

24. COMMISSION DES PARALLAXES STELLAIRES ET DES MOUVEMENTS PROPRES

PRÉSIDENT: M. SCHLESINGER, *Director of the Yale Observatory, New Haven, Conn., U.S.A.*

MEMBRES: MM. G. Abetti, Adams, Alden, H. D. Curtis, C. R. Davidson, De Sitter, Fox, Harper, Jones, Knox-Shaw, Lee, Lockyer, Miller, Mitchell, Russell, Shapley, Smart, Van Maanen, Voûte.

The following brief replies to a questionnaire, circulated by the President in November 1927, show the present status of the work, and the progress made since the last report.

ALLEGHENY OBSERVATORY, Pittsburgh, Pennsylvania, U.S.A. 30-inch Photographic Refractor.

(1) Even though the active parallax list for observation has been reduced to about 60 per cent. of its extent in 1920, this work still absorbs the greater portion of the available time of the Thaw photographic refractor. The total number of plates is now close to 39,000, of which nearly 80 per cent. are parallax. While we have not yet attained the desired goal of an average probable error of $0''.005$, we are coming closer to it, an unpublished list of 60 stars by Mrs Crissman having an average probable error of $0''.0054$. Seventy other parallaxes by Mr Daniel will be published soon. In addition, all work has been completed, on the observational side, on 300 additional regions. The limit for completion of a region is now set at 25 plates, of quality "satisfactory" or better, at at least seven epochs. In all recent regions, where it has been possible to choose either of two sets of comparison stars, one needing a short exposure (30 to 60 seconds), or one needing a longer exposure (generally 180 to 240 seconds), the set requiring the longer exposure is always selected. In addition, we are rather rigidly refraining from taking any plates on nights when the seeing is distinctly below fair. Perhaps all these reasons may contribute to the gradual reduction of the average probable error. (2) Somewhat rough and tentative estimates indicate that the Thaw photographic refractor can be fully and profitably employed in parallax work for the coming 20 or 25 years at least, and such is our present intention. (3) Many of the early regions which were taken with quite short exposure times are now being repeated with other comparison stars requiring longer exposures. (4) We are aiming here at small average probable error, as likely to be of more permanent value than size of output. In addition, we feel that the time has come for a wider selection of stars than was deemed advisable ten years ago. Numerous A and B type, and some peculiar types, all the Cepheids accessible, etc., also, every star in the *American Ephemeris* or in the *Jahrbuch* should eventually be investigated. We should try to get away, if possible, from the undue preponderance of dwarf stars in our lists. As to duplication of work by different institutions we believe that there is still urgent need for some measure of this, and would prefer more, rather than less, of such duplication of results.

HEBER D. CURTIS, *Director*

December, 1927

R. OSSERVATORIO ASTROFISICO, Arcetri, Italy. 12-inch Reflecting Telescope with Objective Prism.

(1) The observations begun in 1923 with the 12-inch reflecting telescope with objective prisms (see report in *Transactions of the International Astronomical Union*, 2, 74, 1925) have been continued in 1924, resulting in the determination of the spectroscopic parallaxes of 275 stars of Secchi's first Type. These have been published in the publications of this Observatory, Nos. 41 and 42 (1924, 1925); as to the results of this series I refer to the previous report and to the comparison made by other investigators. (2) Since 1925 no more observations of spectroscopic parallaxes have been carried out here. But with the same instruments and methods used for the spectroscopic parallaxes, researches have been made in 1926 on the variations of spectra of some Cepheids (see fasc. 44, *Pubblicazioni*, Arcetri). It will be possible to study these spectra also in relation to the luminosity of those stars and hence to determine their parallax. In future, research on the parallaxes of Cepheids and Pseudo-Cepheids is contemplated, conditions permitting. (3) Direct comparisons of star spectra taken with objective-prism and with slit-spectrograph should be made, and a list of fundamental lines on which to base the determinations of spectroscopic parallaxes should be discussed.

GIORGIO ABETTI, *Director*

November, 1927

BOSSCHA-STERREWACHT, Lembang, Java.

Our double 24-inch refractor is on the way from Europe. I hope to start work about May or June, 1928. Our programme will be parallaxes and proper motions of faint stars having large proper motions.

J. VOÛTE

December, 1927

OBSERVATORY, CAMBRIDGE, ENGLAND. 12-inch Polar Siderostat (Photographic).

