

of Brazil the Southern part. Our colleague, Xu Tongqi, has reported on the Chinese General Catalogues.

For the formation of the North Catalogue of General Astrolabes (NCGA), the catalogues of Pulkovo, Paris, San Fernando and preliminary Chinese catalogues have been sent to Xu Jiayan. The NCGA is expected to be completed in 1995. For the South Catalogue (CGAS), Bénévidès, who took over from Clauzet after his untimely death, has reported the following progress. He has placed the work in the hands of J Rego, under his supervision, and it is hoped that the project will be completed in 1995, at the same time as the NCGA.

The linking of the two hemispheres, which is to be made simultaneously by both teams, will benefit, perhaps, from the application of the global method of reduction which Y Kolesnik has applied to the re-reduction of the Quito observations. By using all the modern global methods available, such as those of Bénévidès, Manabe et al., Chollet & Najid will not only provide positional catalogues, but also long series of time and latitude measurements, and improvements in the positions of planets and radio stars. The results will be improved further by re-reduction to the FK5 and eventually the HIPPARCOS catalogue.

2 Reports on formation of large photographic catalogues

2.1 The astrometric recalibration of the HST Guide Star Catalog (Bucciarelli)

Revision 1.2 of the HST Guide Star Catalog (GSC) is being prepared at the Space Telescope Science Institute for release to the astronomical community. This revision, which relies on the same x, y measurements as those of GSC 1.1, is based on a completely new plate reduction strategy. Specifically, the so-called mask method and sub-plate method (Taff, Lattanzi & Bucciarelli, ApJ 361, 667, 1990) are applied, and the 'best' solution is chosen on a plate-by-plate basis.

Another notable improvement, especially for the Southern hemisphere, comes from the use of the PPM North and South (Röser & Bastian, A&AS 74, 449, 1988), as well as the PPM Supplement (Röser, Bastian & Kuzmin, A&AS 105, 301, 1994), as reference catalogues. Moreover, the Carlsberg Meridian Circle Catalogue series (CMC4, CMC5, CMC6, CMC7, 1989, 1991, 1992, 1993, Copenhagen University Obs., Royal Greenwich Obs. and Real Instituto y Obs. de la Armada en San Fernando) are routinely used as an external, independent check on the final astrometric quality. The expected average positional accuracy of GSC 1.2 is $0''.45$. However, because of the non-optimal average density of the reference catalogues, some systematic errors at the plate edges, characterized by a plate-dependent signature, still remain. A magnitude equation very recently detected (Röser, private communication), presently not taken into account by the model, will be addressed and hopefully corrected in a subsequent version of the GSC.

2.2 TRC: 1 million star catalogue GSC-AC: 4 million star catalogue (Röser)

In cooperation with Copenhagen and Lund Observatories and the Sternberg Institute, Moscow, we will compile the Tycho Reference Catalogue (TRC). The Tycho experiment on HIPPARCOS will provide the positions of 1 million stars to $V=12$ mag with an accuracy of 30 mas. Proper motions of ~ 30 mas/yr are also expected. Much better proper motions can be derived from a combination of the Tycho measurements with the Astrographic Catalogue (AC) which contains 9 million measurements of ~ 4 million stars made at the beginning of this century. All these measurements, published in printed form, have been keypunched at the Sternberg Institute.

The AC has to be reduced to the HIPPARCOS system, which will be the key task in this project. Plate-dependent systematic errors, such as distortion, coma, magnitude and colour equations, have to be determined and removed for each observatory zone of the AC. After the successful reduction of the AC, we may expect proper motions with an average *rms*-error of 3 mas/yr in each coordinate over the whole sky.

TRC only exploits one quarter of the AC positions. It is desirable to have proper motions for all of the 4 million stars in the AC. The Guide Star Catalog (GSC) is the only source of modern epoch observations to be combined with AC. At present, GSC is being reduced to the system of PPM at STScI. A similar reduction is being performed at the ARI, together with an investigation of magnitude-dependent effects. A version of the GSC-AC catalogue on the PPM system is presently being compiled at ARI. After completion of the TRC catalogue, an ideal tool for the reduction of GSC will be available. As a result of this reduction, a systematically improved GSC on the HIPPARCOS system will be available. At a pessimistic guess, we expect the *rms*-error per GSC coordinate to be about $0''.35$. With this, the accuracy of the GSC-AC proper motions will be between 5 and 6 mas/yr.

