

## APPENDIX—REPORT OF THE COMMITTEE OF 'SELECTED AREAS'

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This committee is a continuation of Sub-commission 33c (*Trans. IAU*, **11B**, 333, 1962). For a list of earlier reports see *Trans. IAU*, **11A**, 397, 1962.

*Progress of research*

For many types of investigations on galactic structure it is advisable to profit by the availability of photometric, astrometric and spectral data published for stars in Kapteyn's Selected Areas. References are given in *Trans. IAU*, **9**, 469, 1957; **10**, 507, 1960; **11A**, 397, 1962, and in the present volume on pp. 553/5.

In the following the Selected Areas of Kapteyn's Systematic Plan are referred to as SA.

*1. Durchmusterung and Maps*

A. Brun has published an Atlas (**1**) for SA 1–139. The maps cover the fields of the Mount Wilson Catalogue (**47**) except the 'supplementary stars'. For each star  $m_{pg}$  according to (**47**) is indicated; for stars brighter than mag. 13 the spectral type according to the Bergedorfer Spektral-Durchmusterung (**48**) is added. A. Brun has also made a comparison (**2**) of the Mount Wilson Catalogue (**47**) with the Palomar Sky Survey (**49**); he indicates the differences found in magnitude and position.

The Uppsala Observatory has initiated a programme for mapping the Southern areas by means of plates taken with its Schmidt telescope on Mount Stromlo.

*2. Photometry*

A survey of current photometric programmes in the Kapteyn areas was given in *Trans. IAU* **11A**, 390–392, 1962. The following additional information has been obtained.

*Basel.* W. Becker and U. Steinlin report that plates have been taken with the 48-inch Mount Palomar Schmidt for *RGU* photometry in SA 51, 54, 57, 82, 94, 107, 133, 141, and 158. For SA 54, 57, 82, and 133, plates were also taken in the *UBV* system. A. Purgathofer (Vienna) reports that for this programme photo-electric standards in the *UBV* system have been determined at the Lowell and the Mount Wilson Observatories in SA 51, 54, 57, 71, 82, 94, and 107.

*Cape.* For the E-regions of E. C. Pickering's plan for photometric standards (**50**), sequences based on photo-electric and photographic observations have been published by A. W. J. Cousins and R. H. Stoy (**3** and **4**). Stars in SA 165, 167, 170, 173, 175, 178, 183, and 186 are included.

*Cracow and Crimea.* E. Rybka reports concerning the programme for zero-point stars in Selected Areas (*Trans. IAU* **9**, 353, 1957, and **10**, 502, 1960). At the Crimean Astrophysical Observatory photo-electric magnitudes in three colours have now been observed by S. V. Nekrasova and associates for Rybka's 6 mag. pairs (one star of A and one of K type) in all SA 1–139. A preliminary report has been published (**5**), and a final list is prepared. Rybka plans to supplement his programme by similar pairs of mag. 7.5, 9.0, and 10.5 (visual). He finds it very desirable that an extension could be made to include in the scheme the remaining areas SA 140–206.

*Crimea.* Some SA are included in the Milky Way regions selected by G. Shajn (**51**) in connection with research on diffuse emission nebulae. Spectral types, photographic magnitudes and colour indices have been published for stars in Kapteyn areas by E. S. Brodskaya for a

field in Cassiopeia, centred on SA 8 (6), by L. P. Metik for a region in Cygnus with SA 40 in centre (7), and by I. I. Pronik for a Sagittarius-Scutum field with SA 134 in the middle (8).

*Engelhardt (Kazan)*. L. A. Urasin reports on a photographic programme for *UBV* magnitudes in SA 20-43. For this purpose the 38/52/93 cm Schmidt telescope of the observatory has been transferred to the neighbourhood of Alma-Ata. The limiting magnitude will be 15-16. The plates will be measured with a micro-photometer as described by Urasin (52).

*Groningen*. J. Borgman continues making photo-electric observations in some SA, including SA 3-5.

*Kiev*. In 1956 P. P. Parenago (53) proposed 'a plan for a complex study of the selected areas of the Milky Way'. Of his five fields, four include Kapteyn areas. In a catalogue edited by S. G. Gordeladze (9a) pg-, pv-, and pr-magnitudes have been published for parts of Parenago's fields I and II. One of the sub-areas in Parenago's field I in Aquila covers SA 87. The part investigated in Parenago's field II is centred on SA 40. L. N. Kolesnik has studied the relationship between various systems of magnitudes published for SA 40 and investigated the interstellar absorption in this region (9b). G. L. Fedorchenko has treated the SA 87 region (9c).

