

24. COMMISSION DES PARALLAXES STELLAIRES ET DES MOUVEMENTS PROPRES

PRÉSIDENT: Dr K. Aa. Strand, U.S. Naval Observatory, Washington 25, D.C., U.S.A.

MEMBRES: Alden, Ali†, Cecchini, A. N. Deutsch, Haas, Harris, J. Jackson†, Mlle Jenkins, Kohlschütter, König, Lavdovski, Luyten, Morgan, Nechvile, Paloque, Parenago†, Schilt, Smart, Stearns, van de Kamp, van Rhijn†, Vasilevskis, Vyssotsky, Wagman, H. W. Wood.

We note with much regret the deaths of A. Ali, J. Jackson, S. A. Mitchell, P. P. Parenago and P. J. van Rhijn. During the 32 years S. A. Mitchell served as director of the Leander McCormick Observatory, he and his staff determined approximately 1700 parallaxes. He was President of this Commission from 1928 to 1935. J. Jackson took a large part in the Cape parallax program. During his tenure as H. M. Astronomer at the Cape, from 1933 to 1950, parallaxes were determined for about 1600 stars. He served as President of this Commission from 1938 to 1952.

TRIGONOMETRIC PARALLAXES

The activities in the field of determining trigonometric parallaxes remain at a critically low level, although it is realized that much still needs to be done before adequate data will be available to assist in the determination of the physical characteristics of many types of stars (*Trans. IAU* 10, 359–60, 1958). Since the last report only 151 new parallax determinations have been published.

Wagman reports that the parallax program at the Allegheny Observatory is being continued on a full-time basis, with emphasis on sub-dwarfs, white dwarfs and the stars on the Parenago list (*Trans. IAU* 10, 367, 1958).

According to van de Kamp, the Sproul program is being continued without any essential changes, with emphasis on astrometry of nearby stars. Twenty-six stars on the Parenago list have been included.

Stoy writes that the parallax program at the Cape Observatory has been resumed again on a part-time basis after its suspension in 1957. The new observing list contains 172 stars and includes most of the southern stars in the Parenago list. For several of these stars, new parallax determinations have been published in the Sixteenth to Twentieth Cape lists, which have appeared in the *Monthly Notices*. Except for a few results in the Seventeenth list, none of these data was included in the Yale Parallax Catalogue. Complete second series of unmeasured plates are also available for ten stars on the Parenago list.

The erection of the 26-inch refractor of the Royal Greenwich Observatory was completed in June 1958. The main program for this telescope continues to be the measurement of trigonometric parallaxes. The working catalogue is comprised of: (a) stars in Gliese's catalogue believed to be within 20 parsecs, and for which no parallax is yet known; (b) stars in the Yale Parallax Catalogue for which the parallax, if larger than $0''.070$, depends upon one determination only, or for which determinations at more than one station are discrepant by more than $0''.040$; (c) stars in the pre-war working catalogue (largely white dwarfs and K 0 stars of moderate proper motion in the Greenwich Astrographic Catalogue).

With the retirement of H. L. Alden, the future of the parallax program at the McCormick

Observatory has become very uncertain, especially since the telescope is in need of extensive overhauling.

It is of utmost importance that the McCormick Observatory continue to participate in the parallax program and it is hoped that every effort will be made to make this possible.

It is also desirable to have the parallax work resumed at the Van Vleck, Yerkes, and Yale (Southern Station) Observatories, where these programs are not active at the present time for reasons of retirement of, or change in, personnel. Active participation of these observatories is urgently needed to secure the required number of parallaxes for stars brighter than the 13th magnitude within a reasonable span of time.

With regard to parallaxes of stars fainter than 13th magnitude, the situation for the future looks much brighter at the present time, at least for the northern hemisphere.

It will be recalled that the General Assembly in 1958 passed Resolution no. 41 with regard to the urgent need for a reflector for the determination of parallaxes of stars fainter than the 13th magnitude.

Engineering design of a reflector to fill this need was started at the U.S. Naval Observatory in the fall of 1959, and funds for construction were appropriated in July 1960. Final engineering design is now in progress.

The telescope will have a primary mirror with a free aperture of 60 inches and a focal length of 50 feet. A folded system will be used, consisting of a flat secondary with a free aperture of 34 inches, to reflect the light through the center perforation of the primary. A contract has been awarded to Corning Glass Works for the manufacture of the two mirrors, which are to be made of silica. At the writing of this report (December 1960) the secondary mirror has been delivered.