2.3 CPC2: A status report (Zacharias)

The published Second Cape Photographic Catalog (CPC2) (Zacharias et al. A&A, 254, 397, 1992, de Vegt et al. A&AS, 97, 985, 1993) was based on a conventional plate adjustment (CPA). Since then several rigorous block adjustments (BA) have been performed with the data. All solutions showed a large difference (BA-CPA) in $\Delta\delta$ of about 100 mas at the end of the fourfold overlap pattern (i.e. at the equator). This effect disappeared after the removal of systematic errors in the x, y data as a function of location on the plate (field distortions), which amount to about $1.5 \mu\text{m}$ (= 150 mas). The field distortions were determined from the CPA residuals of all 5687 plates by using the SRS reference star catalog. By comparing field star positions on overlapping plates, a CPA of the data with applied corrections for field distortions improved the positions by about 10% with respect to previous results. Details can be found in Zacharias AJ 1995 (in preparation).

This experience shows again how easily a block adjustment can lead to bad results. A publication of this intermediate CPA or BA solution is not planned because of the imminence of the HIPPARCOS catalog which will allow a much improved plate model for a CPA and BA of the CPC2 data.

The final catalog is expected to be published in 1996.

2.4 APM Catalogues (Argyle)

A catalogue resulting from scans with the Automatic Plate Measuring (APM) machine of all POSS1 and currently existing UK Schmidt red and blue survey plates down to galactic latitude 20° is now available. The plates have been digitised with $0''.5$ pixels, resulting in an internal positional accuracy of $0''.1$ and an external accuracy of $0''.5$. The Northern Sky Catalogue is based on 6.2×6.2 degree scans of glass copies of the first epoch POSS O and E plates. The limiting magnitude is 21.5 for the O plates and 20 for the E plates. The Southern Sky Catalogue is based on 5.8×5.8 degree scans of glass copies of the UKST B_J sky survey and originals of the current UKST SES R survey. The limiting magnitude here is 22.5 for the B_J plates and 21 for the R plates.

Internally calibrated magnitudes (accurate to ± 0.2 mag) and colours are available which are sufficiently good for most applications, but eventually external photometry will be included. The data has been parameterised in order to save disk space. This enables shape information to be included for each image as well as position and magnitude. The final on-line version of both catalogues will occupy a total disk space of about 10 GBytes.

The APM Catalogues can be accessed via TELNET (131.111.68.56) or SPAN (63521) to captive account CATALOGUES. A HELP file is available on login. Facilities include the provision of lists of all images within a specified area and also finding charts. Small numbers of enquiries can be dealt with this way, but those with large finding lists should contact one of the following: Mike Irwin (mike@mail.ast.cam.ac.uk) or Steve Maddox (sjm@mail.ast.cam.ac.uk) at the Royal Greenwich Observatory, Cambridge or Richard McMahon (rgm@mail.ast.cam.ac.uk) at the Institute of Astronomy, Cambridge.

2.5 USNOFS POSS measurement program (Harris)

The past year has been spent testing and improving the PMM hardware and developing software for fully-automated scanning and analysis. Scanning the POSS II USNO short-J plates will begin next month (Oct. 94) and scanning of available plates (80% of the northern sky) will be completed this year. These plates will provide the astrometric tie between the deep POSS II plates and bright astrometric standards. The POSS I plates and available POSS II plates will be scanned in 1995.

2.6 Remeasurement of AGK2 plates in the Northern hemisphere (de Vegt)

With the new Hamburg astrometric measuring machine, large sets of plates can be digitised completely very quickly with sub-micrometre accuracy. The complete measurement of a typical astrograph plate ($\leq 240\text{ mm} \times 240\text{ mm}$) can be accomplished in less than an hour, regardless of the number of stars.

We plan to remeasure the ~ 2000 plates of the AGK2 catalog (mean epoch 1930) for the first time completely to the plate limit, which is $\sim B=11-12$. In particular, the plates contain all the TYCHO stars in the Northern hemisphere. Plate solutions will be based entirely on the HIPPARCOS reference frame.

