

24. PHOTOGRAPHIC ASTROMETRY (ASTROMÉTRIE PHOTOGRAPHIQUE)

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I. INTRODUCTORY REMARKS

The name of this commission was recently changed from "Parallaxes and Proper Motions". These data are at this time indeed obtained mostly by the techniques of photographic astrometry, but so is the bulk of relative star positions. It is clear, however, that the nonabsolute determination of relative positions and data derived from them in narrow fields (which describes the scope of this Commission) is going to be carried out more and more also by nonphotographic methods, namely photoelectrically (Earth and satellite based) by interferometry (optical, radio, and speckle) and by direct imaging. This therefore creates considerable overlap with the subject areas and methods of a number of other Commissions, especially Commission 8, and it will be appropriate for Commission 24 in the near future to examine critically the overlapping areas of interest and to come to an agreement about the definition of the proper responsibilities of the individual commissions.

II. TECHNIQUES

a) Satellite based astrometry

Astrometry from satellites is actively planned in the US (Space Telescope) and in Europe (HIPPARCOS). No data have yet been obtained; the work being done at present is mostly the development of the software for the reduction of the observations, note in particular the papers by Jefferys (AJ 84, 1775, 1979; AJ 85, 177, 1980). The papers collected in the conference on European Satellite Astrometry (25.12.060) as well as some published in the proceedings of IAU colloquium No. 48, Modern Astrometry, (25.12.0181) give good overviews over these plans which will therefore not be repeated in this report.

b) Non-photographic small field differential astrometry

Lindgren (IAU Coll. No. 48, Modern Astrometry, 197, 1979) gives a survey of the mathematical techniques for computing the position of objects by photoelectric methods. A team led by Gatewood at the Allegheny Observatory reports near completion of a multi-channel astrometric photometer, (MAP) a photoelectric device which is intended to perform photoelectrically the tasks traditionally performed by long focus photographic astrometric techniques. Gains in precision of about two orders of magnitudes are expected. (see, e.g., Icarus 41, 205, 1980). Connes (cf. Eur. Sat. Astrom. 157, 1979) has been advocating a ground based photoelectric device for single target differential astrometry - i.e., parallax and perturbation studies - which uses custom masks for each region.

c) Interferometry

Routine speckle interferometric measurements of double stars have successfully been carried out for years and are reported on elsewhere. Systems for making ground based optical interferometric measurements within the realm of single tar-

get differential astrometry have been proposed (Shao, Curry) but are not yet operational.

d) Fully automatic measurements of photographic plates

Previously unreported developments concern microdensitometers, described in analyses by Richter (AN 299, 283, 1978), and Auer and van Altena (AJ 83, 531, 1978).

e) Reduction technique

Astrometry is one of the prime areas for the application of sophisticated data adjustment techniques. Papers on least squares adjustment besides those published by Jefferys referred to above (IIa) were reported by Branham (AJ 85, 1520, 1980), Eichhorn (MNRAS 182, 355, 1978), Fresneau (AJ 84, 244, 1979) and von der Heide (AA Supp. 32, 141, 1978). Papers directly concerned with the reduction of measurements made on photographic plates were published by Fresneau (AJ 83, 406, 1978), von der Heide (AA 72, 324, 1979) and Wayman (Irish AJ, 13, 226, 1978).

III. DATA

a) Parallaxes

(i) Parallaxes of individual objects were published by Armbruster (PASP 90, 219, 1978 - ADS 8887), Hershey (AJ 83, 308, 1978 - G24-16), Hershey (AJ 83, 197, 1978 - van Maanen's star), Kamper and Wesselink (AJ 83, 1653, 1978 - α and Proxima Cen.) Kipp and al. (AJ 83, 636, 1978 - 45 Tau., 97 Tau, 102 Tau, 31 Cyg and other stars in the region), Pannunzio (Mem. Soc. Astr. Ital. 51, 137, 1980 - Stein 2051), Russell and al. (AJ 83, 1455, 1978 - Altair), Russell and Kipp (AJ 83, 305, 1978 - 18 Puppis, BD+40°1847, Lalande 26325, Gl37-8 and selected reference stars) and Salter and al. (Nature 280, 477, 1979 - pulsars).

