

32. COMMISSION DES 'SELECTED AREAS'

PRÉSIDENT: M. P. J. van Rhijn.

MEMBRES: MM. Baade, F. Becker, Bok, Brouwer, A. N. Deutsch, Elvius, Fehrenbach, Mme Kalandadze, MM. Kharadze, Oort, Stoy, Young.

PROGRESS OF RESEARCH

The following is a summary of the work on the Plan of Selected Areas since the Rome meeting.

Durchmusterung

Two surveys of the Selected Areas of the Systematic Plan are available ([1])‡ and ([5]). The survey of the areas of the Special Plan is mentioned under [23].

Photographic and visual or photovisual magnitudes, colour indices and effective wave-lengths

Investigations [2]–[4] and [6]–[15] had been completed before the publication of the previous report.

Mount Wilson Observatory: Photovisual magnitudes, northern Selected Areas

Photovisual magnitudes of stars in Selected Areas 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16, 18, 20, 24, 28, 32, 36, 40, 45, 49, 53, 57, 61, 65, 69, 73, 77, 81, 85, 89, 92, 96, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136 have been determined. The observed area is a circle with a diameter of 23'. The limiting magnitude is 14 to 16. The magnitudes have not yet been published on account of the scale error found in the photographic magnitudes ([16]).

Harvard and Groningen: Photographic magnitudes, northern Selected Areas

Photographic magnitudes of the stars in the northern Selected Areas brighter than 13.0 have been determined at the Kapteyn Laboratory on plates taken at the Harvard Observatory. The field is $3^{\circ}5 \times 3^{\circ}5$. The spectral classes of the same stars have been determined at the Hamburg Observatory. The results have been published in [56].

Harvard Observatory

The work on the standard sequences in Selected Areas 141, 158 and 193 has been continued. B. J. Bok and Priscilla Bok have determined photo-electrically standard magnitudes and colours for these Selected Areas ([22]). Photographic and photored magnitudes reported in [22] were determined for twenty stars by comparison with Harvard Standard C Regions. The sequences lie between the photographic magnitudes 8.5 and 14.5. The adopted magnitudes have been reduced to the photo-electric system. Their zero point must be checked before publication.

Miss Olmsted has done considerable work on extending the sequences for Selected Areas 158 and 193 photographically both in blue and red to about 1.5 magnitudes fainter. The magnitudes have been determined by comparison with Harvard Standard Regions at declination $+15^{\circ}$ and by grating plates of long exposures on the Selected Areas.

Photo-electric colours of B stars in Selected Areas 193 have been determined by B. J. Bok and U. van Wijk ([20]). The photographic absorption as a function of the distance has been derived from the colour excesses.

B. J. Bok and Priscilla Bok have determined photo-electrically a standard sequence for Selected Area 141 down to photographic magnitude 15.2. The sequence will be extended to fainter magnitudes by photographic methods.

‡ The numbers in square brackets [1] refer to the list of publications on pp. 469–472. Other references (1) will be found at the end of the report.

Abastumani Astrophysical Observatory

The colour indices of 14,000 stars in areas 1-43 reduced to the international scale have been published ([21]). The magnitudes of the stars are 10-13. See also p. 468 of this report. The work is being extended to the zone of declination $+30^\circ$.

Leiden Observatory

The programme for photographic magnitudes in the southern Selected Areas has already been described (1). The work is still in progress. The measurements of the magnitudes down to magnitude 10.5 have been made by Kooreman and will be finished in 1954. Some additional photo-electric measurements of four standard regions in the -45° zone are being carried out in South Africa.

The colours of B- and A-type stars in northern Selected Areas down to declination -15° in areas with a galactic latitude between -30° and $+30^\circ$ have been published ([19]).

Cambridge (England): Areas at declination $+15^\circ$

The photographic and photovisual magnitudes of 1268 stars in the Selected Areas at $+15^\circ$ in the range 7-10^m have been determined on the international magnitude system of the N.P.S. ([26]). The standard stars were taken from the Seares, Ross, Joyner (SRJ) catalogue. Stars in nine of the Selected Areas were also measured photo-electrically, using a pulse-counting photometer, again with comparison stars near the Pole. In addition 135 SRJ-stars were measured photo-electrically to verify the relation of SRJ-magnitudes to the N.P.S., while all N.P.S.-stars brighter than 10^{m.7} *pv* were measured photo-electrically, to examine their self-consistency of scale.

The catalogue gives the photographic and photovisual magnitudes of the stars together with the recommended magnitudes, which have been derived from the first set by applying corrections for zero point and for scale- and colour-errors of SRJ.

Mount Wilson Observatory

Magnitudes and colours in Selected Areas 57, 61 and 68 have been obtained from photo-electric observations at the 60-inch and 100-inch telescopes. The range covered extends from photographic magnitude 9.0-19.3. The results have been published ([16]). The difference between the photo-electrically determined magnitudes and the *Mount Wilson Catalogue* is nearly zero at the bright end but becomes progressively more positive as the faint limit is reached.