*Leiden*. An investigation by K. K. Kwee (10) of variable stars in a region near the galactic centre, includes photo-electric magnitudes and colours for stars in SA 182, derived by C.Th. Oosterhoff and Th. Walraven.

*Lyon and Haute-Provence (Saint-Michel)*. J. H. Bigay reports photo-electric investigations in the low-latitude areas SA 8, 9, 19, 24, 40, 49, 64, 74, 87, 98, and 110, of O, B, and A<sub>0</sub> stars within fields of  $3^{\circ}5 \times 3^{\circ}5$  size. About 2000 stars are on the programme. For SA 9, 19, and 24 the results are ready (11 and 12). The photo-electric *UBV* measurements, performed at the Haute-Provence Observatory, are supplemented by 'Strömgren photometry'. With the Schmidt telescope of the Lyon Observatory plates have been taken for photographic *UBV* determinations in a zone along the Milky Way, including the above-mentioned areas.

*McDonald (Fort Davis)*. A paper by H. L. Johnson, R. I. Mitchell, and B. Iriarte on the colour-magnitude diagram of the Hyades (13) gives photo-electric data in the *UBV* system for many stars in SA 3, 4, and 5.

*Stockholm (Saltsjöbaden)*. G. Larsson-Leander has determined photo-electric data for 31 stars in SA 4 (14) for a discussion of the intrinsic colours of the Stockholm spectral classification system. K. Lodén reports concerning the programme based on material from the Boyden Observatory (*Trans. IAU*, 11A, 392, 1962) that the majority of the photometric plates for the ten areas have been measured. In each of the areas, except SA 91, photo-electric observations have been made for about 20 stars.

*Toulouse and Haute-Provence (Saint-Michel)*. Stars within SA 49 are included in galactic field no. 13 for which photo-electric data have been published by R. Bouigue and coll. (15).

*Tübingen*. In order to increase the number of stars available for connections between the photo-electric systems on the northern and southern hemispheres, H. Siedentopf and U. Haug have initiated a programme of photo-electric measurements in SA 96, 100, 108, and 112. About 50 stars have been observed in each area at the Beaufort-West Station, South Africa. A connection with northern Johnson-Morgan stars is planned to be done in Sicily by use of the same 40 cm telescope.

*Uppsala*. U. Sjögren has published a paper giving photo-electric data for 76 stars in SA 8 (16), and has started measurements for SA 10 and 20. For SA 19 photo-electric data have been derived for 24 stars by T. Elvius and H. Lindén (17); Lindén has also a programme for SA 18. Y. Ekedahl has measured photo-electrically 160 stars brighter than mag. 11 in SA 2 - 7, and 11. In connection with photo-electric work on bright stars, B. Ljunggren and T. Oja have

observed 130 stars in Selected Areas. Their catalogue (18) includes more than 10 stars for each of SA 8, 19, 40, 64, and 87, about 5 stars for SA 4, 10, 12, and 14, and single stars for ten more areas.

At the Uppsala Southern Station on Mount Stromlo observations with the Schmidt telescope have been performed by G. Lyngå, C. Roslund and B. Westerlund for Elvius' SA programme (*Trans. IAU* 11A, 392, 1962). For SA 164, 201, and 205 the scheme was extended to five colour regions (*UBGV* and *R*). Plates have also been taken for some of the SA observed at the Boyden Observatory for the Stockholm programme. G. Lyngå and C. Roslund have also worked on the programme for photo-electric standards, using both the Bingard telescope and the 50-inch reflector on Mount Stromlo. For each of the twelve areas on the scheme a small number of stars suitable for definition of zero-point have been observed. For SA 205 a complete sequence of about 40 stars is ready in the *UBV* system.

*Warner and Swasey (Cleveland)*. S. W. McCuskey and R. Mehlhorn have derived infra-red magnitudes for 920 stars of types M5 and later in a 9 sq. deg. field surrounding SA 158 (19). The plates have been taken with the Schmidt telescope of the Bosscha Observatory, Lembang. A photo-electric investigation of stars in the galactic cluster NGC 7654 situated in SA 19 has been made by P. Pesch (20).

