

24. PHOTOGRAPHIC ASTROMETRY (ASTROMETRIE PHOTOGRAPHIQUE)

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1.0 Highlights

The ESA Astrometry Satellite Hipparcos collected regularly data in its operational mode from Nov. 27/1989 to Aug. 10/1992 with only minor problems. After this date problems with gyroscopes became serious but successful data collection until March 18/1993 was still possible. Due to additional serious hardware failures the observational phase of the Hipparcos mission will be terminated soon.

Data reduction has been started in May 1991 by the consortia FAST, NDAC and TDAC after major efforts in modifying and writing new software because of the non-geostationary satellite orbit.

Using data from 18 months observing, positions, preliminary proper motions and parallaxes of about 95,000 single stars and 6,000 double stars were obtained. In addition, some thousands of new double stars, (mainly $\rho=0.15-0.4$ arcsec) were found.

From these preliminary results it is already certain that the nominal goals of Hipparcos (2 mas in global positions, parallaxes and yearly proper motions for magnitude 9 stars) will be met.

In total, 36 month of data are available now for final treatment.

In addition about 1,000,000 stars up to $B=11$ have been measured by the Tycho mission.

The final Hipparcos and Tycho catalogs are expected to be released by ESA in the 1996/1997 time frame.

With view to the broad scientific research areas of our commission, the impact of the Hipparcos results can be assessed only marginally at present and will turn this decade into one of the most exiting periods in the long and successful scientific history of commission 24.

Besides the Hipparcos mission encouraging further progress has been achieved also in the fields of HST-FGS astrometry, ground-based optical interferometers and other instrumental developments as for example CCD detectors and new fast plate measuring machines. (see also the previous report).

Another large impact on our work is due to the mature astrometric capabilities of present VLBI which will provide the basis for the new inertial extragalactic radio-optical reference frame with the final goal of an all-frequency high precision reference frame which finally may be capable to align structural features of celestial objects from X-ray to IR and Radio bands unambiguously with sub-mas resolution and positional accuracy everywhere in the sky.

Commission 24 is part of the new Joint Working Group on Reference

Frames, established at the last GA (IAU Bull. 67, 33). In particular our commission will provide a substantial contribution to the problem of linking Hipparcos to the extragalactic frame (see 3.2)

Based on the excellent astrometric capabilities of the new generation of fast plate measuring machines and the huge data storage capacities of present computer systems there will be for the first time a realistic chance to digitize and preserve all old epoch astrometric plate material without any loss of intrinsic accuracy and information content.

In addition precise astrometry of very faint stars will be feasible when the digitization of several epochs of the large sky surveys will be finished soon.

In this context a negative highlight are the recent IAU attempts to force our commission to merge and to establish a new scheme of GA which scientifically is not very helpful to our work.

As it is obvious again from this report the broad and lively research fields of commission 24 clearly justifies its further existence (not excluding the possibility of minor organizational changes).

Because of very restricted space for this report, long name lists in particular for the wellknown large catalog projects had to be omitted.

2.0 Trigonometric Parallaxes and Nearby Stars

From Van Vleck Observatory A. Uppgren reports continuation of the parallax program on nearby stars. In particular work concentrates on metal-poor subdwarfs and stars of intermediate metallicity. Uppgren, Weis in collaboration with Gliese and Jahreiss are preparing a list of the Vyssotsky stars that have accurate positions, p.m. and photometric parallaxes. D.J. MacConnell (STI/CSC) and W. Osborn (Mich. U) report first observations with the HST-FGS to determine parallaxes for high velocity stars. Preliminary reductions indicate an accuracy $< 3\text{mas}$ for stars $> 14\text{th mag}$. Hanson (Lick), Lutz (Wash. State U.) and van Altena (Yale) have nearly completed their project to use the new Yale Parallax Catalog data to improve the luminosity calibration of field subdwarfs by color and metal abundance.

3.0 Catalogs of Proper Motions and Positions

At Hamburg/RGO the conventional plate adjustment solution and photographic photometry of the CPC was finished. The catalog contains 276,131 star positions and V-magnitudes for average epoch 1968 with average m.e. of 60mas . The block adjustment solution of the CPC2 is in progress. At Pulkovo Observatory work for the compilation of p.m. of the FOCAT-S catalog using AC and CPC2 data is finished (in coll. with Sternberg Institute, Astronomical Obs. St. Petersburg, ARI and Hamburg). Also at Pulkovo work for the creation of a catalog of positions and p.m. of about 5 million stars globally on the basis of photographic re-observations of the

AC zones using two similar astrographs on each hemisphere were begun. In the frame of this work at Bolivia already more than 1700 plates were taken in the declination zone +10 to -20 deg. and provisional plate measurements have started. Also at Pulkovo work on the KSZ-plan (absolute p.m. relative to galaxies) was continued. A working catalog data base of absolute p.p.m. in the declination range -5 to +90 deg. was established on magnetic disks. At ARI, Heidelberg, S.Röser and U.Bastian have completed the final southern part of the PPM catalog. It contains 197,179 stars south of -2.5 deg. The average pos. error at present epoch is 110 mas, the p.m. accuracy is 3 mas/yr. The total PPM now contains 378,910 stars.