Dr Baum reports that photo-electric sequences have been set up in the following ten areas:

No.	α	δ	No.	α	δ
68	0 ^h 14 ^m	$+15^\circ$	57	13 ^h 06 ^m	$+30^\circ$
94	2 53	0	107	15 36	0
71	3 14	$+15$	61	17 01	$+30$
51	7 28	$+30$	89	21 11	$+15$
54	10 27	$+30$	N.P.S.	—	$+90$

Except for the N.P.S. the list in each area includes about 40 stars, distributed more or less uniformly over the interval from 9th to 19th magnitude. In Selected Areas 68, 51 and 57 additional stars in the interval from 19th magnitude to 23rd magnitude have been measured with the new photon-counting photometer. The observational material is complete and the results will be published before the Dublin meeting of the Union.

Pulkovo Observatory

The colour indices of the B.D. stars in Selected Areas 1-91 have been observed by G. A. Tikhov. The diameter of the field is 4° . The colours are determined by the method of the longitudinal spectrograph ([8] and [17]). Since the Rome meeting Tikhov has observed the Selected Areas at declination 0° and -15° .

Uccle Observatory

A. Velghe has measured the effective wave-lengths of the stars in the Selected Areas 40 and 41 ([25]). The plates used are the same as in investigation [13] but the effective wave-lengths have been found from tracings of the images.

Cape of Good Hope Observatory

The central part of Selected Areas 140–206 has been photographed with the 74-inch Radcliffe reflector and a yellow filter. The corresponding blue photographs are being taken at the Cape with the 24-inch Victoria refractor. The limiting magnitude is 15.5 for both kinds of plates. The plates have not yet been measured. Probably a number of stars will be observed photo-electrically to provide a framework for strengthening the photographic results.

Cambridge Observatories

The photographic and photovisual magnitudes of all stars in the Henry Draper Catalogue between the 7th and 10th magnitude and lying within an area of $5^\circ \times 5^\circ$ about the centres of the Selected Areas at declination $+15^\circ$, are being observed by direct comparison with the standard E Regions at -45° . Beer, Redman and Yates have already compared the stars at declination $+15^\circ$, with the North Polar sequence ([26]) and the main object of this programme is to provide a link between the northern and southern hemisphere magnitude systems. The necessary observations and reductions are about three-fourths complete.

Stockholm Observatory

The photographic and photovisual magnitudes in 12 Selected Areas have been published by Elvius ([62]); see also p. 467.

Variable stars

For the work on variable stars see [27]–[31].

Sternberg Astronomical Institute

A search is being made for variable stars in the Selected Areas of the northern hemisphere. The field is $10^\circ \times 10^\circ$ and the limiting magnitude of the plate is 17. The results for 20 stars in Selected Area 41 have been published in a Russian periodical (2). Similarly, Selected Area 9 has been discussed (3).

Engelhardt Observatory

A search for variable stars in the Selected Areas at declination $+45^\circ$ is being made. The diameter of the field is 7.5° . A large amount of data has been obtained. An investigation of variable stars in Selected Areas 40 and 32 is being carried out.

Proper motions

Investigations [32]–[42] were completed before 1951.

Early plates of the Selected Areas, which might be used for the determination of the proper motions in the future, have been taken at:

Cambridge

Areas at declination 0° to $+60^\circ$ of the Systematic Plan and the special areas 8, 9, 10, 12, 18, 20 and 24 have been photographed in 1930 with the Sheepshanks telescope (aperture 30 cm., focal length 590 cm.).

Bonn

The areas between declinations 0° and $+75^\circ$ of the Systematic Plan and some 15 Special Areas have been photographed with the 30 cm. refractor (focal length 513 cm.) some thirty years ago. The field is $85' \times 85'$, the limiting magnitude is 15.

F. Becker reports that new plates have been taken of some areas in order to determine the accidental errors of the proper motions derived from new and early plates. It appears that the probable error of a relative proper motion for Selected Areas 74 and 75 lies between $\pm 0''.002$ and $\pm 0''.003$; the time interval is 30 years. Probably a programme of determination of proper motions in a number of northern Selected Areas will be started in the near future.

Yerkes Observatory

Most of the areas between the North Pole and declination -15° have been photographed by Ross with the 10-inch Ross telescope in 1928–32. The limiting magnitude is 16–17, the field has a diameter of 4° to 5° (4).

Lick Observatory

The programme was described in the previous report (5). It forms a part of the Lick determination of proper motions relatively to extragalactic nebulae. Dr Shane reports that the photographing of the Selected Areas will be finished in 1955. The limiting magnitude of the stars is 19; that of the nebulae about 18.4. The photographs are taken on 103a-O emulsion. The exposure times are two hours, interrupted in the middle of the exposure for two minutes, while a one-minute exposure is impressed on the plate.