(1) We are still carrying out our programme of proper motions begun in 1922 by the method of super-imposing a recent plate photographed through the glass with an old one taken directly. Our old plates belong mainly to the parallax programme of Hinks and Russell from about 1900 to 1906. We have therefore an interval now of about a quarter of a century. (2) We have completed the photography of the Selected Areas accessible to the Sheepshanks telescope—it is hoped that these plates will be used in the future for the measurement of the proper motions of stars in these Areas. (3) By the middle of 1926 we had measured a sufficient number of proper motions to justify an analysis of the material. The results are in my paper "The Constants of the Star Streams from Photographic Proper Motions of 3029 Stars", *Monthly Notices*, 87, 122 (December, 1926). This is, I believe, the first occasion that a single observatory has, without external assistance, secured the necessary plates (with the same telescope), completed the measuring of these, and deduced the constants of the streams for faint stars. The average probable error of the proper motions is between 0".3 and 0".4 per century. The principal results of this paper are as follows:

	R.A.	Dec.
Drift I	88°	-12°
Drift II	289	-73
Vertex of streaming ...	92	+20
Solar apex	273	+44

The stars are equally distributed between the two streams. The relative velocities of Drift I, Drift II, and the solar motion are: 1.5 : 0.97 : 0.88.

(4) I have made an analysis—similar to (3)—of the very valuable proper motion material in the *Groningen Publications*—partially analysed by Dr ten Bruggencate, *Bulletin of the Astronomical Institutes of the Netherlands*, No. 85 (September, 1925). This analysis will be found in my paper “The Constants of Star-Streaming from the Groningen Proper Motions”: *Monthly Notices*, **88** (December, 1927). (5) A knowledge of the probable errors of the proper motions is very essential. These are generally calculable only from the proper motion measures themselves. My paper, “The Errors of Photographic Proper Motions”, *Monthly Notices*, **87**, 446, gives an independent discussion, theoretical and practical, of the probable errors. The results are in general accordance with the values of the probable errors—0".3 to 0".4 per century—already stated. (6) We are attempting with the kind assistance of Dr Knox-Shaw, of the Radcliffe Observatory, to measure the colour indices of the stars in the photographic regions in order to find out the relation between star-streaming and spectral type.

W. M. SMART

January, 1928

ROYAL OBSERVATORY, Cape of Good Hope, South Africa. 24-inch Photographic Refractor.

(1) *Programme*: stars south of declination -10° , with proper motions exceeding 40" per century, including many faint stars of large proper motion. A number of stars north of -10° declination, the parallaxes of which have been determined at Allegheny or Leander McCormick, have been included in the programme in order to secure a control over systematic errors.

(2) *Observations*: these were commenced in April, 1926. Up to the end of November, 1927, the number of plates secured was 3040, of which 109 have been rejected as unsuitable for measurement. At present 213 stars are under observation; none of the very bright or very faint stars on the observing programme have yet been observed. The measuring is practically up to date. Bad definition is very prevalent at the Cape and many of the plates have been secured under poor conditions: the relative weight of such plates remains to be determined and will condition future policy as to observing under conditions of seeing which are distinctly poor.

(3) *Future plans*: it is proposed to continue the parallax observations for a minimum period of ten years. The observations will be continued for a longer period if parallax determinations are then considered to be the most valuable work which can be undertaken with the instrument.

(4) *Co-operation*: the field available for observation in the southern skies is so extensive that questions of co-operation do not really enter into consideration at present. The Yale telescope in Johannesburg is the only other instrument actively engaged on stellar parallax determinations in the southern hemisphere. It is desirable to have at least two independent determinations of the parallax of any one star. The Cape programme includes many stars which are also on the observing programme with the Yale telescope.

H. SPENCER JONES

December, 1927

DEARBORN OBSERVATORY, Evanston, Illinois, U.S.A. 18.5-inch Visual Refractor.

A revised summary of the results of our observations for parallax was presented in a paper to the Madison meeting of the American Astronomical Society, September, 1927. The manuscript of the volume containing this work is nearly completed.

PHILIP FOX, *Director*

February, 1928

ROYAL OBSERVATORY, Greenwich, England. 26-inch Photographic Refractor.

