32. COMMISSION DES 'SELECTED AREAS'

PRÉSIDENT: P. J. van Rhijn.

MEMBRES: MM. F. Becker, Bok, Brouwer, A. N. Deutsch, Elvius, Fehrenbach, Heard, Mme Kalandadze, MM. Kharadze, Oort, Mlle Roman, MM. Shane, Stoy, Woolley.

A complete list of references to observational data on 'Selected Areas' up to 1954 is given in *Trans. I.A.U.* **9**, 469. References [1] to [12] and [22] on page 507 have been added for 1955 to 1957.

PROGRESS OF RESEARCH

Durchmusterung. Various surveys of the Selected Areas of both the Systematic Plan and the Special Plan are available as detailed in the previous Report.

Leiden. C. J. Kooreman and P. Th. Oosterhoff have determined photographic magnitudes of 15 651 stars brighter than magnitude 10·5 in eighty-nine southern Selected Areas at declination $-15°$ to $-90°$ [1]. The field measured is 16 square degrees. The plates have been taken with the Rockefeller astrograph of the Leiden southern station and have been measured at Leiden in a Schilt microphotometer. The work will be extended to stars as faint as magnitude 14. All the plates were taken with an objective grating for the establishment of scale. The magnitude difference between the central image and the first diffraction image is one magnitude approximately. The value of this grating constant has been determined by means of known magnitudes in the E regions [13] and the Pleiades [14]. The zero-point of the magnitudes has been referred to that of the E regions.

Mount Stromlo. B. Bok is working on magnitude sequences for the southern Selected Areas 141, 158, and 193. The magnitudes in these three sequences will serve as reference systems for photographic and photo-electric work in some other areas.

Mount Wilson and Palomar. W. A. Baum has determined photo-electric colours and magnitudes in the Selected Areas 68, 94, 71, 51, 54, 57, 107, 61 and 89. The results for areas 57, 61 and 68 have been published (*Ap. J.* **112**, 469, 1950). The material for the other areas is in preparation for publication. Altogether 400 stars have been measured, distributed approximately uniformly in magnitude along the sequence in each area. In areas 68, 51 and 57 the sequences were carried to about magnitude 22, while the others were terminated around 18th or 19th magnitudes.

E. Pettit has measured photo-electrically the magnitudes in the photographic scale of the central stars of the Selected Areas in the 30° zone [2].

Louisiana State University. Kenneth M. Yoss has determined a photo-red magnitude sequence between the magnitudes 9 and 16 in Selected Area 61 [3].

Göttingen. Wolfgang Tripp has determined the magnitudes of 325 stars down to photo-visual magnitude 13·5 in Selected Area 40 in the *R.G.U.* system [4]. The effective wavelengths are 6450, 4800 and 3730 respectively. The field investigated is 6 square degrees in the north-west corner of the area. The polarization of the stars has also been measured (see under 'polarization').

Wroclaw. E. Rybka has determined photo-electrically the blue and yellow magnitudes of thirty-eight stars near the Selected Areas 1–19 [5]. The yellow magnitudes lie between 5·0 and 7·0. The relations to the international photographic and photo-visual magnitudes are given in the paper. It is the purpose of these investigations to strengthen the zero-point of the magnitudes in the Selected Areas. The observations will be extended to the Selected Areas 20–91.

Stockholm. The photographic and photo-visual magnitudes in three further areas have been published by T. Elvius [6].

Abastumani Astrophysical. The determination of the colour indices by E. K. Kharadze

of stars between the magnitudes 10·5 and 13·3 is being extended to the zone of declination +30°. A summary of the previous work has been given [15].

Yerkes. Miss N. G. Roman intends to make a three-colour photo-electric photometry of the stars mentioned under 'absolute magnitudes'.

Variable stars

Sternberg Astronomical Institute. A search is being made for variable stars in the Selected Areas of the northern hemisphere. The field is 10° × 10° and the limiting magnitude is 17. The results have partly been published, see [7] to [11].