### 3. Variable stars

*Harvard (Cambridge) and Vatican*. M. Olmstedt and M. McCarthy report progress on the cepheid investigations in SA 158 and 193 initiated by B. J. Bok.

*Le Breuil-Allier*. A. Brun has published a list of variable stars which he has found in the environments of SA 21 (21).

*Sternberg (Moscow)*. D. Ya. Martynov reports that SA 50 and 110 have been photographed with the wide-angle 40 cm astrograph (plate size  $10^\circ \times 10^\circ$ ) for future investigations of variables brighter than 16<sup>m</sup>5. This work is connected with the plan for investigating the wide surroundings of T-associations.

### 4. Proper motions

*Bonn*. H. van Schewick reports that relative proper motions have now been published for 4914 stars in the following galactic fields: SA 8, 9, 18, 19, 23-25, 40, 49, 63, 64, 73, 74, 87, 97, 98, 110, and 111 (22). The average epoch-difference is 33.8 years. Investigations are on way for derivation of the absolute proper motions for some of the regions. van Schewick has also studied the proper motions of stars in SA 134 in connection with an investigation of the open cluster NGC 6611 (23).

Work has been initiated to derive the solar apex from stars of high proper motions (5" or more for 100 years) in the Bonn (22) and Groningen (54) fields. Special attention will also be paid to the proper motions of variables in the SA. For the derivation of the vertices of stars of different spectral classes a comprehensive research will be made of the proper motion material available in the Bonn (22), Groningen (54), Pulkovo (55), and Radcliffe (56) catalogues. In co-operation with the Vienna Observatory it is planned to take a second series of plates for the polar fields, cf. *Trans. IAU* 10, 503, 1960.

*Lick (Mount Hamilton)*. According to S. Vasilevskis, proper-motion plates in blue have been taken with the 20-inch Carnegie astrograph on 10-inch square plates for SA 1-163 during 1947 to 1957, with exposures of length two hours and one minute, through a coarse grating of four magnitudes' difference between the central image and the first-order spectrum. When in the future the second-epoch plates are to be observed, exposures will simultaneously be made with the 20-inch objective for yellow light, recently installed in the astrograph.

*London (Mill Hill)*. C. W. Allen reports on the repetition of the proper motion plates taken

with the Radcliffe refractor for obtaining a longer time base (*Trans. IAU* **11A**, 393, 1962) that the measurements for SA 3, 4, and 5 are ready.

*Stockholm (Saltsjöbaden)*. Concerning K. Lodén's study of tangential velocities, cf. Section 8.

### 5. Radial velocities

*David Dunlap (Richmond Hill)*. The observational material is now complete for the previously reported radial velocity programme for 55 stars from C. H. Hins's catalogue (57).

*Marseille and Haute-Provence (Saint-Michel)*. Ch. Fehrenbach and M. Dufлот report on the continuation of the determination of radial velocities and spectral types by means of special objective prisms.

With the smaller objective prism (15 cm diam., 80 Å/mm between H $\gamma$  and H $\delta$ , limiting mag. 9.5) the following has been performed:

(a) Results have been published for SA 19, 24, and 55 as previously reported (58); for SA 8, 40, and 74 by Fehrenbach (24); and for SA 57 and 64 by Fehrenbach and E. Rebeiro (25).

(b) Results are close to publication for SA 9, 30, 41, 56, 58, 67, 80, 87, and 98.

(c) Plates have been taken, and in some cases measured, for the following areas: SA 13, 21, 25, 29, 34-37, 39, 43, 46, 49, 52, 53, 62, 66, 68, 69, 75, 81, 85, 86, 90, 91, 94, 110, 113, and 114.

For the larger objective prism (39 cm diam., 110 Å/mm between H $\gamma$  and H $\delta$ , limiting mag. 11.5) the following SA programme is reported:

(d) For SA 8 and 55 results have been published by Fehrenbach and Rebeiro (26).

(e) For SA 19 an extensive study (27) by Dufлот has been published.

(f) For SA 11 the results are ready but publication is delayed because of lack of slit spectrograph data.

(g) Investigations are going on for SA 9, 15, 19 (north-west), 23, 36, 37, 46, 53, and 56-58.