(1) A volume containing the parallaxes of 266 stars with an internal probable error of $\pm 0''.008$ has been published. The parallaxes of 100 additional stars have since been published in the *Monthly Notices*. (2) The work applies to stars north of $+64^\circ$ declination and a very small number of other stars for comparison with other observatories. The programme includes (a) all stars brighter than 5.5 magnitude; (b) stars brighter than 7.0 magnitude with proper motions greater than $0''.100$; (c) stars brighter than 8.0 magnitude with proper motions greater than $0''.150$; (d) faint stars of large proper motion found in the photographic re-observation of the Greenwich Astrographic Zones, now in progress. To reduce the bright stars to the magnitude of the comparison stars of magnitudes 11 to 12, recourse has been had to local staining of the plates with copper sulphate. The first results of this method are now being published and are quite satisfactory. (3) A paper "A Method for Correcting Series of Parallax Observations", by Sir Frank Dyson, has been published in the *Monthly Notices*, 1926.

November, 1927

F. W. DYSON, *Astronomer Royal*

KAPTEYN ASTRONOMICAL LABORATORY, Groningen, Holland.

Since the last report we have measured at this Laboratory the proper motions of the Praesepe stars and have found members of the group as faint as apparent photographic magnitude 18. The results have been published in *Groningen Publications*, No. 41. Dr van Maanen has agreed to take a few plates of the cluster showing very faint stars which are to be repeated after a certain number of years for the determination of the proper motions. Further, we have published the proper motions in some regions of high galactic latitude; see *Groningen Publications*, No. 39. We have been measuring lately the proper motions of cluster Messier 67 and of the Hyades on plates containing stars as faint as photographic magnitude 13.6. Three members of the Hyades group between magnitudes 12 and 13 have been found. Finally, the proper motions have been determined of the stars the parallaxes of which have been measured at the Radcliffe Observatory (see *Radcliffe Observations*, 53). In the future I hope to find large proper motion stars on some of the Franklin Adams plates. These plates contain very faint stars and it seems possible to find all stars the proper motion of which exceeds $0''.3$ per annum, if the plates are repeated now. I have corresponded with Dr Innes and Dr Wood about the repetition of the plates; probably they will start the taking of the plates next year. Finally, some plates taken with the Crocker telescope at the Lick Observatory (*Lick Publications*, 11) will be kindly repeated by the Lick astronomers and will be sent to this Laboratory for blinking purposes. Probably all stars will be found the annual proper motion of which exceeds $0''.4$. The limiting photographic magnitude will be 15 approximately.

P. J. VAN RHIJN, *Director*

November, 1927

HARVARD COLLEGE OBSERVATORY, Cambridge, Massachusetts, U.S.A.

The work on spectroscopic parallaxes at Harvard has progressed in two respects during the past triennium: (1) examination of the fundamental spectroscopic differences in stars of differing absolute luminosities; (2) systematic accumulation of spectrograms for southern stars. Before we can make more than empirical use of the various spectroscopic criteria of absolute magnitude, it will be necessary to make thorough spectroscopic analyses of the origins and intensities of the various lines and bands involved. Through the work of Miss Payne, Professor Gerasimovič, Mr Hogg, and others at this Observatory, we are contributing to the analysis that will be the basis of determinations of absolute magnitudes and spectroscopic parallaxes in the future. Professor Gerasimovič is studying on Harvard plates the relation of emission lines to absolute magnitudes for the various types where such radiations are found; and Miss Payne's spectrophotometric study of high luminosity stars of all types is directly connected with criteria of absolute magnitudes. The investigations of the relation of the width of hydrogen lines in Class A stars to absolute magnitude, mentioned in the last report, has been resumed. Several hundred spectrograms of southern stars brighter than the seventh magnitude have been made for the parallax programme with the Boyden 13-inch refractor. Awaiting further study of absolute magnitude criteria, no systematic discussion of the accumulated data has been undertaken, except that Miss Howarth and the writer are now determining the absolute and revised spectral classes for Class M stars south of -30° declination, following as closely as possible the Mount Wilson system in order to complete for the whole sky, on a homogeneous though perhaps provisional basis, the survey of absolute magnitudes for M stars.

HARLOW SHAPLEY, *Director*

November, 1927

HARVARD COLLEGE OBSERVATORY, Cambridge, Massachusetts, U.S.A.