Engelhardt. A search for variable stars in the Selected Areas at the declination +45° is being made under the supervision of S. T. Habibulin. The diameter of the field is 7°5. About 130 exposures have been made on the areas 23, 24, 31, 37 and 39 since January 1957. The Selected Areas 32 and 40 are being investigated by D. Ya. Martinov at Moscow and the Selected Areas 24 and 31 are being investigated at the Engelhardt Observatory.

Proper motions

Investigation [12] has been completed. Early plates of the Selected Areas which might be used for the determination of the proper motions have been taken at Cambridge (England) and at Yerkes [16].

Lick. The Lick Observatory programme has been referred to in previous reports [17]. The programme includes all Selected Areas at declination −30° and north. The last plate of the series was taken on 28 April 1957 and the plates are stored until such time as it is desirable to repeat them for proper-motion determination.

Yale-Columbia Southern Station. A programme for the determination of proper motions in the southern areas has been conceived at the Yale-Columbia Southern Station [18].

Bonn. The Selected Areas between declinations 0° and +75° have been photographed with the 30-cm refractor (focal length = 513 cm) some thirty years ago. The field is 85′ × 85′, the limiting magnitude 15. The proper motions of the stars in twenty-one areas with a latitude −10° to +10° are being determined at present.

Cape. In connexion with the programme suggested by the Groningen Conference on Galactic Research 1953, the proper motions for stars in Selected Areas 164 to 187 will be determined by repeating early *Carte du Ciel* plates. Special attention is being given to areas 172, 173, 179 and 180.

Helsinki. Proper motions in the Selected Areas 20–26 and 38–43 are being determined by means of early *Carte du Ciel* plates. The field is 50′ × 50′. A magnitude error, which seems to affect the proper motions, is being determined at present.

Groningen and Yale-Columbia Southern station. The proper motions of the stars in the zone of declination −15° have been measured at the Groningen Laboratory by means of plates taken at the Yale-Columbia Southern station with the 66-cm refractor. The proper motion in each area will be determined by means of two pairs of plates. The interval is twenty-four years; the probable error of the proper-motion components is ±0″·0022. The measured field is 60′ × 60′ or 40′ × 40′ depending on the galactic latitude, the limiting photographic magnitude is 15·0. All Selected Areas of the zone −15° have been reduced with the exception of Selected Areas 123, 129, 135, 137 for which some of the plates are missing.

Standards of position

The positions of all the brighter stars in the southern hemisphere are being determined jointly by the Yale Observatory (declination 0° to −30°) and the Cape Observatory (declination −30° to −90°). Several zones have already been published in the *Transactions of the Yale Observatory* and the *Annals of the Cape Observatory*. The stars of the Selected Areas occurring in this investigation will serve as standards of position for these areas.

ABSOLUTE MAGNITUDES AND ACCURATE SPECTRAL CLASSIFICATION INCLUDING LUMINOSITY CLASSES

Mount Wilson and Palomar. Accurate spectral classifications, including giant and dwarf character, of the stars measured for radial velocity were given in a previous report [19].

Abastumani. R. A. Bartaya has determined the absolute magnitudes of 824 B5 to A7 stars brighter than magnitude 9 in the Selected Areas in the zones of declination +60°, +45°, +30° and +15° with an absolute value of the latitude below 30°. The absolute magnitudes are derived from the intensities of the hydrogen lines. The results will be published in *Bulletin Abastumani Astrophysical Observatory*, no. 22. The results for the areas 20, 22, 23, 25, 26 and 41 have already been published [17] and a summary is given in *Astronomical News Letter*, no. 82, p. 10 (English language), and *Contributions du Laboratoire d'astronomie de Lille*, no. 3, p. 12 (French language).