The telescope mounting is of the fork type and the use of new engineering techniques provides a support system which will meet the exacting requirements of a stable optical system needed for parallax work. The telescope will be located at the Flagstaff (Arizona) Station of the U.S. Naval Observatory.

The requirements for high-speed measurements and reduction of photographic positions in connection with ballistic missiles and artificial satellites has brought along new developments in automatic measuring machine designs. The initial costs in these developments are in general entirely too high to be borne by any individual observatory. However, there are now indications that once these costs have been met, additional machines can be produced at a much reduced price which will enable an individual observatory, or a group of observatories, to acquire such machines.

It appears possible, with these new machines, to attain measurements of star positions with speeds ten times that required for the conventional manual machine. The introduction of such machines would greatly reduce the problem of measuring the large number of plates now required in a modern parallax determination.

A substantial saving in time can also be achieved by providing existing measuring machines with digitizers for automatic reading of measurement onto punched cards or tape for analysis by means of high speed computers.

Vasilevskis reports that the automatic measuring machine project for the Lick Observatory has made satisfactory progress.

The investigation of the systematic errors in the trigonometric parallaxes after the marginal

results have been eliminated, as explained in the last report, has not as yet been done. Such an investigation would not be too extensive if performed with modern high-speed computers.

SPECTROSCOPIC PARALLAXES

Morgan reports that the most important development in the field of spectroscopic parallaxes since the last report has been the extension in use of the narrow-band method developed by Strömngren. Strömngren himself, D. L. Crawford, and others have been engaged in programs of precise two-dimensional, quantitative spectral classification by means of interference filters and photo-electric techniques. The calibration process has not yet been solved entirely satisfactorily, but the precision of the observations is so high as to permit, in principle, the determination of the most accurate parallaxes of early-type stars ever achieved.

Buscombe reports that the spectral-luminosity classification of southern stars is being continued at Mount Stromlo, and that Miss P. M. Morris has classified 200 early-type stars in the region of the Scorpio-Centaurus Association. He also mentions the finding list 'Southern Stars of High Velocity' (*Mem. Mt. Stromlo Obs.*, no. 14, 1958) which drew attention to gaps in the data on the kinematics and distribution of these stars.

PROPER MOTIONS

The following report should be supplemented by reference to the reports of Commissions 8, 23 and 33, all of which report on proper motions.

Upon the recommendation of this Commission, the General Assembly in 1958 passed Resolution no. 40 emphasizing the importance of installing a 20-inch astrograph in the southern hemisphere.

Brouwer now reports that the Yale University has received a grant of \$750 000 from the Ford Foundation for the purpose of establishing in the southern hemisphere a twin 20-inch astrograph for the purpose of extending to the South Pole the Lick Observatory project of obtaining absolute proper motions of stars referred to distant galaxies.

The optics for the instrument, intended for work in the photographic and visual region, have been ordered from the Perkin-Elmer Corporation in Norwalk, Connecticut, U.S.A. Negotiations concerning the mounting are in progress. The site for the instrument is still uncertain, pending the outcome of site surveys in progress. It is hoped that a decision can be made early in 1961.

Luyten reports that he has published in mimeographed form two further sections of the 'General Catalogue of the Bruce Proper Motion Survey'; section D containing data for some 15 500 stars between declinations -50° and -40° , and section E containing data for 23 000 stars between -40° and -20° . Sections F and G giving data for 17 000 stars between -20° and 0° , and for 16 000 stars north of the equator, respectively, are being prepared for publication.

In addition to this, proper motions have been determined and published for 100 faint blue stars found by Feige in high galactic latitude and for another 150 stars in the Hyades and Ursa Major regions.

At the tenth General Assembly of the IAU in Moscow a subvention was received toward the publication of a catalogue of stars with motions exceeding $0''.2$ annually, and in the northern hemisphere. The manuscript of this catalogue has now been completed and it is expected that it will be printed and distributed before the next General Assembly in Berkeley.