Alger and Groningen

The proper motions in the areas at the equator have been determined at the Kapteyn Laboratory by means of plates taken at the Alger Observatory. The early plates are the regular plates of the *Carte du Ciel Catalogue*. The measured area of the *Carte du Ciel* plates covers 30–80% of the area $3.5^\circ \times 3.5^\circ$ of the *Bergedorfer Spektral Durchmusterung*. The proper motions will be published in the near future.

Yale-Columbia Southern Station

An intensive programme for the determination of proper motions in the southern Kapteyn Areas has been conceived at the Yale-Columbia Southern Station (6). No plates of this programme have been taken yet. The southern Yale refractor has been dismantled and has been erected on the new site of the Yale-Columbia Southern Station in Australia.

A number of plates of the 1927 series of the zone declination -15° has been repeated. The new and early plates are being measured at present at the Kapteyn Laboratory for the determination of the proper motions.

Cape of Good Hope Observatory

The proper motions of stars within an area of $4^\circ \times 4^\circ$ around the centres of Selected Areas 172, 173, 179 and 180 are being determined by repeating the early *Carte du Ciel Catalogue* plates. The year interval is 50. The determination of the proper motions in these galactic areas has been recommended by the Groningen Conference on Galactic Research, 1953.

Standards of position

The right ascensions and declinations of approximately ten stars in each area have been determined ([43]–[48]).

The position of all the brighter stars in the southern hemisphere will be determined jointly by the Yale Observatory (declination 0° to -30°) and the Cape Observatory (declination -30° to -90°). The stars of the Selected Areas occurring in this investigation will serve as standards of position for these areas.

Spectral classification

Publications [49]–[55] were issued before 1952. The last volume of the *Bergedorfer Spektral Durchmusterung* was published in 1953 ([56]). It contains the photographic magnitudes and spectral classes of the stars brighter than 13^m of the northern Selected Areas. The field is 3°5 × 3°5.

Absolute magnitudes and intensity of Fraunhofer lines

Publications [57]–[62] were issued before 1952.

Mount Wilson Observatory

Accurate spectral classifications including giant, subgiant, dwarf and subdwarf character of the stars measured for radial velocity were given in the previous report (7).

Yerkes Observatory

Miss Nancy G. Roman is at present determining the accurate spectral classes including the luminosity classifications of the following stars:

1. Fundamental stars with known meridian positions in areas with declination 0°, –15° and –30° and south of galactic latitude –50°: Selected Areas 92, 93, 115–19, 138–43, 162 and 163.
2. Fundamental stars in areas with centres north of galactic latitude +50°: Selected Areas 13, 14, 19–34, 54–9, 78–83 and 102–6.
3. All stars down to photographic magnitude 12.0 in a few regions at high galactic latitude and on the galactic equator: Selected Areas 9, 29, 56, 57, 64, 74, 93, 110, 115, 116, 119, 138, while probably some areas in the northern galactic latitude will be added. The list of stars in the *Radcliffe Catalogue of Proper Motions* was used for the northern regions (field 60' × 60'); *Harvard Annals*, 102 was used for areas with southern declinations (field 80' × 80').

David Dunlap Observatory

The absolute magnitude of the stars of the radial velocity programme, which are of H.D. type G0 or later, will be determined on the MKK-system. For the radial velocity programme see p. 468.

Kirkwood Observatory

The spectral types and luminosity classes of a number of K and A stars in Selected Areas at declination –45° are being observed. The magnitude is fainter than 11 photographic (see also p. 468).

Stockholm Observatory

The magnitudes, colours and accurate spectral classifications in 12 Selected Areas have been published by Dr Elvius ([62]). The work is being continued for Selected Areas 3, 4 and 5, the only missing Selected Areas at declination +75°. Further Selected Areas 11–14 are being investigated for the purpose of improving the intrinsic colours. Dr Elvius hopes to extend his researches to Selected Areas 8–10.

Abastumani Observatory

The absolute magnitudes of 176 B5–A7 stars have been determined by R. A. Bartaya in Selected Areas 20, 22, 23, 25, 26 and 41 ([63]). The limiting magnitude is somewhat fainter than 9.0. The dispersion of the spectra is 115 Å/mm. Absolute magnitudes of 336 B and A stars and 425 G and K stars in Selected Areas 17–26, 30, 38–52, and 62–7 are ready for publication. The probable errors are ±0^m.09 and ±0^m.19 for the early- and late-type stars respectively.

Radial velocities

Publications [64]–[66] were issued before 1952.

