

## The SuperCOSMOS Sky Surveys

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**Abstract.** The SuperCOSMOS Sky Surveys (SSS) programme is digitising multi-colour (BRI), multi-epoch Schmidt survey plates with the ultimate aim of covering the entire sky. The R-band is covered at two epochs. The object catalogue and compressed pixel data are stored online and are accessible via the WWW. Coordinates, magnitudes, morphological data and proper motions are available for all objects down to  $B \sim 22$ ,  $R \sim 20$  and  $I \sim 19$ . The survey is available on-line at: <http://www-wfau.roe.ac.uk/sss>.

### 1. SuperCOSMOS

SuperCOSMOS is an ideal machine for large scale survey work. Important characteristics of the machine include:

- fast scanning time: SuperCOSMOS scans a  $320 \times 320$  mm area of the Schmidt plate in  $\sim 2.5$  hours.
- positional accuracy: the design of the machine and environmental control enable relative positional measurements at a precision of  $\sim 0.5 \mu\text{m}$
- good dynamic range and 16-bit digitisation in  $10 \mu\text{m}$  pixels: these are well matched to the image quality of the photographic atlases.

### 2. Available Services

The SSS data consist of object catalogues to the plate limits from BRI plates including astrometric and photometric calibration. Colours, proper motions, image classification and morphological parameters are available. H-compressed pixel data are available in small FITS file subsets with included object catalogues. In relation to the SSS data, the Wide-Field Astronomy Unit (WFAU) currently offers online queries for:

- small area (up to 15 arcmin) pixel images with attached object catalogue,
- medium-scale (up to  $10^\circ$ ) object catalogues with user-specified magnitude range and output format (FITS, ASCII or tab-separated),
- multiple object small pixel images in batch mode.

Whole-sky catalogue access and analysis online is currently being planned.

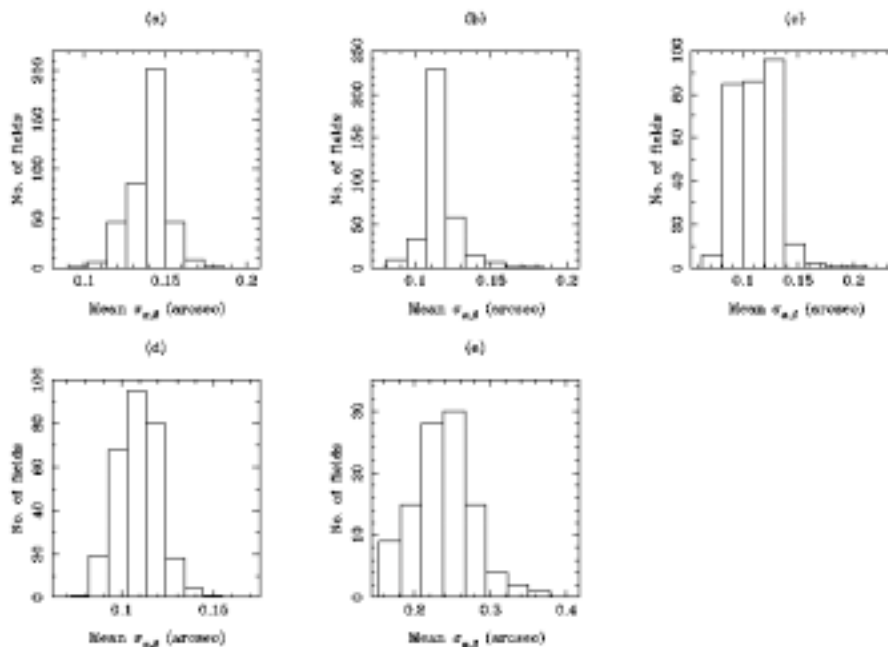


Figure 1. Astrometric residuals from Tycho-2 standards. Five panels show: (a) SERC J/EJ, (b) SERC ER/AAO-R, (c) SERC-I, (d) ESO-R and (e) POSS-I E. Modal values are in the range 0.1 to 0.2 arcsec.

### 3. Astrometric and Photometric Calibration

Absolute positions are calibrated with respect to the Tycho-2 catalogue while proper motions are zero-pointed on the extragalactic frame using the images of galaxies. The initial photometric calibration is based on the Guide Star Photometric Catalogue I; in due course we plan to recalibrate using GSPC-II.

Figure 1 shows histograms of the mean RMS residual per star per plate in either coordinate for Tycho-2 reference catalogue stars.

For quasar images from Veron-Cetty & Veron (1998), Figure 2 shows distributions of residual X- and Y-displacement (between first and second epoch plates) and indicates that the zero point of proper motions is truly extragalactic.

### 4. WWW Interface

Most people will interrogate the South Galactic Cap (SGC) database via the World Wide Web. An interface has been set up to enable subsets of the large database to be extracted. The primary data format is FITS for both images and binary tables of object catalogues, which enables porting of the data into established software packages. Object catalogues are additionally available in plain text format for readability. Basically, the user specifies the region of interest (up to 15 arcmin for images and up to several 100 square degrees for object

