Digitisation of the Second Palomar Sky Survey: Program Definition and Status

1. The Second Palomar Sky Survey

The second Palomar sky survey (POSS-II) is still under way using the 48-inch Oschin Schmidt telescope at Palomar Observatory. For a brief description, see Reid et al. (1991). When completed, the photographic survey will consist of some 900 fields spaced at 5° intervals, covering the entire northern sky in three bands: blue-green (IIIa-J emul. + GG395 filt.), λ_{eff} ~ 480 nm; red (IIIa-F emulsion + RG610 filter), λ_{eff} ~ 650 nm; and near-IR (IV-N emulsion + RG9 filter), λ_{eff} ~ 850 nm. At the moment, approximately 50% of the J plates, 60% of the F plates, and 15% of the N plates of adequate quality are in hand. The survey should be 90 – 95% complete by early 1996.

The new survey reaches ~ 1^m – 1.5^m deeper than the old POSS-I, mainly due to the new fine-grain emulsions and the improved telescope optics; the gain would have been larger, but the Palomar sky is now much brighter than in the 1950s. The typical limiting magnitudes are:

$$B_J \sim 22.5,\ R_F \sim 20.8, \text{ and } I_N \sim 19.5$$

The fine grain emulsions and the better image quality make the classification of faint objects (stars versus galaxies) possible to a magnitude level at least 1^m – 2^m deeper than in the old survey. Photographic copies of the survey (glass and film) are being produced at the ESO photolabs in Garching and will be distributed to subscribers at cost.

2. The Digitization of POSS-II at STScI

There are presently *two* digitization efforts of POSS-II under way:

1. Digitisation of both the old POSS-I and the new POSS-II plates at the USNOFS by D. Monet et al. The main purpose of this project is to obtain proper motions for a large number of stars.
2. Digitization of POSS-II at STScI. (Glass copies of the POSS-I plates have been digitized by several groups, including STScI, RGO and U. of Minnesota.)

As reported in the previous newsletter, it is planned that the entire POSS-II will be digitized using the modified PDS plate scanners at STScI. A memorandum of understanding has been signed by STScI and Caltech to this effect, and the digitization of plates is now in progress. It is anticipated that the completion of the photographic survey and its digitization should roughly coincide (approximately 1995 – 1997 timeframe).

A description of the STScI POSS-II scanning parameters and quality control tests appears in an article by Lasker in this newsletter. Astrometric plate solutions will be provided for all fields by STScI. Photometric CCD calibration efforts are now under way at both STScI and Palomar. The scans, in a compressed form, will be distributed to the community, probably in CD-ROM format. The compression algorithm will result in no perceptible loss of photometric or astrometric accuracy.

3. Cataloging Efforts at Caltech

Caltech Astronomy and the Jet Propulsion Laboratory Artificial Intelligence Group are collaborating in the development of a system for constructing calibrated, object-classified catalogs from the digitized POSS-II (and also POSS-I, etc.). We employ a combination of existing packages (FOCAS and the SAS data analysis program library) and special-purpose machine learning and analysis software. The present system is capable of processing individual plates, while we continue to extend the system to be able to process and integrate multiple plate scans and CCD calibration data in an objective, uniform and (semi-)automatic fashion. The system will allow for continuous upgrading and re-calibration of the resulting Palomar Northern Sky Catalog as more CCD and plate

data are added in.

In the end, we expect to have a catalog of all objects (in at least two, but often three, bands) down to the POSS-II limit ($B_J \sim 22$ mag), with approximately 90% accurate star/galaxy classifications down to $B_J \sim 20.5 - 21$ mag. A description and preliminary results of the classification method we employ appear in the proceedings of the Digitised Optical Sky Surveys Workshop, 1991. We anticipate that this Palomar Northern Sky Catalog will contain up to 20 million galaxies, and over 100 million stars, including over 100 thousand quasars. A fragmentary release of the Catalog may begin within 2 years or so, with a nearly complete release within about 5 years from now. The Catalog will exist as a continuously upgraded data base, which may be accessed via computer network links.

In addition to the 'obvious' projects (homogeneous optical identifications for radio, IRAS, X-ray, etc., catalogs, studies of large-scale structure, including clustering of galaxies, clusters, active nuclei, generation of objective cluster catalogs, studies of Galactic structure using star counts, multicolor searches for high-z quasars, etc.), numerous new investigations should become possible with such a data base.

References

Reid, I.N., et al., 1991, *PASP*, **103**, 661.

Weir, N., and Picard, A., 1992, *A Comparison of Star/Galaxy Classification Approaches on Digitised POSS-II Plates*, in *Digitised Optical Sky Surveys*, eds. H.T. MacGillivray and E. Thomson, Kluwer, Dordrecht, p225.

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