Stockholm. The photographic and photo-visual magnitudes, the colours and accurate spectral classifications in three further Selected Areas have been published by T. Elvius [6]. The numbers of the fifteen areas so far published are 2–7, 15–20, 40–42. The results for the areas no. 11–14 are being prepared for publication. Collection of the plate material for areas 8–10 is being continued. The photometric work contains all stars down to $m_{pg} = 14{\cdot}0$; the limiting magnitude of the spectral classification and absolute magnitude determination is $m_{pg} = 13{\cdot}6$. The field is $1° \times 1°$, or, for some star-poor areas, $1°{\cdot}5 \times 1°{\cdot}5$. The plates taken for the determination of radial velocity have also been used for spectro-photometric research, in order to study the spectral equivalents with the view to find population criteria suited for statistical purposes. Advantage is taken of the larger dispersion of the radial-velocity prism (100 Å/mm) as compared with the objective prism for the spectro-photometric work. The polarization in some of the areas has been measured by L. O. Lodén.

Haute Provence. The accurate spectral classification of the stars in the galactic Selected Areas 9, 24, 25, 74, 98, 87, 64, 40, 41, 10 and 19 and in the polar areas 55 to 58 and 80 to 81 is being made on the radial-velocity plates. The limiting magnitude is 10. The work will be extended to all Selected Areas, declination 0° to +90°. A number of areas will probably be investigated with a new prism which will be ready for use in the near future.

David Dunlap. The spectral classifications on the MK system have been made for a number of stars in Selected Areas north of declination +15° as explained in the section 'Radial velocities'.

Yerkes. Miss Nancy G. Roman is determining the accurate spectral classes including luminosity classification of the following stars:

(1) Fundamental stars with known meridian positions in areas south of galactic latitude −50°: Selected Areas 92, 93, 115–19, 138–43, 162 and 163.

(2) Fundamental stars in areas north of galactic latitude +40° and on the galactic equator: Selected Areas 13, 14, 15, 29–34, 53–60, 78–83, 87, 98, 102–6, 128 and 157.

(3) All stars down to photographic magnitude 12·0 in regions at high galactic latitude and on the galactic equator: Selected Areas 9, 13, 29, 31, 32, 34, 55–8, 64, 74, 80–2, 93, 98, 110, 115, 116, 119, 129 and 138. The list of stars in the *Radcliffe Catalogue of Proper Motions* was used for the northern regions (field $60' \times 60'$); *Harvard Annals* **102** was used for areas with southern declination (field $80' \times 80'$).

Photo-electric magnitudes in three colours will probably also be determined.

RADIAL VELOCITIES

Haute Provence. Ch. Fehrenbach will determine the radial velocities of the stars in the Selected Areas enumerated above under 'Absolute magnitudes' [20]; the work will be extended to all Selected Areas, declination 0° to +90°. The limiting magnitude is 10. The measurable field is $3° \times 4°$, the probable error of a single plate is 4–5 km/sec [21].

The radial velocities in a number of areas will be measured with a new prism, which is being investigated at present.

Stockholm. The device mentioned in *Trans. I.A.U.* **9**, 468 has been further improved and will be used for the determination of the radial velocities in a number of Selected Areas.

David Dunlap. The radial velocities have been measured for:

(*a*) ninety-five stars of photographic magnitude 7·5–8·0 spectral class A–M in areas $6° \times 6°$ centred on the Kapteyn areas north of $+15°$ and between 0^h and 6^h.

(*b*) 104 stars brighter than photographic magnitude 7·6 in areas $6° \times 6°$ centred on the Kapteyn areas between 9^h and 18^h north of $+15°$. The MK classifications of these stars have been determined if the spectral class is equal to or later than F8.

(*c*) Observations for radial velocity are being continued on fifty-five fundamental stars with photographic magnitude brighter than 10·1 chosen from Hins' catalogue.

Goethe Link. The radial velocities, spectral types and luminosity classes of a number of A and K stars of magnitude 11 in the Selected Areas at declination $-45°$ are being determined by F. K. Edmondson.

Cape Observatory. The radial velocities of a number of stars with proper motion exceeding $0''.100$ in the Selected Areas 140–206 have been observed at the Cape Observatory; see *M.N.R.A.S.* **117**, 534, 1957.