(1) Since the 1925 meeting of the Union the blink microscope has come into active use here. About 360 pairs of plates taken with the Bache telescope (scale 1 mm. = $3'$) have been examined and 2500 objects marked. The majority of these stars have now been measured, and a list of 179 new proper motion stars was published in *Harvard Circular*, 310. It is hoped that among the remainder there will be about 500 more new proper motion stars. (2) In addition a number of plates taken with the Bruce 24-inch telescope have been blinked and another 3000 objects have been marked. It is found that on a good pair of plates, with an interval of 25 to 30 years, proper motions as small as $0''.04$ annually may be seen, while the limiting magnitude for discovery seems to be about 1.5 above the limiting magnitude of the plate. Already 500 proper motions larger than this limit, and of stars mainly between magnitudes 12 and 16, have been measured. (3) In preparing these measures for publication a number of questions have been raised, chief among which are: (a) Which method of identification shall be chosen? Since the majority of these stars will not be of any more than statistical interest, it is doubtful whether it is necessary, or, in view of the labour involved, even advisable, to publish equatorial co-ordinates. If these are published, however, which equinox should be chosen? Two of these suggest themselves in preference to all others, namely, the uniform equinox of 1900 (the *Astrographic Chart* and the *Henry Draper Catalogue and Extension*) or the

Durchmusterung equinox (1855 and 1875 respectively). (b) In order to facilitate comparison of results, and especially in order to make the results of use in statistical investigations, it is urged that at least an attempt be made to standardize the magnitude systems. Instances are not rare in which the difference between the published value and the corresponding international standard exceeds two magnitudes. (4) One problem has arisen which seems of sufficient importance to call for special recommendations. It has already been pointed out by Hertzsprung that it should be possible to determine the angular motion of the Magellanic Clouds, in not too long a time, if the assumption may be made that the two Clouds move parallel in space. The possibilities have again been discussed by the present writer in a paper in the *Proceedings of the National Academy* (U.S.A.). As a result it is here urged that an effort be made to determine the proper motion of the stars in the Clouds by direct meridian observations as well as by photographic comparison with the foreground stars.

W. J. LUYTEN

December, 1927

LEIDEN OBSERVATORY, Holland.

We have for several years been engaged in deriving the proper motions of stars in the region of the Pleiades down to the 14th or 15th magnitude from a comparison of old and new plates. The work is progressing steadily. We have now entirely finished 8 pairs of plates and have measured 11 other pairs.

W. DE SITTER, *Director*

December, 1927

NORMAN LOCKYER OBSERVATORY, Sidmouth, England.

(1) Papers published since the last report in 1925:

"The Luminosities and Parallaxes of 525 Stars, Types Fo to Mb." (*Memoirs of the Royal Astronomical Society*, 64, 1.)

"Spectroscopic Parallaxes of B-Type Stars (3rd Paper): Second List of 100 Parallaxes." (*Monthly Notices*, 85, 439.)

"Spectroscopic Parallaxes of B-Type Stars (4th Paper): The Method of Adams and Joy." (*Monthly Notices*, 87, 364.)

"Spectroscopic Parallaxes of 300 Stars of Spectral Class A₀ to A₅." (*Monthly Notices*, 87, 387.)

The total number of parallaxes published since the last report, in 1925, is 1225, as follows: Types F-M, 525; A, 300; B, 400. (2) The work in hand is restricted to the B-type stars and is of two kinds: the method of line intensity, the measurements being made with the wedge; and a modification of Adams and Joy's method. The latter is applicable generally but the former only to a limited section of B-type stars. Photographs are being taken of all B-type stars down to magnitude 6.5 and -30° declination, parallaxes being measured by both methods when possible. (3) The present system of carrying out the work and co-operation seems satisfactory and I have no further suggestions to make.

WILLIAM J. S. LOCKYER, *Director*

November, 1927

LEANDER McCORMICK OBSERVATORY, Virginia, U.S.A. 26-inch Visual Refractor.