(ii) Published lists of newly measured parallaxes include the following: Auer et al. (AJ 83, 640, 1978), Harrington and Dahn (AJ 85, 454, 1980), Hershey (AJ 83, 1119, 1978) Ianna (AJ 84, 127, 1979), Scales (MNRAS 184, 101, 1978). Upgren and Breakiron (AJ 85, 71, 1980) and Vilkki (AJ 83, 978, 1978).

(iii) Among papers concerning parallaxes were those by Halliwell (AJ 24, 259 and 273, 1980 - research priorities), Hershey (AJ 85, 1399, 1980 - astrometric analysis of 14 Sproul series), Lutz (IAU Coll. No. 48, 7, 1979 - statistics and parallaxes), Murray and Corben (MNRAS 187, 723, 1979; 900 parallaxes and proper motions near the South Galactic Pole determined with the UK Schmidt telescopes [methods and first results]) and Upgren and Lutz (Dudley Obs. Rept. No. 14, 235, 1979 - The influence of parallax errors on photometric calibration), Lippincott and Hershey (AJ 84, 567, 1979), Hanson (MNRAS 192, 347, 1980), and Lutz and Upgren (AJ 85, 1390, 1980).

b) Proper Motions

(i) Papers published on proper motion programs include one by Klemola (IAU Coll. No. 48, 387, 1979 - Lick program) and one by Rakhimov (Tr. Astr. Inst., Tashkent Vol. 2, 59, 1978 - on the Tashkent catalogue of proper motions with reference to Galaxies).

Eggen (ApJ Supp. 39, 89, 1979) published photometric data for stars brighter than 15^m whose proper motion exceeds 1"/yr., and in (ApJ Supp. 43, 457, 1980) the data for stars <15^m with 0".7/yr < μ < 1"/yr.

(ii) Lists of proper motions of a relatively small number of objects include those by Clements and al. (Observatory 100, 5, 1980; HD 27507) Karimova and Pavlovskaya (proper motions of 84 Mira Ceti type stars: Peremennye Zvezdy, 20, 369, 1977)

Rakhimov (Tsirk. Astr. Inst. Tashkent, No. 82, 9, 1978 - stars in the neighborhood of the galaxies NGC 6106 and NGC 6206). J. Spencer-Jones and J. B. Alexander published a list of common proper motion pairs in the south galactic cap (Observatory 98, 49, 1978). The proper motions of 64 RR Lyrae variables were published by L. Wan et al. (Acta Astron. Sin., 19, 192, 1978). Terzan and al. published the pms of 42 nearby stars in the direction of the galactic center (CR Acad. Sci. Paris 290, Ser.B, 321, 1980).

(iii) Concerning the determination of the proper motions of a large number of stars, Giclas reports that the Lowell proper motion survey begun in 1957 with the 33 cm. astrograph, of stars between magnitudes 8 and 17 with motions larger than $0''.19/\text{yr.}$ was terminated in 1980 with the publication of LOWELL BULLETIN No. 166, "A Summary Catalog of GD and GR Stars - the white dwarf suspects and red dwarf stars identified from the regular program but with motions smaller than $0''.19/\text{yr.}$ " The results of the survey are contained in over 800 pages of the Lowell Bulletins which contain data on 16788 program stars, 1900 white dwarf suspects, 504 very red stars, and include over 14000 finding charts for these stars. The last ones were Lowell Obs. Bull. Nos. 163 (1978) - 165 (1979) by Giclas & al. Kharchenko published the second part of the "catalogue of proper motions of stars in selected regions of the sky with galaxies" (Glav. astron. obs. AN USSR Kiev, 151 pp, 1980). The first part of this catalogue (Glav. astron. obs. AN USSR, Kiev, 72 pp) was published in 1978 by Rybka.

Luyten reports that his catalogue of stars with motions larger than $0''.18$ annually (NLTT), which contains some 58,800 entries, was published and distributed (in four volumes) during 1979 by the University of Minnesota, Minneapolis, Minnesota during 1979.

A statistical summary, and discussion of all motions in the sky larger than $0''.2$ annually, was published in 1981.

Together with Hill and Morris of the Dominion Astrophysical Observatory, Luyten has published motions for more than 10,000 stars brighter than 21 pg in the central region of the Hyades.

A list of nearly 1000 possible candidates for membership in the Hyades cluster has been published, likewise with the above two colleagues.