From Lowell Observatory, Giclas reports that the proper-motion survey of the northern hemisphere, utilizing 30-year-old plates taken with the 13-inch photographic telescope, is

about one-third completed. The results from the first 50 regions, together with identifying charts for each star listed, have been published (*Bull. Lowell Obs.*, no. 102, 1959). By October 1960, 93 plates had been blinked and measured. A total of 4593 stars has been retained for publication. Their magnitudes range from 8.0 to 16.5, and they have proper motions larger than $0''.27/\text{year}$. Each star has been measured independently by two different observers and the mean p.e. of a single determination of motion from one pair of plates is $\pm 0''.021/\text{year}$. Upon combining duplicate observations from overlapping plates, the total number of different stars listed is reduced to 3358 of which 2120, or 63%, have no previously published motions. Of these newly listed stars, there are 18 having motions larger than $1''.0/\text{year}$ and 316 with motions larger than $0''.5/\text{year}$. From a qualitative estimate of the color of the star by comparison of the blue plate with a red one, 48 white dwarf suspects are listed. Forty-nine new pairs of stars with common proper motions have been found, and 22 additional pairs have been added by finding a second fainter star with motion common to an already known proper motion star. This program is supported, in part, by a National Science Foundation grant.

Nechvile reports that he is preparing a list of nearly 4000 faint stars in the range of 12th to 16th photographic magnitudes. The proper motions are determined from the Henry Brother's plates taken at the Paris Observatory, which were repeated by Nechvile. Many of the stars have considerable proper motions indicating that they are dwarf stars, which should be further investigated.

Kohlschütter calls attention to the fact that the final volumes (11 to 15) of the AGK 2 have been completed and distributed. Volume 11 contains a detailed description of the methods used at Bonn for the observations and the reductions. The results of a preliminary investigation of color effect are given in table form and may be applied to the positions given in the catalogue. A more extended investigation of this effect will be published in *Veroff. Sternw. Bonn*.

Franz is continuing the proper motion work on galactic clusters from plates taken with the 40-inch refractor of the Yerkes Observatory with an interval of nearly 50 years. The clusters are NGC 129, 457, 7788, 7790 and *h* Persei. The yearly proper motions have been determined with a mean accuracy of $\pm 0''.002$ (m.e.) from one pair of plates. Most of the plates were measured by A. Lenham when he was at the Yerkes Observatory. Altogether there are 22 clusters for which two or more early plates were taken with the 40-inch at the beginning of this century (*Trans. IAU* 10, 585, 1958).

Palouque writes in regard to the Fourth Toulouse Catalogue that the volume containing the stars between 10 and 11 hours of right ascension will appear in print before the Berkeley meeting. Rather than continuing with the remaining hours of right ascension it is contemplated to determine the positions of the reference stars which were used for the proper motion determinations for the many stars specially requested. It is also planned to continue the proper motion work on variable stars in the Plaut list between $+4^\circ$ and $+12^\circ$ declination. The second list of proper motions has been published in *Ann. Obs. Toulouse* 27, 1959 and a third list will appear before the General Assembly at Berkeley.

At the Cape, Lourens has derived proper motions of selected lists of RR Lyrae variables and A-type stars by comparing old catalogue places with modern positions determined photographically (*Mon. Not. astr. Soc. S. Afr.* 19, 11, 118, 1960).

The following report, prepared by A. N. Deutsch, has been received from the Astronomical Council of the U.S.S.R. Academy of Sciences and is reproduced in full:

1. *Studies dealing with the catalogue of faint stars. The use of galaxies for the determination of absolute proper motions.*

(a) Photographic observations of galaxies and fundamental stars were continued at the observatories of Pulkovo, Moscow, Kiev (Goloseevo), Tashkent, Bucharest, Shanghai (Zô-Sè), Toulouse, Santiago, San Fernando, Perth. It is possible that the Cordoba and Cape Observatories will participate in systematic observations.

Photographic observations, with the normal astrograph, of 240 fundamental stars (two plates for each) in the declination zone $+90^{\circ}$ to -5° were completed at the Pulkovo Observatory; a list of these stars is published in *Trans. 13th Astrometric Conference, U.S.S.R.* (pp. 12-16). A list of 70 fundamental stars in the zone -5° to -25° was compiled; stars of this list are observed mainly at the Bucharest and Zô-Sè Observatories. The list of fundamental stars in the zone -25° to -90° will be compiled after a final selection has been made of the centres of the areas containing the galaxies in this zone.

It is very desirable that observatories in the southern hemisphere with Carte-du-Ciel type astrographs or longer focus astrographs (these being preferable) participate in the photography of fundamental stars.

(b) A catalogue of 226 galaxies in 48 areas of the declination zone -5° to -25° was published (Fatchikhin, N. V. and Latypov, A. A., *Astr. Circ. Tashkent*, no. 302, 1959); the observations were made with the normal astrograph of the Tashkent Observatory. Of the observed galaxies, 133 are suitable for precise astrometric measurements.

