

Considerable progress was also reached in the construction of new astrometric instruments, such as Danjon's *prism astrolabe*, horizontal mirror meridian instruments by Soukharev and Atkinson, new photographic zenith tubes and so on.

The most essential drawback of the present astrometric investigations, is, however, the insufficient observation of the southern sky.

The most important task of Commission 8 for the future is, in my opinion, a further strengthening and stimulation of international co-operation in the domain of astrometry, and a greater development of this branch of astronomy, especially at the observatories in the southern hemisphere.

M. S. ZVEREV
President of the Commission

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8a. SUB-COMMISSION ON PHOTOGRAPHIC CATALOGUES OF STARS BRIGHTER THAN THE NINTH MAGNITUDE

At the Rome meeting the President of Commission 8 recommended that a sub-commission be given the name 'Photographic Catalogues of Stars Brighter than the Ninth Magnitude' as better expressing the nature of its work than the original name. This makes it clear that the sub-commission is concerned with the repetition of photographic observations of AG stars in the northern hemisphere and its counterpart in the southern hemisphere and also the consideration of meridian-circle programmes required to support such projects.

The symposium on the astrometry of faint stars during the Rome meeting of the Union and the conferences on galactic structure at Groningen (1953), on problems in astrometry at Evanston (1953) and on astrometry at Pulkovo (1954) have shown how basic our subjects are to other fields of astronomical research. Especially closely related are the following:

- (a) The construction of a fundamental system of faint stars.
- (b) The determination of absolute proper motions of stars by measuring them against a background of extragalactic nebulae.

Of particular importance is the proposal made by O. Heckmann⁽¹⁾ at the Evanston Conference. This plan proposes that the northern hemisphere be reobserved photographically at Bergedorf and Bonn with the same instruments as were used for AGK 2.

The project is provisionally designated as AGK 3. Three possible lists of reference stars for AGK 3 were considered at this conference: the list known as AGK 2 A, observed for AGK 2; that proposed by M. S. Zverev, KSZ; and the list observed at Washington since 1941. Both AGK 2 A and KSZ were considered to contain too many faint stars that cannot be well observed with most meridian circles. As a result of its deliberations, the conference recommended⁽²⁾ that the United States Naval Observatory prepare a list of about 14,000 reference stars, distributed as uniformly as possible over the northern sky, between visual magnitude limits 6.5 and 8.5. This list has since been prepared by F. P. Scott. A report by Mr Scott supplies the following information on the composition of this list. It contains approximately 13,500 stars of mixed spectral type from -5° to $+90^{\circ}$ declination, suitable for the reduction of the proposed AGK 3 plates. It provides a minimum of twelve stars, three in each quadrant, for the reduction of each AGK 3 plate. This minimum is exceeded for the majority of plates. The bulk of the stars in the list, 84%, are in the visual magnitude range 6.5 to 8.5. Fewer than 0.5% are fainter than visual magnitude 9.0.

The list contains approximately the following numbers of stars common with other lists:

with AGK 2 A, 4600; with GC, 4400; with KSZ, 3,700.

As the original Washington list, it has been selected for the dual purpose of providing reference stars for the photographic reobservation of AG zones and for the Lick survey of extragalactic nebulae. A grating in front of the photographic objective is used in the Lick survey and contemplated for AGK 3.

The details of the meridian-circle programme to observe these reference stars must be further considered. A conference at Brussels early in 1955 is planned for this purpose. Provisionally it can be said that the plan is for the reference stars to be observed by a number of meridian circles, and that the revised FK 3, now being prepared by A. Kopff and his associates, will be used as the fundamental system.

The Cape Observatory reports that the work on the 'Cape photographic catalogue for 1950.0' has continued during the past three years. The first three sections of this catalogue covering -30° to -35° , -35° to -40° and -52° to -56° will appear in *Cape Annals*, Vols. 17-19, which will shortly be published. The plates for the zone between -56° and -60° were measured at Greenwich and reduced as far as to give the positions of the stars for 1950.0. This material was returned in 1953 to the Cape where the catalogue is being compiled. The computation of the proper motions and the catalogue precessions are complete and the manuscript of the catalogue is being started. It is hoped that it may be possible during 1955 to publish this catalogue, together with that for the zone -60° to -64° , which is already complete, as Vol. 20 of the *Cape Annals*.