David Dunlap Observatory

The radial velocities of the following stars are being determined at present:

1. 369 stars of photographic magnitude 7.5–8.0, spectral classes A–M, in areas $6^\circ \times 6^\circ$ for Selected Areas 1–91.
2. 105 stars brighter than photographic magnitude 7.6 between 9^h and 18^h in areas $8^\circ \times 8^\circ$ for Selected Areas 1–91.
3. Fifty-five fundamental stars brighter than photographic magnitude 10.1 chosen from C. H. Hins' *General Catalogue of Positions and Proper Motions of 1190 Standard Stars in the Selected Areas 2 to 115*.

Observatoire de Haute Provence

No progress has been made with the determination of the radial velocities in a number of Selected Areas with an objective prism (8). The programme will probably be continued in the near future.

Cape of Good Hope Observatory

Selected Areas 140–206: the radial velocities of the G.C. stars with a proper motion exceeding $0''.100$ annually in an area of $6^\circ \times 6^\circ$ surrounding each Selected Area are being determined by the Cape observers with the 74-inch Radcliffe reflector. The programme is well on the way to completion.

The next radial velocity programme will probably include all A–M stars brighter than $7^m.6$ photographic and lying within an area of $6^\circ \times 6^\circ$ around each centre.

Kirkwood Observatory

The radial velocities, spectral types and luminosity classes of a number of K0 stars in Selected Areas at declination -45° are being determined at the Kirkwood Observatory. The stars are fainter than photographic magnitude 11. Selected Areas 164–7 and 179–87 are completed. The results will be published in the near future. A number of A stars will be investigated as soon as the K stars programme is completed.

Stockholm Observatory

Lindblad and Elvius are trying to determine radial velocities by using two identical prisms *à vision directe* placed side by side in front of the objective of the 40 cm. astrograph. The prisms are orientated so as to give two spectra of each star side by side but with opposite spectral dispersion. A full observation consists of a second exposure with both prisms rotated 180° . This construction is likely to eliminate field errors; standard stars for the determination of the zero-point of the velocity are needed in each field.

If the results prove to be satisfactory, the method will be used for the determination of radial velocities in a number of Selected Areas.

INVESTIGATIONS BASED ON OBSERVATIONAL MATERIAL OF THE SELECTED AREAS

Some of the papers issued since the Rome meeting and listed on pp. 469–472 contain, besides observational data, theoretical investigations based on these data. I will give here only a partial summary of Kharadze's work ([21]), because most astronomers cannot read this book, written in Russian. The colour indices of about 14,000 stars brighter than $13^m.3$ in Kapteyn's Selected Areas 1–43 have been determined and the interstellar absorption of light on the basis of the colour excesses has been investigated. The stars observed have been taken from the *Bergedorfer Spektral Durchmusterung* Band 1 and 2. About 400 stars brighter than photographic magnitude 13.3 have been observed per area in fields near the Milky Way and 250 stars per area in higher galactic latitudes.

The photographic and photovisual magnitudes have been determined by comparison with the north polar sequence. Both magnitudes have been reduced to the international system and the colour indices are photographic minus photovisual magnitude. The colour indices are in Table xxiii. The first column of the table gives the number of the star in the *Bergedorfer Spektral Durchmusterung*; the second column the colour-index in $0^m.01$ (negative values are in heavy type). The selective absorption has been found for each area as a function of the distance. The stars have been divided into groups according to photographic magnitude and spectral class. The mean distance of each group has been computed by means of assumed absolute magnitudes for stars of each spectral class given in Table xxxiii; the photographic absorption, needed in the determination of the distances, has been computed from the colour excess by multiplication with the factor 5.2. The colour excesses have been found by means of the intrinsic colour indices as a function of the spectral class, given in Tables xxxi and xxxii.

The colour excesses as a function of the distance have been tabulated in Table xxxvi; the first column denotes the distance, the second to fourth columns the colour-excesses derived from the B0-F5, F0-K5 giants and the F0-K5 dwarfs respectively. Graphs have been given of the colour-excess as a function of the distance for each area on pp. 314-54, the black circles, open circles and crosses corresponding with the columns 2-4 of Table xxxvi. The constants α_0 and β in the following formula for the absorption $A(r, b)$, as a function of the distance r and galactic latitude b , have been computed in chapter iv, §13.

$$A(r, b) = \frac{\alpha_0 \beta}{\sin b} \left(1 - e^{-\frac{r \sin b}{\beta}} \right).$$

In the next section some physical properties of the scattering material have been considered.

A. N. Deutsch (Pulkovo Observatory) has continued his investigation of the double and multiple stars in Kapteyn Selected Areas of the northern sky (6). Proper motions $\geq 0''.015$ were analysed. Wide pairs were found according to similar motion. Pulkovo and Radcliffe photographic catalogues of proper motions of stars up to 15^m were used as a basis of the investigation. Spectral and colour characteristics of wide pairs and double stars are also investigated. As a basis of that investigation the Bergedorf spectral catalogue and the Abastumani catalogue of colour indices of stars in Kapteyn Selected Areas 1-43 are used.