(1) Since the last report, the second parallax volume has been distributed. This has completed the details for 700 stars. The parallaxes of a total of 850 stars have been finished up to the present. We are planning to continue the parallax observations without substantial changes. (2) We are greatly interested not only in parallaxes but also in many different kinds of proper motion investigations. We are continuing the measures of the motions of the Boss stars with respect to stars of the tenth visual magnitude. The work already completed has furnished the means of deriving the solar motion, corrections to Boss's system of proper motion, and also the secular parallaxes of stars of tenth magnitude in different galactic latitudes. This work, and that along similar lines, have made us desirous of extending the observations for proper motions to stars fainter than the tenth magnitude; we have made a beginning by securing the first epoch of plates in some regions surrounding Boss stars at different galactic latitudes. Unfortunately, since our telescope is a visual refractor, the exposures necessary to secure well-measurable images of stars of the twelfth and thirteenth magnitudes are rather long. As a result, the observational work cannot proceed with great rapidity. Moreover, since it has been shown that the sizes of the motions of faint stars are intimately connected with spectral type, the B-type stars having smaller proper motions than those of later spectral types, we are very anxious to ascertain the spectral types of faint stars in different parts of the sky, that is, in different galactic latitudes. (3) The secular parallaxes of stars of tenth magnitude, referred to above, have given valuable information regarding the annual parallaxes of stars of the tenth magnitude. This has furnished the corrections to be applied to trigonometric parallaxes to change from relative to absolute parallaxes; van de Kamp has shown that the correction in the Milky Way amounts to $+ 0''.003$, while at the galactic pole it is $+ 0''.007$. Attention should be called to the fact that discussions of systematic errors of parallax series hitherto carried out on the assumption of a constant correction from relative to absolute parallax may have caused the derivation of a spurious systematic correction depending on the right ascension. (4) The first plates on a programme of more than one hundred Cepheids have been secured. The proper motions thus derived will be combined with other material eventually to determine the parallaxes of the Cepheids. The whole parallax work seems to be well organized and I have no recommendations to make for co-operative work.

S. A. MITCHELL, *Director*

November, 1927

MOUNT WILSON OBSERVATORY, Pasadena, California, U.S.A. 100-inch and 60-inch Reflecting Telescopes.

(1) We have determined approximate spectroscopic parallaxes for about 500 additional stars since 1925. For those of spectral types, F, G, and early K we are engaged in further computations of the reduction system and zero point in order to secure more accurate values. A list of definitive parallaxes for 410 M-type stars, containing both giants and dwarfs, was published in 1926, and a somewhat smaller list of K5 stars is nearly completed. We are following in general the plan of concentrating on stars of a single spectral type, beginning with type M and going through K5 to K0, G, and F. The development of a method of

determining the approximate absolute magnitudes and parallaxes of faint dwarf M stars directly from the spectral type (*Astrophysical Journal*, 64, 321, 1926) is proving useful in practice. (2) All our spectroscopic observations of stars of types Fo or later are being used for absolute magnitude and parallax determinations. We are planning to observe all the Boss stars of these types, and have on our programme as well a great number of visual binaries and stars of large proper motion. (3) The theoretical investigation by Strömberg of the errors in the absolute magnitudes of the M-type stars, and the derivation of certain general formulae connecting such errors for any class of stars with the peculiar radial velocities and proper motions should prove of considerable value to those working on mean parallaxes. An important question is raised by the measurements of the proper motions of the fainter Cepheid variables, mainly by Wilson. The values are considerably larger than would be expected from the period-luminosity law. Accordingly, we are observing about 50 of these stars for radial velocity at Mount Wilson in order to secure an independent determination of their mean parallax. (4) I believe the greatest field of usefulness for observers of parallaxes by the trigonometric method lies in stars of large proper motion and large parallax where spectroscopic and photometric methods cannot compete in accuracy. A very important but difficult problem would consist in very accurate measures of certain visual binaries to increase our knowledge of masses, and add to the material used by Eddington in his mass-luminosity relationship.

November, 1927

WALTER S. ADAMS, *Director*

MOUNT WILSON OBSERVATORY, Pasadena, California, U.S.A. 100-inch and 60-inch Reflecting Telescopes.