POLARIZATION MEASURES

Stockholm. The polarization of stars of various apparent magnitudes has been studied in some Selected Areas by L. O. Lodén [22]. The limiting magnitude is $m_{pg} = 16·0$. The accuracy is 0·1 %–0·2 % in p and 2° for θ. Lodén has especially studied areas at intermediate and high latitudes where he investigated the correlation between colour excess and polarization.

Göttingen. The polarization of the stars down to magnitude 13·5 has been measured by Wolfgang Tripp in the north-west corner of Selected Area 40 [4]. It appears that the magnetic lines of force are almost perpendicular to the galactic plane.

Pretoria. Radial velocities in southern Selected Areas were measured in South Africa (see the report of Commission 33).

INVESTIGATIONS BASED ON THE MATERIAL OF THE SELECTED AREAS

L. Plaut [23] has investigated the relation between the various systems of photographic magnitudes of stars in the northern Selected Areas. The magnitudes in areas 2, 6, 7, 15–20 and 40–42 have been reduced to a uniform system.

T. Elvius [24] has studied the colour excesses and the absorption in the Selected Areas 2–5, 7, 15–20 and 40–42 by means of the observational material [6]. The absorption of light as a function of the distance from the Sun, and the distribution of the absorbing clouds in each Selected Area have been discussed. In the areas treated in the paper no absorption appears to be present within the first 100–200 pc from the Sun. At larger distances agglomerations of obscuring clouds are found. The distribution of interstellar matter seems to be similar to that of neutral hydrogen. Further, the density of the red giants as well as of dwarfs has been investigated in the region between longitudes 55° and 107°. It appears from the density distribution, as a function of the distance z from the galactic plane, that the Sun is situated 25 to 50 pc north of the plane of symmetry. Star densities generally increase with distance from the Sun for the first few hundred parsecs parallel to the galactic plane. The distribution of star density is found to be similar to the distribution of the obscuring clouds and of the interstellar hydrogen, according to *B.A.N.* no. 452.

P. J. van Rhijn [25] has determined the absorption of photographic light and the space densities of the A0–A5 stars, of the A0 stars, and of the K giants, in a number of Selected Areas between longitudes 42° and 138° and in zones between specified limits of latitude and longitude; the limits of latitude are 20°, 30°, 66°.5 and 90° whereas the longitude limits depend on the latitude. The densities have been derived from the numbers of stars of a specified apparent magnitude according to the *Henry Draper Catalogue* and the *Bergedorfer Spektral-Durchmusterung.* Absorption has been found in the individual

Selected Areas by means of the colour indices determined by Kharadze or, in the higher latitude zones, by means of the data of *Groningen Publications*, no. 53, table 2. A correlation appears to exist between the space densities of the A0 and A0–A5 stars, on the one hand, and the hydrogen density according to *B.A.N.* no. 475, on the other, for $z < 50$ pc; for $z > 50$ pc no such correlation is found. In the case of the K giants the existence of a correlation is doubtful. The photographic absorption per unit distance increases regularly with increasing hydrogen density.

W. Zonn [26] has investigated the selection factor, due to the patchy structure of interstellar matter, which lowers the value of the observed mean colour excesses of stars, especially those with apparent magnitudes near the limiting magnitude of a catalogue. A method for taking this factor into account has been applied to the fifteen Selected Areas investigated by Elvius [6]. The colour excess as a function of the distance from the galactic plane, the ratio of photographic absorption and colour excess, and the dispersion of the colour excesses of a single cloud have been determined.

A. Deutsch at the Pulkovo Observatory has compiled a catalogue of proper motions exceeding 0″015 in 115 Selected Areas on the basis of the Pulkovo and the Radcliffe observations. About 300 double and multiple stars have been found on the basis of the common motion of the components. The list of these stars is ready for publication. Some statistical investigations have been started on the proper motion stars ($\mu > 0''.015$) of the catalogue.

DESIDERATA FOR FUTURE WORK

The most important problems to be investigated by means of the Selected Areas are:

(*a*) The dependence on the spiral structure of the Galaxy of the density of the stars in space, of the absorption of light in space and of the motions of the stars.