PUBLICATIONS CONTAINING OBSERVATIONAL DATA ON THE PLAN OF SELECTED AREAS

Durchmusterung and magnitudes

- [1] E. C. Pickering, J. C. Kapteyn and P. J. van Rhijn, 'Durchmusterung of Selected Areas', *Harv. Ann.* **101-3**, 1918-24.
- [2] F. H. Seares, Mary C. Joyner and Myrtle L. Richmond, 'Reduction of the Harvard-Groningen Durchmusterung to the International System of Magnitude and Colour', *Mt Wilson Contr.* no. 289; *Ap. J.* **61**, 303, 1925.
- [3] J. A. Parkhurst, 'Photographic and photovisual magnitudes of the stars in the zone $+45^\circ$ ', *Publ. Yerkes Obs.* **4**, pt. 6, 1927.
- [4] P. J. van Rhijn and B. J. Bok, 'Photovisual magnitudes for the Selected Areas at $\delta = +75^\circ$ ', *Publ. Kapteyn Astr. Lab. Groningen*, **44**, 1929.
- [5] F. H. Seares, J. C. Kapteyn and P. J. van Rhijn, 'Mount Wilson Catalogue of photographic magnitudes in Selected Areas 1 to 139', *Carnegie Inst. Publ.* no. 402, 1930.
- [6] L. F. Slocum, 'Study of colour indices of faint stars in five Selected Areas in the Milky Way', *Lick Obs. Bull.* no. 434, 1931.
- [7] Photographic magnitudes of stars brighter than $14^m.0$ in 40 of Kapteyn's Selected Areas determined at the Royal Observatory, Greenwich, under the direction of Sir Frank Dyson, *Astronomer Royal*, 1931.

- [8] G. A. Tikhov, 'Théorie du spectrographe longitudinal et catalogue des couleurs des étoiles de la Bonn Durchmusterung dans les aires 1-43 du plan systématique de Kapteyn', *Publ. Obs. Cent. Pulkovo*, sér. 2, **50**, 1937.
- [9] Cecilia Payne-Gaposchkin and Sergei Gaposchkin, 'Photographic magnitudes in Selected Areas at -15° ', *Harvard Observatory Mimeographs*, ser. 2, no. 1.
 ——— 'Photographic magnitudes in Selected Areas at -45° and -60° ', *Harvard Observatory Mimeographs*, ser. 2, nos. 2 and 3.
- [10] B. J. Bok and W. J. Swann, 'Photovisual magnitudes for the Selected Areas at $\delta = +75^{\circ}$ ', *Harv. Ann.* **105**, 371, 1937.
- [11] S. Gaposchkin, 'Standards for Selected Areas 140-206', *Harv. Ann.* **89**, no. 9, 1937.
- [12] Martin-Christopher Clasen, 'Farbenindices in den offenen Sternhaufen N.G.C. 1027 und I.C. 1805 und den Kapteynschen Eichfeldern 26, 35 und 40', *Astr. Abh. Hamburger Sternwarte in Bergedorf*, **4**, no. 10, 1937.
- [13] A. Velghe, 'Over kleuraequivalenten van sterren in Selected Areas 40 en 41 van Kapteyn', *Meded. Koninklijke Vlaamse Acad. Wetenschappen, Lett. Schone Kunsten Belgie, Kl. Wetenschappen*, **3**, no. 5, 1941.
- [14] J. J. Nassau and J. A. Hynek, 'Magnitudes and colours in the globular cluster Messier 12 and Selected Area 108', *Ap. J.* **96**, 37, 1941.
- [15] W. Lohmann and G. R. Miczaika, 'Selektive Absorption in den 4 Kapteynschen Eichfeldern 8, 9, 18, 41', *Veröff. Bad. Landes Sternw. Heidelberg*, Bd. **14**, no. 10, 1946.
- [16] J. Stebbins, A. E. Whitford and H. L. Johnson, 'Photoelectric magnitudes and colours of stars in Selected Areas 57, 61 and 68', *Ap. J.* **112**, 469, 1950.
- [17] G. A. Tikhov, 'Catalogue des couleurs des étoiles de la B.D. dans les aires 44-91 du plan systématique de Kapteyn', *Publ. Obs. Cent. Pulkovo*, Vol. **66**, 1951.
- [18] G. E. Kron and J. Lynn Smith, 'Red and infra-red magnitudes for 125 stars in ten areas', *Ap. J.* **113**, 324, 1951.
- [19] Th. Walraven and A. D. Fokker, 'Photoelectric colours of B- and A-type stars in a number of Selected Areas', *Bull. Astr. Inst. Netherlands*, Vol. **x1**, no. 455, 1952.
- [20] B. J. Bok and U. van Wijk, 'Photoelectric colours of B-stars in five regions of the southern Milky Way', *Astr. J.* **57**, 1213, 1952.
- [21] E. K. Kharadze, 'Catalogue of colour indices of 14,000 stars and an investigation of the absorption of light in the Galaxy on the basis of the colour excesses of the stars', *Bull. Abastumani Obs.* no. 12, 1952 (Russian paper).
- [22] B. J. Bok, Studies of the southern Milky Way. *Harv. Reprints*, 2nd ser., no. 42, 1952.
- [23] P. J. van Rhijn, *Durchmusterung of Selected Areas of the Special Plan*, 1952; Vol. I, containing the areas 1-29, and Vol. II, containing the areas 30-46.
- [24] Salvatore Taffara, 'Fotometria fotografica delle regioni stellari Selected Area 49', *Contr. Osserv. astrophys. Univ. Padova, Asiago*, no. 33, 1953.
- [25] A. Velghe, 'Détermination microphotométrique de longueurs d'onde effectives d'étoiles dans le voisinage du pôle et dans les aires de Kapteyn 40 et 41', *Comm. Observ. R. Belgique*, no. 14, 1954.
- [26] A. Beer, R. O. Redman and G. G. Yates, 'Photographic and photovisual magnitudes of 7^m - 10^m stars in the $+15^{\circ}$ Selected Areas', *Mem. Astr. Soc.* Vol. **LXVII**, Part 1, 1954.

