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CLASS: Cosmic Lens All–Sky Survey

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Abstract. The Cosmic Lens All-Sky Survey (CLASS) is aimed at identifying lenses where multiple images are formed from compact flat-spectrum radio sources. In four observing "seasons" with the VLA A-array at 8.45 GHz in 1994, 1995, 1998 and 1999, CLASS has observed over 12,000 radio sources. When combined with the JVAS survey, the CLASS sample contains over 15,000 images and at least 17 lenses, with 11 so far in CLASS as well as a number of candidates still being followed up. In this poster, we present a summary of the CLASS observations, the JVAS-CLASS sample, and statistics on subsamples of the survey.

The Cosmic Lens All-Sky Survey (CLASS, most recently described in Myers et al., 1999) is an international (USA, UK and Netherlands) collaborative project to create the largest and best–studied statistical sample of radio-loud gravitationally lensed systems. With this survey, combined with detailed studies of the lenses found therein, powerful constraints can be placed on the cosmography (i.e., expansion rate, mean density, and cosmological constant) of the Universe. CLASS is aimed at identifying lenses where multiple images are formed from compact flat-spectrum radio sources. These lens configurations should be easily identifiable in the radio maps. Thus, CLASS is most efficient at finding galaxy-mass lenses (which will dominate the counts for surveys not targeted at clusters) with separations of around a few arcseconds. CLASS will also be able to detect more extreme lensed systems with larger separations, which are due to clusters of galaxies. Of course, the CLASS database will also contain a rich sample of radio galaxies and quasars for the study of AGN phenomena.

The parent catalog finally adopted for CLASS was the GB6 (Gregory et al. 1996) at 4.85 GHz, and spectral selection was done versus the NVSS (Condon et al., 1998) at 1.4 GHz. To obtain compact multiply-imaged components, we exclude sources with spectral index $\alpha < -0.5$ between 4.85 GHz and 1.4 GHz, where $S \propto \nu^{\alpha}$ where ν. This is designated as the "CLASS-NVSS Statistical Sample", which consists of 11685 targets with a GB6 flux density of 30 mJy or more, an NVSS source within 70″ of the GB6 position, and a spectral index $\alpha \geq -0.5$ versus NVSS. If we include the JVAS sources (Patnaik et al., 1992; Browne et al., 1998; Wilkinson et al., 1998), we then have a total of over 15000 sources observed.

The Very Large Array (VLA) is being used as the primary instrument for the CLASS survey. In its largest "A" configuration, the VLA provides high-quality

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images with an angular resolution of 0.2 arcseconds at our average observing frequency of 8.45 GHz. For all CLASS observations, an on-source dwell time of 30 seconds was used, with 3.3-second integrations. A compact source from the JVAS calibrator list was observed after every 10–14 target sources for phase calibration. We were able to observe one target source per minute, including the overhead from observing calibration sources and slewing between sources.

The initial editing and calibration of the data was done using AIPS following the standard procedure. A cross–check of sources which were observed twice during the CLASS sessions and calibrated independently gives an rms position difference of 35.2 mas. This is in line with our expected uncertainties due to the JVAS position errors.

The single-source data were then processed automatically in DIFMAP. The *automap* algorithm can be outlined as follows: (1) Primary Cycle – find peaks in large image above some SNR cutoff; (2) Secondary Cycle – move to location of peak, make small image, find peaks in small image and create CLEAN window; (3) Tertiary Cycle – deconvolve and self–calbrate iteratively.

The main data product of the auto-mapping procedure are the Gaussian MODELFIT results, which were filtered to select candidates with multiple components, and further filtered to find those with multiple compact components. From this list of around 1000 multiple sources the 10's of lenses must be found! So far, CLASS has discovered 11 new radio-loud gravitational lens systems and at least one probable binary AGN (quasar). In addition, there are a number of candidate lenses still being followed-up by the team.

It is planned to release the entire CLASS database as soon as the survey is completed, uniformly calibrated, and verified. This will likely occur in late 1999. In the meantime, if there is something specific from the survey that you need, contact the author. For details, see the UPenn CLASS page:

http://www.physics.upenn.edu/myers/class.html

The full version of this poster can be found at:

http://www.physics.upenn.edu/myers/class/boston/

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