(1) Two hundred and fifty fields have been finished for the determination of parallaxes, including 274 stars and nebulae. The majority of the material, 158 stars, was put on the programme in order to furnish necessary material for the determination of spectroscopic parallaxes; many of the objects were included on account of the discordant observations of other observers. The results further include 31 stars with proper motions larger than 1" annually, among them Wolf 359; with the parallax derived for this star, 0".404, this is the faintest star known at present, having a visual absolute magnitude of +16.5 and a photographic absolute magnitude of +18.5. The results include, further, 6 faint stars of large proper motion, discovered during the parallax work; 4 stars which were suspected by others to have either large parallaxes or proper motions; 11 stars of the special spectroscopic types, O, N, or M pec; 5 stars of the Algol type, 12 Cepheids, 11 long-period variables, and 5 novae; 31 nebulae, mostly planetaries. (2) In collaboration with Dr Schlesinger and Mr Mitchell a list was compiled of test objects for systematic errors. For 36 of these objects parallaxes have now been finished. (3) The need of reliable proper motions for Cepheid variables was strongly felt and in co-operation with Mr Mitchell and Mr Alden it was decided to secure the necessary material as soon as possible. For 79 fields first-epoch plates have now been secured. (4) I would urge that due attention should be paid to the resolution of the joint meeting of Commissions 24 and 25 (see page 204 of Vol. 2 of the *Transactions* of the Union). With the increasing number of faint stars of large proper motion, I think it is worth the consideration of photometric observers, and it might be well to urge them once more.

December, 1927

A. VAN MAANEN

PRINCETON UNIVERSITY OBSERVATORY, Princeton, New Jersey, U.S.A.

Dr Kovalenko completed last year at Princeton a doctoral thesis upon "A determination of the solar apex and the mean parallax of tenth-magnitude comparison stars, based on photographs taken at the McCormick Observatory". My own investigations on the dynamical parallaxes of double stars have been held up, partly on account of pressure of other work of my own, and partly because Miss Moore, who had the details in hand, has been at Mount Wilson. The present situation with regard to programmes and co-operation appears to me very satisfactory.

HENRY NORRIS RUSSELL, *Director*

November, 1927

RADCLIFFE OBSERVATORY, Oxford, England. 24-inch Photographic Refractor.

(1) Two series of plates are being taken of each of the Selected Areas in the northern hemisphere and of those on the equator, 135 areas in all, including the special fields. The first series consists of plates containing two exposures of 30 minutes at each epoch, the time interval being at least ten years. The second series consists of pairs of plates each containing two exposures, the plates at the second epoch being taken with the glass side turned towards the objective. Sixty-one areas have so far been completely observed, and the reduction of 35 of these has been finished. The work is being pushed on with all possible speed, but the weather conditions have been so bad that progress in the taking of photographs has been very slow during the past two years. Preference is being given to alternate areas in the plan, with the intention of publishing results representative of the northern hemisphere before the whole plan can be completed. (2) The limiting magnitude of the stars with measurable images lies between 14 and 15 (photographic). The probable error of a derived proper motion in either co-ordinate (mean of two determinations) is slightly over $\pm 0''.005$. It is estimated that the number of stars included in the whole programme is 30,000. (3) A *systematic* magnitude equation has been detected and traced to change in relative adjustment of the two components of the objective during the programme (see *Monthly Notices*, 87, 439). It is believed that it will be possible to determine its value with sufficient accuracy, and consequently to free the observations from it.

H. KNOX-SHAW, *Director*

November, 1927

VAN VLECK OBSERVATORY, Middletown, Connecticut, U.S.A. 20-inch Visual Refractor.

(1) Since the last report 1500 parallax plates have been secured. The programme includes faint stars of large proper motion, a few first magnitude stars, and most of the "test stars" selected by the committee appointed at the last meeting of the Union. (2) A paper on the effects of atmospheric dispersion upon stellar parallax determinations was read at the New Haven meeting of the American Astronomical Society, December, 1927. (3) No change in the parallax programme is contemplated.

FREDERICK SLOCUM, *Director*

December, 1927

DOMINION OBSERVATORY, Victoria, British Columbia. 72-inch Reflecting Telescope.

(1) An observing programme of A-type stars was prepared a few years ago. This consisted of stars for which parallaxes were available and also stars of undetermined parallax between the magnitudes 5.5 and 6.5, accessible at this observatory. Occasionally on poor nights spectra of stars brighter than 5.5 are secured. To date about 850 A-type spectra are available of which about 220 are of stars with measured parallax. To date there are available spectra of 740 B-type stars. (2) About 150 additional A-type spectra are needed to complete the provisional programme and approximately 1000 will then be available for the determination of spectroscopic parallaxes. More B stars, especially of the later types, will also be observed. (3) No spectroscopic parallax work has yet been carried out for the B-types. The A-types seem most satisfactorily dealt with when divided into four groups: (a) those showing only the K-line and *Mg* 4481 in addition to the hydrogen lines. The others, by an extension of the Mount Wilson method, are divided into three groups according to the sharpness of the lines, (b) sharp, (c) moderately sharp, and (d) nebulous. Provisional empirical curves are available for each group although the range in (d) is small. Search has been made for lines sensitive to absolute magnitude in this type and a few such have been found. Even better results would seem to be possible if, on large scale microphotograms, areas corresponding to these lines were measured by a planimeter. (4) Several cases are known for which there is a marked difference between the spectroscopic and trigonometric parallax. While it is possible that unknown factors vitiate the spectroscopic results, it is also possible that the trigonometric results are in error. Would it not be well for several observatories doing direct parallax work to reobserve a small selection of these? A list could be filed with the President of the Committee.