Variable stars

- [27] H. Knox-Shaw, 'Observations of variable stars in the Selected Areas 1-115', *Astr. Nachrichten*, **253**, 217, 1934.
- [28] A. A. Wachmann, 'Photografische Beobachtungen von Veränderlichen auf dem Kapteyn Eichfeld 41', *Astr. Abh. Hamburger Sternw. Bergedorf*, **4**, no. 5, 1935.
- [29] E. A. Baker, 'Variables in Kapteyn's Selected Areas 2 to 19', *Mon. Not. R. Astr. Soc.* **97**, 541, 1937 and **98**, 65, 1937.
- [30] A. A. Wachmann, 'Beobachtung von Veränderlichen in der Umgebung von Kapteyn Feldern der nördlichen Milchstrasse. Teil II (Eichfeld 64).' *Astr. Abh. Ergänz. Astr. Nachrichten*, Bd. **2**, no. 5 1948.

- [31] E. A. Baker and R. W. Wrigley, 'The variables in the Selected Areas at 75° and 60° north declination', *Publ. R. Obs. Edin.* Vol. 1, no. 1, 1939 and Vol. 1, no. 3, 1949.

Proper motions and trigonometric parallaxes

- [32] O. J. Lee, 'Parallaxes and proper motions of 1041 stars in the zone $+45^\circ$ ', *Publ. Yerkes Obs.* 4, pt. 4, 1926.
- [33] W. M. Smart, 'Proper motions of the special area no. 12', *Camb. Observations*, 26, 1928.
- [34] A. van Maanen and H. C. Willis, 'Proper motions of some very faint stars', *Mt Wilson Contr.* no. 412, 1930.
- [35] A. N. Deutsch, 'Faint stars in the Selected Areas (zones $+75^\circ$ and $+60^\circ$) with large proper motion', *Pulkovo Obs. Circ.* no. 8, 1933.
- [36] H. Knox-Shaw and H. G. Scott-Barrett (compilers), *Radcliffe Catalogue of Proper Motions in the Selected Areas 1 to 115*. 1934.
- [37] C. H. Hins, 'General Catalogue of Positions and Proper Motions of 1190 Standard Stars in the Areas 2-115 of Kapteyn's Plan of Selected Areas', *Annalen van de Sterrewacht te Leiden*, deel 15, vierde stuk, 1934.
- [38] A. N. Deutsch and E. J. Perepelkin, 'Eigenbewegungen von 3189 Sternen in den Kapteynschen Arealen $\delta = +75^\circ$ und $+60^\circ$ und in dem Areal 28', *Publ. Obs. Cent. Pulkovo*, Sér. 2, 45, 1935.
- [39] P. Th. Oosterhoff, 'Proper motions of 651 stars in 97 Selected Areas', *Ap. J.* 83, 340, 1936.
- [40] B. Hiemstra, 'Dark clouds in Kapteyn's Special Areas 2, 5, 9 and 24 and the proper motions of the stars in these regions', *Publ. Kapteyn Astr. Lab. Groningen*, no. 48, 1939.
- [41] A. N. Deutsch, 'The proper motions of 18,000 stars in 74 Kapteyn's Areas from $+75^\circ$ to $+15^\circ$ declination', *Publ. Obs. Cent. Pulkovo*, Sér. 2, 55, 1940.
- [42] A. N. Deutsch and W. W. Lavdovsky, 'Proper motions of 3188 stars in 5 Special Kapteyn Areas (nos. 9, 12, 17, 24 and 25)', *Bull. Cent. Obs. Pulkovo*, 17, no. 6, 1948 (Russian paper).