The plates for the zone -64° to -68° have been measured and the reductions are well in hand. The zones between -68° and -90° have been photographed and the corresponding meridian observations of suitable reference stars are complete. It is hoped that the catalogue as a whole will be available by 1960.

The Yale Observatory published in its *Transactions*, Vol. 23, a supplement to the Yale zone catalogues in declinations -30° to $+30^{\circ}$. This supplementary volume furnishes additional comparisons with the General Catalogue and improved positions and proper motions of numerous stars for which incomplete data were given in the zone catalogues. Vols. 24 and 25 contain a revision of the zones $+25^{\circ}$ to $+30^{\circ}$ and $+20^{\circ}$ to $+25^{\circ}$ previously published in Vols. 9 and 10. The revised positions are referred to equator and equinox of 1950.0, are on the FK 3 system, have been obtained by combining the Yale position with the AGK 2 position at approximately the same epoch, and the proper motions have also been improved. Further details are found in *Trans. I.A.U.*⁽³⁾

Yale Transactions, Vol. 26, part I, now in the Press, will contain a catalogue of 1031 stars within 5° of the north celestial pole. This work was undertaken primarily to test the field of a new 8-inch Ross camera which had been used for the plates in declination $+60^{\circ}$ to $+90^{\circ}$. With the full aperture images of excellent quality are obtained on plates

measuring 8×10 inches. However, it was necessary to reduce the aperture to 4 inches in order to obtain images of good quality near the corners of 17×17 inch plates.

As reported in *Trans. I.A.U.* (4), the new series of plates covering declinations $+50^\circ$ to $+90^\circ$ is to be measured at the Watson Scientific Computing Laboratory in New York. Details of the performance of the automatic measuring engine are given in an article by W. J. Eckert and R. B. Jones (5), a paper presented at the Evanston conference on problems in astrometry. Experimentation with the new measuring machine has delayed its application to routine measurements, but it is now expected that the measurements of the zone $+50^\circ$ to $+60^\circ$ will be carried out during the first half of the year 1955.

The Lick Observatory reports that the first set of plates taken with the 20-inch Carnegie astrograph for the Lick proper-motion programme has been completed. The first plate on the programme was taken 10 April 1947, the last one on 4 March 1954, all by C. D. Shane and C. A. Wirtanen. The total number of fields is 1246. They cover the sky from the north pole down to declination -23° . Each plate covers a $6^\circ \times 6^\circ$ field; the overlap is 1° on each side of a plate. The scale of the instrument is $55''14/\text{mm}$. More detailed reports concerning the programme have been published by C. D. Shane and S. Vasilevskis (6) and by S. Vasilevskis (7). S. Vasilevskis has been appointed in charge of further developments on the programme. Recently several plates have been measured with the large measuring engine at Yale University and with the automatic engine of the Watson Computing Laboratory of the I.B.M. to investigate the accuracy to be expected in stellar proper motions with reference to the extragalactic nebulae and to obtain data for planning a large measuring engine for the Lick Observatory.

The Lick Observatory also calls attention to the two resolutions at the I.A.U. Rome meeting and the third resolution of the Evanston conference which call for a programme in the southern hemisphere similar to that of the Lick proper-motion project. They urge that the extension to the south should not be delayed, and recommend an instrument similar to the 20-inch Carnegie astrograph. An overlap of at least 5° with the area covered by Lick would be desirable. The report further states that smaller instruments, like normal astrographs, could photograph nebulae following the Russian programme and contribute an additional weight to stellar proper motions with reference to extragalactic nebulae. However, the photographs of single bright nebulae have at least two disadvantages:

(1) Relative constants of two plates cannot be determined from nebulae. Stars introduce a cosmical error due to their individual motions, and they cause an additional error if the set of faint reference stars in the field of a nebulae is different from the set in the field of a catalogue star, as proposed by A. N. Deutsch (8).

(2) As a general rule, not many bright nebulae have small and symmetric nuclei or condensations for accurate measurements. To obtain the best images, exposure time should be different for different nebulae, but this variation may introduce additional errors due to different mean distances of reference stars for different plates.