W. E. HARPER

December, 1927

YALE UNIVERSITY OBSERVATORY, New Haven, Connecticut, U.S.A. 26-inch Photographic Refractor (South Africa), Two Wide-Angle Doublets.

(1) The work of determining the proper motions of many faint stars by a comparison of modern photographic positions with the Gesellschaft places determined 40 to 50 years earlier, is being pushed forward as rapidly as possible. Since the last report we have issued catalogues of positions and proper motions in the Gesellschaft Zones -2° to $+1^{\circ}$, $+1^{\circ}$ to $+2^{\circ}$, and $+50^{\circ}$ to $+55^{\circ}$. We expect to publish within a few months the proper motions of all the Gesellschaft stars in the zone 55° to 60° . We are engaged in measuring on plates of very large angular field (150 square degrees) the two zones that extend from $+20^{\circ}$ to $+30^{\circ}$. Theoretical investigations by Mr Schilt, Miss Barney, and the writer are described in "The Effect of a Rotation of the Galaxy on Proper Motions in Right Ascension and Declination." By Jan Schilt. *Proceedings of the National Academy of Sciences*, **13**, 642. "Discussion of the Proper Motions in the Equatorial Zone." By Jan Schilt and Ida Barney. *Astronomical Journal*, **37**, 181. "The Relative Parallaxic Motions Derived from Gyllenberg's Catalogue for the Zone $+35^{\circ}$ to $+40^{\circ}$." By Jan Schilt. *Astronomical Journal*, **38**, 31. "The Apex of Solar Motion for Stars of Different Magnitudes and Spectral Types." By Jan Schilt. *Publications of the Astronomical Society of the Pacific*, **39**, 203. "Some Aspects of Astronomical Photography of Precision" (George Darwin Lecture, 1927). By Frank Schlesinger. *Monthly Notices of the Royal Astronomical Society*, **87**, 506.

(2) The Yale telescope at Johannesburg was set up in June, 1925, and Dr Alden was left in charge of it. Observations for the determination of trigonometric parallaxes were begun in September of that year. Up to the present time over 10,000 usable plates have been secured, each with three exposures, an average of 360 a month, or sufficient material for about 200 parallaxes a year. Many stars are now being observed in their fifth season and definitive parallaxes are being derived by Dr Alden. Plates measured by him at Johannesburg, as well as others measured at New Haven, yield results of satisfactory accuracy, the probable error of one good plate being about $0''.022$, equivalent to 0.0012 mm.

(3) The observing programme is an extension of the one that the writer constructed for the Allegheny Telescope in 1914, and includes all stars down to visual magnitude 5.5 of all spectral types except the few that are earlier than A0. The limits of declinations are from $+10^\circ$ to -80° . There is a zone of 23 degrees in width that is common to the Allegheny and the Yale programmes, and thus rich material will be provided for a determination of the systematic difference, if any, between the two series. The angular dimensions of the plates, the methods of observation, measurement, and reduction, as well as the general character of the telescope, are the same in the two cases; it is hoped that there will thus be provided a uniform determination of the trigonometric parallaxes of all the bright stars in both hemispheres.

(4) In addition to bright stars, the programme contains about 200 fainter stars of large proper motion. (5) First-epoch plates for the determination of proper motions in the southern Selected Areas are being obtained as rapidly as circumstances will permit, and also plates for the determination of the proper motions of a selected list of Cepheid variables. (6) A general catalogue of trigonometric parallaxes, containing all such data available through publication and otherwise up to January 1, 1925, was printed and has been distributed to those who are especially interested in this work. A card catalogue of all determinations of parallaxes (trigonometric, spectroscopic, dynamic, and other) is kept up-to-date at Yale Observatory. This catalogue is at the disposal of astronomers who have need of it, and lists of its data have been and will be copied out upon request.