(*b*) How far does this dependence extend in the direction perpendicular to the galactic plane?

(*c*) In these investigations a separation of the stars according to spectral-luminosity class, to Miss Roman's weak-line and strong-line spectra, and to Baade's populations I and II, seems desirable.

These problems ought to be considered in relation to the existence of the 'local system' [27]. As found by Miss Roman the population type may probably be determined by means of the intensity in the ultra-violet light, an excess being an indication of population II.

The following observations, including many mentioned in the 1955 Report, are recommended by the Commission: (numbers in parentheses refer to paragraphs in the 1955 Report as printed in *Trans. I.A.U.* **9**, 473).

(*a*) The colours of a number of stars in each Selected Area to be used for the determination of the absorption. Kharadze is working in this field for the northern areas. A photoelectric determination of the standards in each field seems desirable.

(*b*) See (3). These data might also be used for a re-determination of the general luminosity curve which is important in connexion with the work by Salpeter [28].

(*c*) See (5). Areas at high latitude nos. 55 to 58, 80 and 81 have since been added. Some areas at intermediate latitude will be added by a commission appointed at the Stockholm Conference for the Co-ordination of Galactic Research, 1957.

(*d*) See (6).

(*e*) See (7).

(*f*) The dependence of the characteristics of the motions on the distance from the galactic plane might be found by an investigation as started by Miss Roman, if the radial velocities and the proper motions have been determined at some other observatory.

Wesselink suggested that identification charts for the Selected Areas should be published [29]. A commission, consisting of Stoy, Wesselink and Baum, was formed at the previous meeting of the Union to discuss this matter. Stoy reports that the general

consensus of opinion is that identification charts are unnecessary for all areas, but that anybody publishing precise data for the fainter stars should be encouraged to include an identification chart.

P. J. VAN RHIJN
President of the Commission

REFERENCES

[1] Kooreman, C. J. and Oosterhoff, P. Th. Photographic magnitudes of 15651 stars brighter than 10·5 magnitude in the southern Selected Areas, derived from plates taken by Dr A. J. Wesselink. *Ann. Sternw. Leiden*, **21**, Tweede stuk, 1957.
[2] Pettit, E. Magnitudes and color indices of extra-galactic nebulae determined photo-electrically. *Ap. J.* **120**, 416, 1954.
[3] Yoss, K. M. Photo-red magnitude sequences in the north polar sequence and Selected Area 61. *Astr. J.* **60**, 339, 1955.
[4] Tripp, W. Photographische Polarisationsmessungen und Dreifarbenphotometrie in Selected Area 40. *Z. Ap.* **41**, 84, 1956.
[5] Rybka, E. Standard two-colour magnitudes of 38 stars near the Selected Areas 1 to 19. *Acta Astr.* **7**, 65, 1957.
[6] Elvius, T. A photometric and spectrophotometric investigation.... Second Catalogue (812 stars in Selected Areas nos. 3, 4 and 5). *Ann. Stockholm Obs.* Bd. 18, no. 7, 1955 and Bd. 19, no. 3, 1956.
[7] Deutsch, A. N. Observations of variable stars in 74 Selected Areas north of declination +15°. *Variable Stars*, Moscow, **5**, 225, 1939.
[8] Kurochkin, N. E. On 20 new variable stars in the region π_2 Cyg and Selected Area 41. *Variable Stars*, Moscow, **9**, 197–204, 1953.
[9] Kurochkin, N. E. 16 new variable stars in Selected Area 9. *Variable Stars*, Moscow, **9**, 402–6, 1954.
[10] Kurochkin, N. E. Variable stars in Selected Area 110. *Variable Stars*, Moscow, **10**, 171–4, 1955.
[11] Kurochkin, N. E. New variable stars in Selected Area 110. *Variable Stars*, Moscow, **11**, 111–15, 1956.
[12] van Rhijn, P. J. and Plaut, L. Proper motions of stars in the Selected Areas at the equator derived from plates taken at the Alger Observatory. *Publ. Kapteyn Astr. Lab., Groningen*, no. 56, 1955.
[13] *Cape Mimeograms*, no. 3, 1953.
[14] *Ann. Sternw. Leiden*, **19**, Tweede stuk, 1946.
[15] *Trans. I.A.U.* **9**, 468, 1957.
[16] *Trans. I.A.U.* **9**, 465 and 466, 1957.
[17] *Trans. I.A.U.* **8**, 479, 1952; and **9**, 467, 1957.
[18] *Trans. I.A.U.* **7**, 334, 1950.
[19] *Trans. I.A.U.* **8**, 485–95, 1952.
[20] Fehrenbach's method has been described in *J. d. Obs.* **38**, 165–87, 1955; and **39**, 53 and 104, 1956.
[21] *Publ. Obs. Haute Provence*, **3**, no. 38, 1955.
[22] Lodén, L. O. *Arkiv. Astr.* Bd. 2, no. 11, 1957.
[23] *B.A.N.* no. 473, 1956.
[24] *Ann. Stockholm Obs.* Bd. 19, no. 3, 1956.
[25] *Groningen Publications*, no. 57, 1955 and no. 59, 1956.
[26] *Astr. J., Moscow*, **33**, 855, 1956; Astr. Obs. Warsaw Univ., *Reprint* no. 2, 1957.
[27] *Smithson. Contr. Astrophys.* **1**, no. 1, 155, 1957; *Sky and Telescope*, **16**, 214, 1957.
[28] *Ap. J.* **121**, 161, 1955.
[29] *Trans. I.A.U.* **9**, 475, 1957.