Since the northern hemisphere will be well observed by the AGK 3 project, the Yale Observatory had decided not to continue taking plates on the northern hemisphere south of $+50^\circ$. Instead it proposes to concentrate on the southern hemisphere. At present the best plan appears to be to defer the reobservation of the zones between 0° and -30° until the early 1960's, after the observation of the AGK 3 reference stars can be completed. It is hoped that then the United States Naval Observatory in Washington and the Cape Observatory can simultaneously undertake the observation of reference stars between 0° and -30° . In the meantime the Yale Observatory plans to take photographic plates south of -30° in co-operation with Mr Harley Wood, Director of the Sydney Observatory. For the reference stars it is contemplated that the positions of the current Cape programme of all GC stars brighter than magnitude 8.5 between -30° and -52° might serve. Correspondence is in progress between the Yale Observatory and the Cape Observatory concerning the possibility of inserting a number of additional stars in regions where the distribution of the GC stars is insufficient.

It is evident that the problem of dealing with the reobservation by photography of the southern hemisphere is much more difficult than that for the northern hemisphere, simply because the number of meridian circles in the southern hemisphere available for the observation of the necessary reference stars is so exceedingly limited.

DIRK BROUWER
President of the Sub-Commission

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Report of Meeting of Commissions 8 and 8a. 30 August 1955

PRESIDENT: Prof. M. S. Zverev.

SECRETARY: Prof. J. Larink.

1. The Draft Report is approved after a short discussion. A notice of publication of the last volumes of the *Geschichte des Fixsternhimmels (GFH)*, edited by Prof. Haas, will be added.

2. Dr Fricke reports that in the future it is planned, in the volumes of the *Apparent Places of Fundamental Stars*, to drop the Mean Places of these stars as a separate list, since these data are given at the foot of each page. Dr Fricke wants a discussion on the following three proposals, which have been made in Commission 4 (Ephemerides):

- (a) Beginning with 1958 the Mean Places will be dropped.
- (b) The list of Mean Places of Fundamental Stars will appear every ten years (1970, 1980, etc.); it will be given for the first time for 1961, since the FK₄ will be finished in time for this edition.
- (c) The Mean Places will be given, without the highest accuracy, as a special publication.

After discussion between Fricke, Atkinson, Sadler, Dieckvoss, Levy, Fayet, Nemiro, Brouwer and Murray, Dr Fricke proposes the following formulation:

In the years following 1960, when the publication of the *Apparent Places of Fundamental Stars* has been taken over by the *Astronomisches Recheninstitut* at Heidelberg, the Mean Places will be dropped generally. They will appear in 1970, 1980, etc. Since the FK₄ will not be finished when the Apparent Places for 1960 are going to press, the Mean Places for 1960 will appear in the 1961 edition of the Apparent Places.

There being no objection, this proposal is accepted.

3. Dr Atkinson proposes to give, in star catalogues, besides the epoch of observation, the mean of the parallactic factors for each star, so as to make a correction of a star place possible if a parallax of this star becomes known. The president considers it quite enough to publish, besides the mean epoch, the mean fraction of the year. After a short discussion the proposal of Dr Atkinson is accepted (see Resolutions).

I. AGK 3 R

O. Heckmann and Dr Brouwer report on the Brussels meeting 28–30 March 1955 (*Communications de l'Observatoire Royal de Belgique*, no. 85). By combining the star list of Scott and Zverev, the new catalogue of reference stars for the photographic re-observation of the catalogues of the *Astronomische Gesellschaft* (AGK 3 R) will comprise about 21,000 stars. F. Scott has undertaken the distribution of these 21,000 stars among the following twelve observatories: Berlin-Babelsberg, Bordeaux, Greenwich, Hamburg-Bergedorf, Heidelberg, Lund, Nicolaiev, Ottawa, Paris, Pulkovo, Strassburg, U.S. Naval Observatory in Washington.

He reports that ten observations of each star in combined lists have been agreed upon. The total number of meridian observations now consists of 210,000 observations of reference stars and 50,000 observations of fundamental stars.