In addition, Luyten published a second edition of the LHS Catalogue (University of Minnesota, 1979) of stars with proper motions exceeding $0''.5/\text{yr.}$, and with Albers, an atlas of finding charts for these (Univ. of Minn., 1979).

(iv) Criteria for determining membership of clusters by means of proper motions were discussed by de Graeve (Vatican Obs. Pub. 1, No. 16, 1979), McNamara and Schneeberger (AA 62, 449, 1978) and King (J. Proc. RS New S Wales 112, 101, 1979 = Sydney Obs. Pap. No. 85).

(v) Proper motions in the regions of stars, streams or associations were published by Latyshev (Astron. Tsirk., No. 1055, 7, 1979 - U Ma stream), Krisciunas (Observatory 99, 5, 1979 - U Ma stream) Quian (Kexne Tongbao 24, 795, 1979 - Orion Trapezium) and Yatsenko (Astrometr. Astrofiz. No. 40, 51, 1980 - Trapezium type systems).

(vi) Papers concerned with Proper motions of members in the region of open clusters include those by Artyukhinā and Kholopov (Tr. Gos. Ast. Inst. Sternberg 47, 105, 1976 - Hyades surroundings), Bronnikova & al. (Zvezd. skop. i dvojn sist., Sverdlovsk. p. 97, 1979 - Cr 428), Fresneau (AJ 85, 66, 1980 - α Per cluster), Frolov (Izvest. No. 196, Astrofiz. Astrometr. p. 69, 1979 - NGC 7788, NGC 7790, Berkeley 58, anon. cluster), a series by D. S. King (all in J. Proc. RS NSW.: 111,

1, 1978, also Syd. Obs. Pap 79 - NGC 3532; 111, pt. 3-4, 61, 1978 - NGC 2516; 112, 13, 1979, also SOP 86 - NGC 2669 and IC 2391). Luyten published, as part LIII of his proper motion survey with the forty-eight inch Schmidt telescope, proper motions for 3040 stars in the Hyades (Univ. of Minnesota, Minneapolis, Minn. 1980). Further papers are those by Sanders and Schröder (AA 88, 102, 1980 - NGC 6494), and Vasilevskis and al. (AA Suppl. 37, 333, 1979 - central Pleiades).

(vii) Proper motions in the region of globular clusters were determined by Cudworth (all AJ 84, 1979; p. 774-M13 [with G. D. Monet], p. 1005 - also M13; p. 1312 - M3, and p. 1866 - M5).

c) Positions of Celestial Objects

(i) Solar system objects. Positions of satellites were reported by Benedict et al. (AJ 83, 999, 1978) and Ianna et al. (AJ 84, 429, 1979). Taff gave a report on a non-photographic real time technique, for identifying asteroids and other moving objects (BAAS 12, 743, 1980).

(ii) Radio Sources. Positions of radio sources were reported by Argue and Sullivan (Observatory 100, 152, 1980 - OR 103), Argue and Ward (Observatory 100, 36, 1980 - 3A 2254 - 033), Cudworth and Oravec (PASP 90, 333, 1978 - NGC 7027), de Vegt and Gehlich (AA 79, L16, 1979 - SS433 and Mitt. Astron. Ges. No. 48, p. 147, 1980 - 3C273B), Harrington et al. (AJ 85, 64, 1980 - SS433), Johnston et al. (Cel. Mech. 22, 143, 1980 - catalogue of radio positions) Walter and West (ESO Scio. Prepr. No. 59, 1979 - optical positions of radio sources in the southern hemisphere).

(iii) Catalogues. There were two new photographic star catalogues. The Yale zone from -60° to -70° , containing precise positions for about 15000 stars finished by Eichhorn and Fallon, and magnetic tapes with the pertinent information have been distributed to several astronomical data centers from where copies may be obtained, Klychnik and Potter published a new catalogue of geodetic stars in the zone -10° to $+10^{\circ}$ (Wiss. Z. Univ. Dresden, 28, 718, 1979).

IV. TRANSFER TO MACHINE READABLE FORM

Corbin has almost completed punching the AC Cape onto cards, Eichhorn has undertaken to keypunch the data in the AC Melbourne zone - one third of this has thus far been accomplished.

V. ACKNOWLEDGEMENT

This reporter wishes to thank those of his colleagues who have assisted with the compilation of this report through submitting information on their activities.

Heinrich Eichhorn
President of the Commission