*Radcliffe (Pretoria)*. Stars in SA 172, 193, and 194 are included in a third list of radial velocities of faint southern O and B stars published by M. W. Feast and A. D. Thackeray (59). Feast *et al.* give spectral and photometric data for these stars (60).

*Uppsala*. With a 'prisme-à-vision-directe' on the 15 cm astrograph, cf. C. Schalén (61), K. A. Clemert has investigated SA 8 and 11. Some plates have also been taken in SA 18 and 19.

### 6. Spectral and luminosity classification; absolute magnitudes

*Abastumani (Mount Kanobili)*. E. K. Kharadze reports that two-dimensional spectral classification and magnitude determinations down to mag. 12 have been carried out in some of the areas proposed by Parenago (53). S. Apriamashvili investigates a field in Aquila (centred at  $\alpha = 19^{\text{h}} 00^{\text{m}}$ ,  $\delta = +3^{\circ}$ ) and another in Scutum ( $\alpha = 18^{\text{h}} 40^{\text{m}}$ ,  $\delta = -4^{\circ}$ ), both within Parenago's area I, and close to SA 110. Kharadze has in collaboration with Apriamashvili and T. Kotchlashvili prepared a catalogue for stars in Parenago's Cygnus field (P. area II) where SA 40 is situated. N. Kalandadze investigates the Parenago areas III and IV in Taurus.

*Bergedorf*. Stars in some galactic SA are included in the OB-survey which is approaching its end, cf. the main report of Com. 33.

*Crimea*. The catalogues mentioned in Section 2 also include spectral determinations by Brodskaya for SA 8 (6), by Metik for SA 40 (7) and by Pronik for SA 134 (8).

*Engelhardt (Kazan)*. L. Urasin reports that plates have been taken in SA 25-29 with a 8° objective prism on the 70 cm meniscus telescope at the Abastumani Observatory. The spectral plates for the continued SA programme (*Trans. IAU* **11A**, 394, 1962) will be taken with the 35/50/120 cm uviol-meniscus telescope of the Engelhardt Observatory. The spectrophotometric methods developed at the Stockholm and Uppsala Observatories will be applied. Preparatory investigations have been performed in order to calibrate spectral and luminosity criteria (28).

*Haute-Provence (Saint-Michel)*. Several stars in SA 8, 9, 19, 21, 22, 24, 40, 41, 43, 46, 64,

74, 87, 98, and 110 are included in a list of M, S, and C stars found by H. Perraud (29 and 30) from observations with a 'prisme-à-vision-directe'. She has also searched for emission stars; the published results (31) include stars in SA 8, 24, 64, 74, and 87.

*Kiev.* In connection with the research on the Parenago plan, mentioned above (Section 2), spectral determinations have been made by Fedorchenko in a field including SA 87 (9c).

*Lyon and Haute-Provence (Saint-Michel).* Bigay will determine absolute magnitudes by the 'Strömgren method' for early type stars in some galactic SA, cf. Section 2.

*Marseille and Haute-Provence (Saint-Michel).* Spectral determinations in the MK system are included in the SA programme of Fehrenbach and collaborators, reported above in Section 5.

*Radcliffe (Pretoria).* Spectral types for stars in SA 172, 193, and 194 have been published by Feast *et al.* (60).

*Stockholm (Saltsjöbaden) and Uppsala.* For the SA programmes reported in *Trans. IAU* 11A, 394 and 395, 1962, additional spectral material has been secured by G. Lyngå, C. Roslund and B. Westerlund with the Uppsala Schmidt telescope on Mount Stromlo.

*Warner and Swasey (Cleveland).* S. W. McCuskey reports spectral determinations for 920 stars of type M5 and later in a region centred on SA 158 (19), cf. Section 2. For a study of the normal stellar population in the same direction spectral types and luminosity classes as well as pg-magnitudes have been determined for 1684 stars in a 25 sq. deg. area centred on the same SA. The plates were taken with the Bosscha Observatory Schmidt telescope. This research is nearly complete and some results will be related in the main report of Commission 33. The SA 158 investigation also includes a study of unpublished material from Tonantzintla. In connection with the SA 158 survey, McCuskey has found seven faint objects with emission lines (32).