The expected accuracy of the new AGK2-catalog is about $0''.12$. Proper motions of all TYCHO stars with an accuracy of about 2 mas/yr can be then be derived. Furthermore, the new AGK2-data will provide an excellent basis for the final reduction of the AC zones in the Northern hemisphere. For more details, see de Vegt et al., IAU Symposium 161, 173 (1994).

2.7 FON project: current status (Kislyuk)

The FON project (fotograficheskii obzor neba – photographic survey of the sky) was proposed by astronomers of Golosiiv Observatory (Kiev) in 1977. Six observatories of the former USSR, equipped with the same type of wide-angle Zeiss (Jena) astrograph ($D=400\text{ mm}$, $F=2000\text{ mm}$ and 3000 mm), took part in the project. In order to ensure the fourfold overlap of the Northern sky, the six instruments were divided into four groups (Kitab & Kiev, Zelenchuk, Abastumani & Zvenigorod, Dushanbe), each of which undertook to photograph the whole Northern hemisphere once. Between the groups the plate centres were displaced by 2° in RA and/or Dec. To evaluate the magnitude equation there were two exposures (18 min and 40 s) on each plate. ORWO ZU21 emulsion is used.

Systematic observations for the FON project were started in 1982. Unfortunately, the disintegration of the USSR has had an influence on the continuation of the observational part of project. Kitab and Dushanbe are furthest behind in observation. At present Golosiiv Observatory has finished a single coverage of both the Kitab and Kiev zones of the sky. Zelenchuk, Abastumani and Zvenigorod have practically finished FON observations as well.

At the end of 1991 Golosiiv Observatory started measurements of FON plates obtained at Golosiiv. A special automatic measuring machine – PARSEC (Programming Automatic Radial-Scanning Coordinatometer) – has recently been constructed for this purpose. PARSEC measures the rectangular coordinates and magnitudes of stellar images. As a first step the FON photographic catalogue will be used to determination new positions and proper motions of the Astrographic Catalogue stars (AC). The AC is used in two ways: as the input catalog for PARSEC and as the first epoch for proper motion determination. At present about 500 plates from the Golosiiv FON collection have been measured (the whole single coverage comprises ~ 1700 plates). The PPM catalogue is used as the reference system for reduction of the plates. First estimations of the

accuracy using double images of PPM stars on each plate are as follows: $0''.25$ and $0''.004/\text{yr}$ for positions and proper motions, respectively.

Some researches regarding the processing of FON plate measurements will be carried out in cooperation with the Sternberg Astronomical Institute (Moscow, Russia) and the Astronomisches Rechen-Institut (Heidelberg, Germany).

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3 Planned observational programmes

3.1 Tokyo PMC DISC-II (Yoshizawa)

Meridian observations with a drift-scanning CCD micrometer of stars and extra-galactic compact objects fainter than mag 12 will complement the forthcoming HIPPARCOS/TYCHO catalogs in forming a new definition of the stellar reference frame based on the geometrical concept of an inertial system. A survey of proper motions of young stars and old giants may be especially interesting for the study of galactic kinematics under a quasi-inertial reference frame.

The performance of DISC-II (second DIGital Strip scanning CCD micrometer) is reported in Yoshizawa (1994, IAU Symposium No. 166). A short summary of the results is as follows:

- The internal error of a single observation averaged over a wide range of zenith distance is ~ 60 mas at mag 10, increasing to 150 mas at mag 15.
- With a field of view of 0.6 degrees in declination, DISC-II attached to the Tokyo PMC and working under the drift-scanning mode at a fixed declination, can sweep out a long strip, and can digitize all the positions and magnitudes of $\sim 60\,000$ stars down to mag 16 during eight consecutive hours.
- Fourfold observations of the same strip with DISC-II will enable us to determine the positions of tens of thousands of stars with an internal precision better than 50 mas.

As for equipping the Tokyo PMC program with DISC-II, we are tentatively proposing to perform drift-scanning observations of two (or three) years duration. The scope of the program is planned to be the fourfold coverage of the sky comprising $\sim 10\,000$ square degrees, yielding the positions of a few million stars down to mag 16 with expected internal precision better than 50 mas. For a technical reason the drift-scanning observations with DISC-II will be restricted to the equatorial zone $\pm 35^\circ$.

3.2 USNO catalog programs (Gauss)

The Astrometry Department of the US Naval Observatory in Washington has several projects currently active that will provide new star positions. The Navy