At Lick, Klemola, Hanson and Jones have completed work on Part I of the Lick NPM program (900 fields outside the Milky Way), the catalog gives absolute p.m., positions and photometry for 150,000 stars. Plans have begun for NPM Part II (350 Milky Way fields) to complete the sky down to -23 deg. Hanson is using the NPM to study the solar motion and galactic rotation.

At Strasbourg Astronomical Observatory A.Fresneau derived relative p.m. between northern AC zones (+1 to +31deg.) and the HST-GSC for 1 million stars in the magnitude range $B=9.5-12.5$. These data are being used for galactic p.m. studies.

3.1 Special Catalogs

At USNO D.Pascu has continued photographic and CCD observations of satellites of Mars, Jupiter and Saturn. (see also Comm.20 rep.) Klemola and Own(JPL) constructed a catalog of positions (4800 stars) in the field of minor planet Ida for Galileo spacecraft encounter in August 1993.

D.Hoffleit (Yale) contributed to the updating of various Yale catalogs especially the Bright Star Catalog and the Catalog of Trigonometric Parallaxes she also wrote a historical account on "Yale and USNO Cooperation Especially in the Brouwer and Clemence Era".

J.Dommaget (ROB) in collaboration with O.Nys reports extensive work on double and multiple star systems especially in context with the Hipparcos Input Catalogue. The Catalog of Double and Multiple Stars (CCDM) has been completed.

At Lohrmann-Observatory (T.U.Dresden) A.Steinert reports cooperative work on minor planets with ITA St.Petersburg, about 50 plates/year were taken with the Zeiss-Sonnefeld astrograph.

3.2 The Extragalactic Reference Frame and Linking Procedures

The new WG on Reference Frames, chaired presently by C.de Vegt, has established a first list of about 500 compact radio sources mainly with optical counterparts, optical and radio work on these objects is underway by many contributing observatories.

The Potsdam group (headed by E.Schilbach) reports work on optical positions of 50 radio sources, based on Tautenburg Schmidt plates. The plate material will be also used to derive p.m. relative to galaxies (joint prog. with Hamburg/MAMA/APM).

At Hamburg/USNO/NRL/CSIRO the extensive joint program on optical and VLBI radio positions of extragalactic sources has been continued, the program contains about 400 sources presently and will contribute in particular to the construction of a groundbased Hipparcos extragalactic link. At Bonn P.Brosche reports continuation of work on a Hipparcos p.m. link using plates of a small number of sources with up to 80 years epoch difference. At Shanghai Observatory positions of 85 radio stars and 3 extragalactic sources have been determined with the Zo-se refractor. At Pulkovo a program for determining positions of fainter stars of 13-16th mag. in 73 fields (dec. zone +30 to +90) around radio sources has been started.

4.0 Proper Motions and Star Clusters

At Potsdam absolute p.m. and B,V magnitudes for 10,000 stars up to 20th mag. were determined in two regions near the NGP. In addition extensive p.m. work in the Pleiades and the globular clusters M3 and M92 is reported. (coll. with Bonn, APM). In Taskent A.Latypov reports p.m. work on Cepheid EV Sct. At Bonn relative p.m. of selected open and globular clusters were determined. At NAO Tokyo M.Miyamoto and M.Soma have finished an extensive study on the galactic velocity field of about 30,000 M-K giants. At Shanghai Observatory J.J.Wang and collaborators report work on positions and p.m. of Presepe stars from plate material obtained with the Zo-se 40 cm refractor and other p.m. studies on NGC2286 and M67. Using a new kinematic method with the NPM data to correct rel. p.m. to absolute Hanson and Cudworth (Yerkes) have determined improved space velocities of 14 globular clusters. Klemola, Stauffer, Prosser and Probst (KPNO) completed the first phase of an photometric and astrometric survey in the extended Pleiades field. Klemola and collaborators completed a study of the space motion for globular clusters NGC 362 and 6218. Jones, Klemola and Lin have completed the first phase in measurement and analysis of absolute p.m. of LMC red-giant stars in its remote halo around the globular cluster NGC 2257.

5.0 Instrumentation, Techniques and Reduction Methods

The Bordeaux Observatory is developing a CCD micrometer to be installed at its automatic meridian circle in 1994. Using Hipparcos star positions in narrow strips the expected accuracy of single stars to $V=15$ should be better than 50mas. At Hamburg/USNO N.Zacharias has continued work on block adjustment simulations for complete sphere plate overlap configurations. Stable solutions with only a small number of reference stars <100 seem to be feasible. At Shanghai Observatory detailed studies of PDS astrometric capabilities have been made. At Hamburg/USNO a new 5-lens astrograph lens system, optimized for the red spectral range (5500A-7000A), has been developed and is close to delivery. Also at Hamburg work on the new CCD-based granite plate measuring machine is nearly finished, extensive test measurements are being prepared.