Meridian positions

- [43] R. Prager, 'Katalog von 1885 Sternen für das Aequinoxtium 1925', *Veröff. Univ.-Sternw. Berlin-Babelsberg*, 5, Heft 3, 1924.
- [44] H. A. Martinez, 'Estrellas Kapteyn para las areas seleccionadas australes observadas', *Publ. Obs. Astr. La Plata*, 2, no. 1, 1927 and 15, 1939.
- [45] C. Mönnichmeyer and J. Hopmann, 'Katalog von 1172 Sternen in Kapteyn's Selected Areas auf Grund der Beobachtungen am Repsoldschen Meridiankreise', *Veröff. Univ.-Sternw. Bonn*, no. 21, 1930.
- [46] C. H. Hins and J. J. Raimond Jr., 'Catalogue of 1172 reference stars in the areas 2 to 115 of the Systematic Plan of Selected Areas. Observations of the Leiden Observatory.' *Ann. Sterrew. Leiden*, deel 15, derde stuk, 1930.
- [47] B. Sticker, 'Bestimmung der Orte von 10 Polarsternen in Kapteyn Feld 1', *Astr. Nachrichten*, 256, 349, 1935.
- [48] L. Courvoisier, 'Ortsbestimmung von zehn Polsternen', *Astr. Nachrichten*, 261, 5, 1936.

Spectral classification

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DESIDERATA FOR FUTURE WORK

1. The scale of magnitudes in the northern hemisphere will be checked photo-electrically for Selected Areas 51, 54, 57, 61, 68, 71, 89, 94 and 107 down to magnitude 19 and for Selected Areas 51, 57 and 68 down to magnitude 23. Moreover, the magnitudes brighter than magnitude 10 in the zone $+15^{\circ}$ have been determined at the Cambridge Observatory, partly photo-electrically (see p. 464). Advice about the photo-electric check of the magnitudes of a large number of Selected Areas must be postponed until the photo-electric magnitudes by Dr Baum in ten Selected Areas have been published (p. 464).

The scale of magnitudes of the southern Selected Areas is being investigated at the Leiden, Cape and Harvard Observatories.

2. As stated in the report, the colours of a number of stars in part of the northern

Selected Areas have been determined. The work is being continued at various observatories. It is to be hoped that the colours of a number of stars, suitably distributed over the magnitudes and spectral classes, will be determined in *all* the areas of the *Bergedorfer Spektral Durchmusterung* and *Potsdam Spektral Durchmusterung*. The colours of B- and A-stars are specially important, because the absorption of light in space can be derived from them. A careful comparison of the colours with some well-known colour system seems important.

The photo-electric colours by Walraven and Fokker ([19]) furnish valuable material for the reduction of the colours, derived by photographic methods, to the international scale. It seems important that astronomers, who determine the colours by photographic methods, include the stars observed by Walraven and Fokker in their programme. The number of stars observed by Walraven and Fokker is in several cases somewhat too small for the reduction just mentioned and it would be valuable to have their observations somewhat extended.

3. The spectral classes of the *Bergedorfer Spektral Durchmusterung* and of the *Potsdam Spektral Durchmusterung* might be used to greater advantage if a luminosity classification and a specification into Miss Roman's⁽¹⁰⁾ classes I and II were available. The latter is especially important for the investigation of the motions. The classifications may, for the northern hemisphere, probably be derived by means of the plates to be taken for the determination of the radial velocities with an objective prism (see p. 468). For the work done along these lines see (8).

4. The radial velocities of the southern G.C. stars in Selected Areas 140–206 with a proper motion exceeding $0''.100$ annually are being derived at the Cape Observatory. The programme will probably be extended to all stars in these Selected Areas brighter than $7^m.6$ photographic.

5. The Groningen Conference on Galactic Research has recommended the observation of the proper motions and objective prism radial velocities in the Selected Areas with a galactic latitude between -10° and $+10^\circ$ and a few Selected Areas at high latitude still to be chosen. Some Selected Areas at intermediate latitude will be added later on. The proper motions will be determined in an area $3^\circ.5 \times 3^\circ.5$ around the centres of the northern Selected Areas and an area $4^\circ.0 \times 4^\circ.0$ around the centres of the southern Selected Areas by means of *Carte du Ciel* plates with a year interval of 50 or more. The limiting magnitude is about $12^m.5$. The measured areas correspond with the areas, observed in the Bergedorf and Potsdam Spektral Durchmusterung, respectively.

The radial velocities of the northern areas will probably be determined at the Observatory of Haute Provence. The field is $3^\circ \times 3^\circ$, the limiting magnitude 12–13⁽¹¹⁾.