M. Zverev communicates the revision of the KSZ-list recently carried out at Pulkovo: 1118 of the fainter stars were taken off and 1453 brighter stars and stars situated in the neighbourhood of the selected extra-galactic nebulae were added. The KSZ-list now contains 15,690 stars from $+90^\circ$ to -30° declination, thus 50.7 stars per 100 square degrees.

D. Brouwer then formulates the following two recommendations, which are unanimously accepted:

(a) The plan of observing the *Astronomische Gesellschaft* stars for a third time, by repeating at Bonn and at Hamburg-Bergedorf the photographic observations made by these observatories around 1930, has been considered in different international conferences. In addition, Commission 8 has examined the resolutions adopted by the Conference on Astrometry held in Brussels 28–30 March 1955, which deal in particular with the meridian observations of the necessary reference stars and with the current revision of the FK 3 by Prof. Kopff.

The Commission recommends the approval by the General Assembly of the resolutions adopted at the Brussels Conference (*Comm. Obs. Royal de Belgique*, no. 85, pp. 40–2), with one change: no. II of these Resolutions is to be replaced by the following item:

The Conference appreciates the co-operation already offered by the above-named twelve observatories.

The division of observations of the reference stars is shown in the following table prepared by Scott.

	C		S'		Z'	
	a	b	a	b	a	b
Declination $+40^\circ$ to $+90^\circ$ N =	85	1224	97	3058	781	1588
Pulk.-Nic.	2	2	2	2	2	2
French Obs.	—	—	2	2	4	4
Wash.	2	2	2	2	—	2
Grw.	2	2	2	2	—	—
Berg.	2	2	2	2	2	—
Lund	—	—	—	—	—	—
Heid.	—	—	—	—	—	—
Ott.	2	2	—	—	—	—
Bab.	—	—	—	—	—	—
	10	10	10	10	10	10

TABLE (cont.)

	C		S'		Z'	
	a	b	a	b	a	b
Declination +15° to +40° N=	100	1104	99	3496	967	1737
Pulk.-Nic.	2	2	2	2	2	2
French Obs.	—	—	2	—	4	4
Wash.	2	2	2	2	—	2
Grw.	2	2	2	2	—	—
Berg.	2	2	2	2	2	—
Lund	—	—	—	2	—	2
Heid.	—	—	—	—	—	—
Ott.	2	2	—	—	—	—
Bab.	—	—	—	—	2	—
	10	10	10	10	10	10
Declination +5° to +15° N=	37	544	22	1578	530	642
Pulk.-Nic.	2	2	2	2	2	2
French Obs.	2	—	2	—	4	4
Wash.	2	2	2	2	—	2
Grw.	2	2	2	2	—	—
Berg.	—	—	—	—	2	—
Lund	—	—	—	2	—	2
Heid.	2	2	2	2	—	—
Ott.	—	2	—	—	—	—
Bab.	—	—	—	—	2	—
	10	10	10	10	10	10
Declination -5° to +5° N=	28	535	30	1518	534	719
Pulk.-Nic.	2	2	2	2	2	2
French Obs.	2	—	2	2	4	4
Wash.	2	2	2	2	—	2
Grw.	2	2	2	2	—	—
Berg.	—	—	—	—	2	—
Lund	—	—	—	—	—	—
Heid.	2	2	2	2	—	—
Ott.	—	2	—	—	—	—
Bab.	—	—	—	—	2	2
	10	10	10	10	10	10

If Z is the complete Zverev list, S the complete Scott list and C the stars common to both lists, then Z' in the table is $(Z-C)$, S' is $(S-C)$; a indicates stars equal or fainter than 8.9, b stars equal or brighter than 8.8 and N the number of stars. The number of stars per zone will be changed slightly due to revisions of both star lists.

(b) The Commission recommends that a permanent committee, consisting of D. Brouwer, A. Danjon, W. Fricke, O. Heckmann, A. A. Nemiro, F. P. Scott (chairman), L. S. T. Symms and M. S. Zverev, be appointed to deal with the co-ordination of the various phases of the project. This committee shall have authority to make decisions necessary to ensure the successful completion of the work.