COMMISSION 32

Report of Meeting. 15 August 1958

ACTING PRESIDENT: A. Blaauw.

SECRETARY: L. Perek.

The Acting President remarked that only a part of the Report as compiled by P. J. van Rhijn had been published in the *Draft Reports*; the extensive list of references to all work done in the Selected Areas had been omitted. The Commission felt that it would be desirable to publish the complete version including the list of references in the *Transactions*. If it is not published in the *Transactions*, the full version will be circulated to all members of Commission 32. (*Note.* The list complete up to 1954 is published in *Trans. I.A.U.* **9**, 469.)

At a suggestion by E. K. Kharadze and B. J. Bok, the Acting President will ask W. A. Baum to publish the preliminary magnitudes and colours in a number of Selected Areas.

The meeting unanimously carried a motion by B. J. Bok, seconded by R. H. Stoy, proposing that the Acting President give the thanks of the Commission to Prof. P. J. van Rhijn for the preparation of the Report and for all his work done for the Commission.

The *Draft Report* was adopted with a correction proposed by Stoy, with reference to radial velocity work done in South Africa.

The proposal by the President, P. J. van Rhijn, to discontinue Commission 32 and to incorporate it into Commission 33 as a new Sub-Commission 33*c* was discussed. Though important work has been done by the Commission in the past, plans of a different character are now developing. Instead of adding new areas it is preferable to move the whole Plan of Selected Areas into the sphere of Commission 33 and perhaps in the long run to extend the activities of the new Sub-Commission to other, related, projects. Another reason for this proposal is the new organization of the Union; some members seem to hesitate to continue as members of Commission 32 when limited to membership of three commissions only. Membership of a sub-commission will not count as membership of a commission in this respect.

B. J. Bok remarked that there is no danger of neglecting the Selected Areas in the new arrangement. The majority of members present were of the same opinion and the motion was carried (see Resolution no. 60).

In a discussion on the desiderata for future work it was felt desirable to co-ordinate current programmes on radial velocities, photo-electric photometry, photographic colours, and proper motions. A meeting of a small group will be organized for this purpose. Its members are: Miss N. G. Roman, E. K. Kharadze, Ch. Fehrenbach, C. W. Allen.

The Commission recommended that identification charts be published for Selected Areas where magnitude sequences are available. The charts of Selected Areas observed by Stebbins, Whitford and Johnson will be published by Perek in the *Bulletin of the Astronomical Institutes of Czechoslovakia.*