(c) A catalogue of 1198 galaxies in 94 areas in the declination zone -25° to -68° was compiled by Adelina Gutierrez Alonso. The co-ordinates of the centres of the areas will be shifted somewhat so as to provide for a more symmetrical distribution of the galaxies on the plates. The observations were made with the normal astrograph of the Santiago Observatory. Of the total number of galaxies, 459 were found to be suitable for precise astrometric measurements.

Seven areas in the zone -68° to -90° were photographed at the Cape Observatory. The plates were sent to the Pulkovo Observatory for examination. The galaxies in six of these areas are suitable for precise astrometric measurements.

(d) The Transactions of the 12th (1957) and 13th (1958) Astrometric Conferences, U.S.S.R., were published. Articles mentioned in the previous report (*Trans. IAU* 10, 362, 1958) are included in these publications.

(e) The Transactions of the 14th (1960) Astrometric Conference, U.S.S.R. were published. The following papers are included:

A. N. Deutsch, A report of the sub-commission on photographic astrometry.

N. V. Fatchikhin, On the reference of stars to galaxies.

A. B. Onegina, The precision of positional measurements of galaxies taken with the 400 mm astrograph at Goloseevo.

2. *Studies on the determination and investigation of stellar proper motions.*

Several papers mentioned in the previous report (*Trans. IAU* 10, 363-364, 1958) have now been published:

(a) An investigation of the proper motions of stars in the region of the association in Orion, by G. V. Ahundova (*Pulkovo Bull.*, no. 160, 1957).

(b) A study of the motions of open stellar clusters, by N. M. Bronnikova (*Pulkovo Bull.*, no. 161, 1958).

(c) A catalogue of proper motions of 5939 stars in four open clusters and their vicinity, by N. M. Bronnikova (*Trans. Pulkovo Obs.* 72, 1958).

(d) Investigations of proper motions in the surroundings of ten bright stars, by A. B. Onegina (*Bull. Central Obs. Acad. Sci. Ukr. S.S.R.* 2, 2, 1958). A catalogue of proper motions of 2615 stars is given at the end of the paper.

(e) The catalogue of proper motions of 14165 stars in the open stellar clusters NGC 129, 457, 581, 752, 869, 884, 1907, 1912, 2168, 6883, 6885, 7092, 7209 and their vicinity, by V. V. Lavdovsky is in press (*Trans. Pulkovo Obs.*). The probable error of one proper motion is between $\pm 0''.001$ and $\pm 0''.002$.

New Papers:

(a) An improvement of proper motions of stars, by Alksne Z. I. Daube, L. Reisin (*Astr. ž., Moscow* 36, 677, 1959).

(b) Meridian proper motions of 161 stars in the region of the Orion belt, by N. M. Artiukhina (*Astr. ž., Moscow* 36, 121, 1959).

(c) On a method for improving the proper motions of GC stars, by N. M. Artiukhina (*Astr. ž., Moscow* 36, 690, 1959).

(d) Absolute proper motions of 21 RW Aur type stars, by N. M. Artiukhina (*Astr. ž., Moscow* 36, 832, 1959).

(e) Astronomy in the U.S.S.R. during 40 years (1917–57), Moscow, 1960. The articles: 'Fundamental astrometry' by M. S. Zverev, 'Photographic astrometry' by A. N. Deutsch and 'Stellar astronomy' by P. P. Parenago are related to topics of Commission 24. A complete bibliography of papers on astronomy, published in the U.S.S.R. during 1917–57, is given at the end of the volume.

(f) A comparison of proper motions and magnitudes of stars in areas 9 and 24 of Kapteyn's special plan, from measurements at Pulkovo and Groningen. The determination of light absorption by dark nebulae in these areas. A. N. Deutsch and O. N. Chudovicheva (*Pulkovo Bull.*, no. 168, in press). A catalogue of proper motions and magnitudes of 1028 stars is given at the end of the paper. A new method is proposed for the determination of light absorption.

(g) The proper motions of type M, carbon, zirconium and titanium variable stars were determined at the Astrophysical Laboratory of the Latvian Academy of Sciences (Riga). The second-epoch plates were obtained with the Pulkovo normal astrograph. Meridian and photographic positions were used for the determination of the proper motions of 400 stars and the improvement of GC proper motions of 207 stars of the above mentioned types.

(h) The photography of variable stars for the determination of proper motions was continued with the 380 mm astrograph of the Sternberg Astronomical Institute.

K. AA. STRAND
President of the Commission