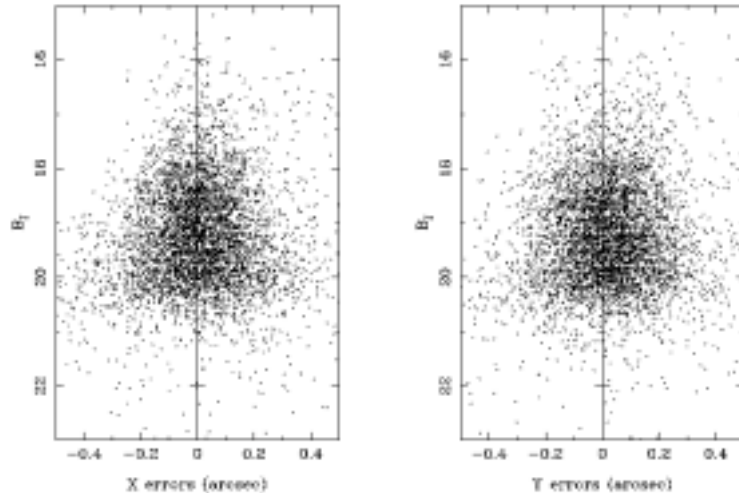


Figure 2. Distributions of residual X- and Y-displacement as a function of  $B_J$  magnitude in QSO images for the entire South Galactic Cap survey.

catalogues) and a primary colour; FITS files are then efficiently extracted and sent back to the user's home institute for browsing and manipulation.

## 5. Accuracy of Parameters

As is usual with measurements from wide field Schmidt plates, the external astrometric and photometric accuracies of the data are limited by position- and magnitude-dependent systematic errors. However, the internal accuracy (i.e., when comparing image data in restricted position and magnitude ranges) is unaffected by this, and for some astronomical applications it is the internal accuracy that is important. Typical numbers for the astrometric and photometric precision for well-exposed stellar images are as follows:

- $\sigma_{\alpha,\delta} \sim 0.05$  arcsec;  $\sigma_{B,R,I} \sim 0.05$  mag;  $\sigma_{\mu} \sim 5$  milliarcsec/yr (internal)
- $\sigma_{\alpha,\delta} \sim 0.3$  arcsec;  $\sigma_{B,R,I} \sim 0.3$  mag;  $\sigma_{\mu} \sim 10$  milliarcsec/yr (external)

## 6. Completeness and Reliability

Completeness and reliability of image classification of the SGC data have been assessed by comparison against external datasets. We find that the completeness is essentially 100% to within 1.5 mag of the nominal plate limits ( $B_J=21.5$ ,  $R=20.5$ ,  $I=17.5$ ). For the  $B_J$  data we find that the image classification is  $> 90\%$  reliable to  $B_J \sim 20.5$ . The limiting factor for reliable image classification is the resolution of the photographs coupled with the typical angular size of galaxies as a function of magnitude: at  $B_J=20$ , the typical scale size of a galaxy is comparable to the resolution.

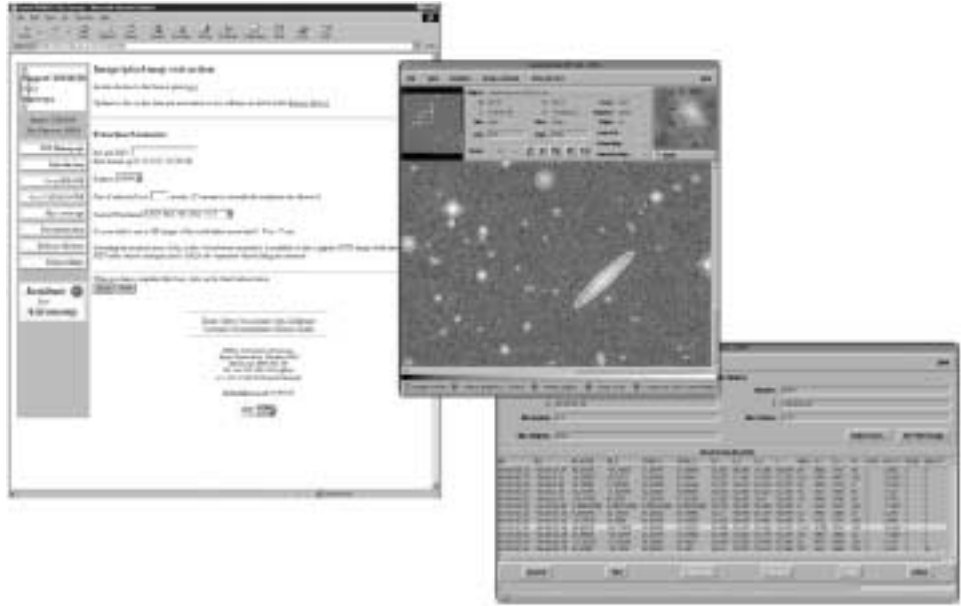


Figure 3. Extraction example using the GAIA/SkyCAT software.

## 7. Example

In the example shown in Figure 3, a 10 arcmin region has been extracted in the B band from a south galactic pole field containing a rich cluster of galaxies.

The data have been displayed using the GAIA/SkyCAT software. In this way, it is possible to browse the data by clicking on objects in the image display or the catalogue list to highlight them in both. All the catalogue parameters for a given object can then be examined (e.g., position, shape, brightness and classification).

## 8. Timescales

A 5000-square degree area centred on the SGC is available online now. By early 2001 we will have the entire southern sky available online in both J and second epoch R. The four-colour southern sky survey will be complete by mid-2002. It is hoped that we will then expand the survey into the northern hemisphere to cover the entire sky using the Palomar first and second epoch surveys.

## References

- Veron-Cetty, M.-P. & Veron, P. 1998, “A Catalogue of Quasars and Active Nuclei”, Garching, ESO Scientific Report Series Vol. 18