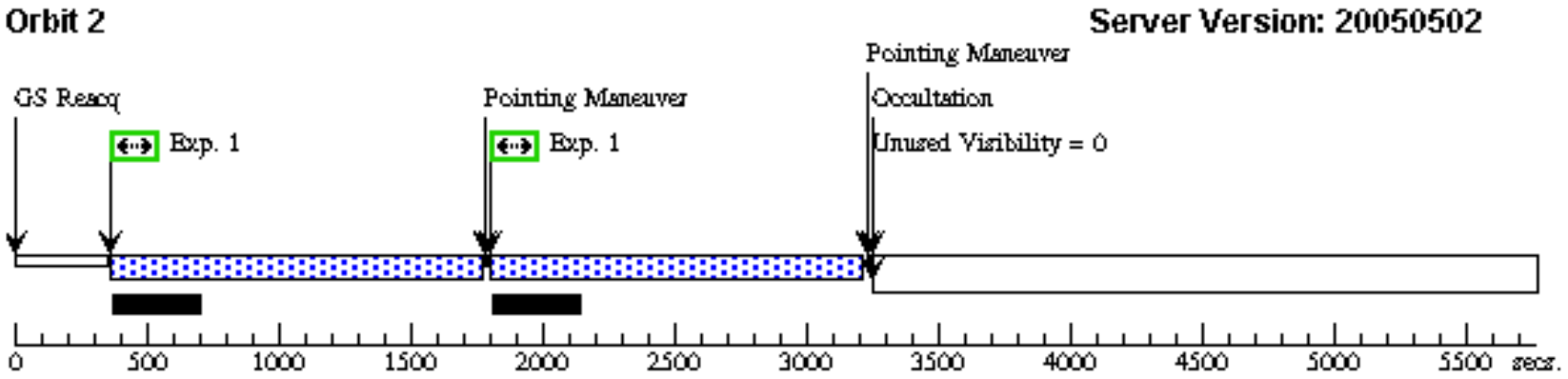
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CSL-1	RA: 12 23 30.6040 (185.8775167d) Dec: -12 38 56.89 (-12.64914d) Equinox: J2000 Plate Id: (?)	Redshift: 0.463	V=20.71+/-0.03	Coordinate Source: Alcala et al. 2004, AA, 428, 339

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	csl-1-r1	(1) CSL-1	ACS/WFC, ACCUM, WFC2	F625W	CR-SPLIT=NO	POS TARG 40,0	Pattern 1-1 (1)	1100.0 Secs	
								[==>1245.0 Secs (Pattern 1)] *[==>1245.0 Secs (Pattern 2)]*	***[1]***
								[==>1286.0 Secs (Pattern 3)] *[==>1286.0 Secs (Pattern 4)]*	***[2]***
2	csl-1-i1	(1) CSL-1	ACS/WFC, ACCUM, WFC2	F775W	CR-SPLIT=NO	POS TARG 40,0	Pattern 2-2 (2)	750.0 Secs	
								[==>803.0 Secs (Pattern 1)] *[==>803.0 Secs (Pattern 2)]* *[==>803.0 Secs (Pattern 3)]*	***[3]***

Orbit Structure





Orbit Structure (continued)