FRANK SCHLESINGER, *Director*

February, 1928

YERKES OBSERVATORY, William Bay, Wisconsin, U.S.A. 40-inch Visual Refractor.

(1) The time of the 40-inch telescope for the morning and evening hours, of about one-half of the nights, has continued to be given for the investigation of stellar parallaxes. Since the last report, the parallaxes of 35 stars were published in the *Astronomical Journal*, 37, 43, 1926, by Dr O. J. Lee. Dr Lee concluded his measures of the plates of the 24 Selected Areas in the Zone $+45^\circ$ declination, and they were published in March, 1926, as Part 4 of Vol. 4 of our Publications. This includes the mass parallaxes and proper motions of 1041 stars in these areas, together with a discussion by Dr Lee. A briefer discussion of some of these results had been previously given by Mr Lee in the *Astronomical Journal*, Nos. 847-8. (2) It is intended that about the same time as heretofore shall be given to stellar parallaxes in the programme of the 40-inch telescope for some years to come. Dr Lee resigned on August 1, 1926, and since September 22, 1926, this work has been placed in the hands of Dr G. W. Moffitt. Sufficient epochs have now been observed on eight or ten stars which have been on the programme for several years past, so that their measurement can now be commenced.

(3) The observational programme has been increased by the addition of 29 M stars ("Titans"), from the list published by Adams, Joy, and Humason, *Astrophysical Journal*, 64, 225, 1926, having spectroscopic parallaxes of $0''.03$ or over, but lacking trigonometric determinations. From most of these stars, the plates for the first epoch have been obtained and for some of them two epochs have been already secured. Stars having large proper motions are being added to the parallax programme, from the lists of such stars discovered here by Dr F. E. Ross. Something over 100 such stars will be added to the parallax list during the year, most of them having annual proper motions of between $0''.3$ and $0''.5$, but some of the stars found by Dr Ross to have exceptionally large proper motions will also be observed here for parallax and proper motion. (4) All but three or four of the plates required for the auxiliary programme covering 44 fields, duplicating early fields for proper motion, have been taken. (5) Dr Frank E. Ross has progressed rapidly in his repetition of the photographs taken by Professor Barnard with the Bruce 10-inch telescope, as well as in his comparison of the new plates with the old under the blink machine. His examination thus far of about 200 plates has resulted in the discovery of over 700 stars having proper motions in excess of $0''.1$ annually, most of them being larger than $0''.2$. Five lists covering 680 stars have been published by him in the *Astronomical Journal*, and it seems probable that the total number found on this programme will exceed 850, if the present proportion of such stars continues in the fields remaining to be investigated. Dr Ross does not regard this examination as at all exhaustive for the stars of $0''.1$ proper motion, as he finds that many stars with proper motion as high as $0''.2$ may escape detection when near the edges of the plates. The largest proper motion thus far found in this survey was $5''.4$, the star being of thirteenth magnitude. (6) Dr Moffitt has introduced new methods of treatment in the dark room which have reduced the necessary time of exposure by at least half of the time that was heretofore required. (7) During the summer of 1925 Miss A. V. Douglas, of McGill University, studied the spectrograms of 206 stars of types B9 and A at the Yerkes Observatory. Her criteria of absolute magnitudes were based upon the relative widths and intensities of various dark lines. For 80 of the stars trigonometric or group parallaxes were available. For 73 of the stars spectroscopic parallaxes had been determined at Mount Wilson and the agreement was satisfactory. Miss Douglas' table, therefore, gives absolute magnitudes and spectroscopic parallaxes for 81 stars, which had not been observed elsewhere. Her results were published in the *Astrophysical Journal*, 64, 262, 1926. It is planned that further studies of this sort will be made on the large number of our spectrograms of stars of Classes A and B. (8) It seems desirable that the interchange of cards giving the stars added to their programmes for parallax should be continued between observatories engaged in this work. The study of the systematic errors between the determinations at different observatories should be continued as far as possible.

EDWIN B. FROST, *Director*

November, 1927

It is evident from the above replies that this Committee has no important resolutions to offer to the Union at this time.

FRANK SCHLESINGER
President of the Commission

February 10, 1928