### 7. Polarization

*Stockholm (Saltsjöbaden).* The previously reported investigation by L. O. Lodén on the polarization of stars in some SA has now been published (33 and 34). It includes photo-electric polarization measurements for SA 2, 3, 7-9, 11, 17-19, and 40-42, and photographic determinations for SA 192 and 193. The results are discussed in relation to the colour excesses and the distances of the stars as found from the Stockholm SA Catalogues and Investigations by T. Elvius and K. Lodén (62). A new photo-electric device for polarimetric measurements has now been put into operation.

*Uppsala.* The two-beam photo-electric polarimeter constructed by A. Elvius (63) will be used also for SA stars.

### 8. Investigations based on the material of Selected Areas

A. N. Deutsch has published an investigation (35) of double and multiple stars, based on Selected Area material of proper motions and distance moduli.

K. Lodén has performed a study (36) of the tangential velocities of 1319 stars in SA 2-7, 11-20, and 40-42, for which absolute magnitudes and photometric data have been published by T. Elvius and herself in the Stockholm Catalogues (62). The distance moduli, corrected for the absorption derived from the colour excesses, have been combined with the proper motions from the Pulkovo (55) and Radcliffe (56) catalogues. From the tangential velocities the solar motion and the velocity ellipsoid of the peculiar motions have been derived for groups of stars of various spectral types and luminosity classes. Mrs Lodén plans to extend this investigation to southern SA for which proper motions are available, as soon as necessary data for the distances of the stars have been furnished by the Stockholm and Uppsala investigations mentioned in Sections 2 and 6.

The paper (27) by M. Duflot reported above in Section 5 includes a thorough discussion of the distribution of interstellar absorption in SA 19 based on photo-electric and spectral data; cf. also (37). Interesting features in the distribution of the radial velocities are studied with respect to spectral types and stellar distances.

McCuskey and Mehlhorn have, as reported in Section 6, investigated the distribution of late M-type stars in a region near the galactic centre, including SA 158 ( $l^{\text{II}} = 4^\circ$ ,  $b^{\text{II}} = -9^\circ$ ). In their analysis of the space density, the authors (19) include similar but still unpublished data for over 7000 stars in a wider field, found on infra-red spectral plates taken at the Tonantzintla Observatory. Among other results may be mentioned that close to the galactic centre the density gradient perpendicular to the galactic plane appears to be quite high. The stellar space density and the luminosity function of the normal stellar population in the SA 158 region have been subjected to a study by McCuskey (38).

The material of photometric and spectral data (6-8) derived at the Crimean Astrophysical Observatory for galactic fields which include SA 8, 40, and 134, cf. Sections 2 and 6, has been used for studies of the distribution of absorbing matter by Brodskaya (39), Metik (41 and 43), and Pronik (44). These authors have also investigated the space distribution of stars in their respective fields (40-42 and 45).

W. Zonn has made a statistical analysis (46) of the colour excesses of 500 F5-Go stars in 14 SA from T. Elvius' catalogues (62). He concludes that the colour excesses produced by an individual cloud nearly constantly amounts to  $0^m.06$  (int. syst.).

#### *Desiderata for future work*

Some of the suggestions expressed by P. J. van Rhijn in his last reports on 'Selected Areas' have resulted in new work, but many of his proposals have not yet induced response. Reference is therefore made again to the paragraphs where van Rhijn summarized his desiderata (*Trans. IAU* 9, 472-474, 1957, and 10, 506, 1960).

Much of the Selected Area material already existing could be used with increased advantage for studies of galactic structure and dynamics, if supplementary work be performed in accordance with previous recommendations:

- (a) Determinations of photo-electric sequences for all areas (cf. also E. Rybka's suggestions mentioned in Section 2). Already performed photo-electric measurements should be reduced and published in order to be available to other workers.
- (b) Photo-electric spectrophotometry and colour determinations (also in other systems than *UBV*) are desirable for more objects than the sequence stars.
- (c) Extension of the proper-motion programmes.
- (d) Publication of identification charts.

E. K. Kharadze has specifically expressed the opinion, that it is reasonable to enlarge the competence of the Selected Area Committee to include schemes for systematic investigations on galactic structure which require combined efforts by several observatories in selected regions on the sky even outside the Kapteyn areas, cf. the plans by Parenago (53) and Shajn (51). By suggesting, following up and reporting such work, the Committee would serve still better the purpose for which it is intended.

TORD ELVIUS  
*Chairman of the Committee*

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