6. The Groningen conference also recommended the re-observation of the proper motions determined at the Radcliffe Observatory. The limiting magnitude is 15. The repetition would give a tenfold increase of the weight of the proper motions and probable errors of the order of $\pm 0''.001$. Perhaps the Bonn Observatory might want to co-operate in this plan. The galactic Selected Areas may be given preference, because an improvement of the proper motions is most important in the Milky Way regions, where the proper motions are smallest.

7. The proper motions of stars down to magnitude 18 or 19 in the northern Selected Areas, referred to extragalactic nebulae, will be determined at the Lick Observatory. It is desirable to have this work extended to the southern hemisphere.

By implementing the above suggestions, the following problems might be brought nearer to solution:

(i) The relation of the densities of stars of a specified spectral class and luminosity class with respect to the spiral structure near the Sun.

Some of the spiral arms outside the Orion arm near the Sun and depicted in *B.A.N.* 452 might be investigated by means of faint early B stars in some suitably chosen Selected Areas. The faintest among them may be recognized as B stars by means of the method of the colour difference⁽¹²⁾. The spectral- and luminosity-classes may be derived by means of Strömgen's interference method⁽¹³⁾.

(ii) The distance in the direction perpendicular to the Milky Way to which the influence of the spiral arms on the density of the classes mentioned under (i) can be traced.

(iii) The dependence of the absorption of light in interstellar space on the spiral structure: is the absorption per unit distance larger inside the spiral arms than outside the arms?

(iv) The dependence of the characteristics of the motions of the stars of a specified spectral- and luminosity-class on the spiral structure of the galaxy and on the distance from the galactic plane.

P. J. VAN RHIJN
President of the Commission

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Report of the Meeting. 31 August, at 2 p.m.

ACTING CHAIRMAN: Prof. J. H. Oort.

SECRETARY: Dr A. Blaauw.

After deciding unanimously to send their greetings to the President of the Commission, Dr P. J. van Rhijn, the Commission discussed the principal progress reported in the Draft Report. Fehrenbach stated that objective prism radial velocity plates of the Selected Areas have been taken, but that the measurements have not yet begun. W. Baum's measurements of magnitudes in ten Selected Areas were reported to be almost completed; they will be published within a year, with charts for identification. Miss N. Roman has taken slit spectra of stars brighter than the 12th magnitude in several S.A.'s, but the stars were not yet classified. E. K. Kharadze reports analysis of the colour observations in S.A.'s between galactic longitudes 40° and 145° . The distribution of dust is found to agree with other determinations of the location of the spiral arms. The absorption in the northern S.A.'s appears to be stronger than in the southern ones. The colour work in the S.A.'s is being extended to the zone $+30^\circ$ and will later be done also for the zone $+15^\circ$ declination.

Next, the desiderata for future work were discussed in the order listed in the Draft Report.

i. Checking of existing photometry in the S.A.'s by means of the new photometry of Baum will become an important project as soon as the new standards are available. If, indeed, the errors are about the same for all areas, then checking of all areas may not be necessary. Zero point checks by means of a few stars in each area may be the most

important thing to do. This will require only a small telescope, but a good sky. Photographic methods using photo-electric standards may also be very useful. E. Rybka intends to observe the magnitudes brighter than $m = 15$ in S.A.'s 1 to 91.

2. Miss N. Roman is collecting photo-electric colours for the stars for which she obtained slit spectra.

3. It was recommended that Miss Roman's work on luminosity classification be continued.

4. R. H. Stoy reported the observations of 300 stars for proper motions and colours. This programme will be completed next year. F. Edmondson announced that the faint K-star radial velocity programme is practically finished. The Commission welcomed his intention to extend this work to the A stars.

5. See the research by Fehrenbach in the beginning of this report.

6. The Bonn Observatory has started the repetition of S.A.'s below 10° galactic latitude for proper motion measures. The area measured is 1.8 square degrees, the limiting magnitude 14.5 and the expected probable error $\pm 0''.001$ or $\pm 0''.002$.

J. H. Heard remarked that the fifty-five fundamental stars in the S.A.'s observed for radial velocity at Toronto (p. 468) are in the north galactic polar cap.

M. Rigal inquired whether it would be desirable to carry out limited programmes for a few Selected Areas. The Chairman confirmed this, and referred to the Report of the Groningen Symposium on Co-ordination of Galactic Research.

There were no further comments and the Draft Report was approved by the Commission.

Next, a request by A. J. Wesselink, which reached the Commission via Commission 25 (Photometry), was discussed. Wesselink suggested that identification charts of the Selected Areas be published. The Commission supported the proposal of Commission 25, that a small committee consisting of Stoy, Wesselink and Baum discuss this matter before the next I.A.U. meeting.