II. COMMUNICATIONS OF INDIVIDUAL MEMBERS OF THE COMMISSION

1. G. van Herk reports his work on the flexure in the tube of the meridian circle of the Leiden Observatory.

The van Heel method of aligning three points was used. So far, only the influence of the observer's heat on the flexure of the tube was investigated. The differences in temperature measured at two parts of the ocular end of the tube showed a consistent correlation with the change in flexure as measured optically.

2. B. Guinot reports on the derivation of the systematic errors $\Delta\alpha_s$ and $\Delta\delta_s$ of FK 3 and N 30.

La méthode d'observation des hauteurs égales se prête à la détermination des erreurs $\Delta\alpha_s$ et $\Delta\delta_s$ des catalogues utilisés. Ces erreurs se déduisent de la considération des écarts 'observé minus calculé' en fonction de l'azimut.

Les résultats suivants ont été obtenus avec l'astrolabe impersonnel de M. Danjon à l'observatoire de Paris. 301 étoiles du FK 3, de magnitude inférieure ou égale à $5^m.3$, et de déclinaisons comprises entre $+18^\circ$ et $+78^\circ$ et observées d'octobre 1953 jusqu'à juin 1955. Environ 6000 passages ont été utilisés.

Le tableau donne les écarts, 'catalogue minus astrolabe', pour les positions du FK 3 et du N 30 à l'époque de l'observation.

	FK 3 – Astrolabe		N 30 – Astrolabe		Erreurs quadra- tiques moyennes	
+ 74°0	– 0 ^s .045	– 0 ^o .04	– 0 ^s .018	– 0 ^o .09	± 0 ^s .011	± 0 ^o .10
69.5	– 21	– 11	– 2	– 18	8	12
59.5	– 17	—	0	—	4	—
50.0	+ 2	+ 5	– 5	– 5	3	12
40.5	+ 5	– 2	+ 2	– 1	3	6
32.5	+ 2	– 5	– 3	– 2	3	4
26.0	+ 3	– 2	– 2	– 2	4	4
22.5	+ 5	0	+ 4	+ 1	8	5
+ 19.5	—	+ 7	—	+ 7	—	6

Ces nombres ne sont définis qu'à une constante près. Les valeurs absentes du tableau auraient un poids très faible (étoiles circumméridiennes pour les ascensions droites, étoiles à la plus grande digression pour les déclinaisons).

Les résultats pourraient être entachés d'erreur, s'il existait une erreur systématique d'observation en fonction de l'azimut, mais, d'une part l'accord des résultats des cinq observateurs ayant travaillé avec l'instrument, d'autre part l'absence d'erreur systématique dans la vitesse d'instrument du micromètre, me font croire que l'on peut accorder une grande confiance à ces résultats.

3. J. Larink makes some remarks on the catalogue of 3356 faint stars observed at Bergedorf by H. Kox and himself, and at Heidelberg by A. Bohrmann, I. Groeneveld and H. Klauder. Since each star has been observed eight times, the mean error of one catalogue position is $\pm 0^s.006$ sec δ in α and $\pm 0".16$ in δ . The systematic difference between Bergedorf and Heidelberg is $0^s.000$ and $-0".05$. These values are independent of the brightness of the stars, which varies between $8^m.0$ to $10^m.5$.

Proper motions have been derived for all stars by comparison with AGK 2 and AGK 2 A. Proper motions have also been derived for the stars between 0° and $+50^\circ$ declination which are in the catalogue Küstner 1900 (Bonn X), including the positions of this catalogue reduced to FK 3. Comparison of these two determinations of proper motions, which are both printed in the catalogue of faint stars, shows no systematic difference in α ; in δ there is a systematic difference of $-0".24$ for the proper motion in

100 years. A correction of $+0''.14$ to the declinations of Kü 1900 would remove this systematic difference.

4. B. Strömgren reports on the new 7-inch transit with glass circles, which has been erected about 60 km. west of Copenhagen. The constancy of the instrument has been examined by photographic measurements of the Polarisima and by photographic determinations of the nadir point and the collimation error.

5. J. Dick reports on the appearance of the second part of the volume 24 of the *Geschichte des Fixsternhimmels, Abteilung II*.

When closing the meeting the President expressed his gratitude to the translators, Mme S. D. Gossner and Prof. J. Witkowski, and also to Dr A. A. Nemiro for his active aid during the meetings of Commission 8.