McCORMICK SPECTRAL STATISTICS

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ABSTRACT

A summary is given of the spectral statistics of the second proper-motion program of this observatory. The 441 regions are fairly uniformly distributed over two-thirds of the sky.

The present spectral counts are based on only 7600 classified stars, in contrast with the much larger numbers involved in the published spectral statistics of Harvard, Potsdam, and Bergedorf. However, the McCormick material has the advantages that it samples two-thirds of the sky with a single instrument and that the number of samples is relatively large. Thus, although the total area classified is only four-tenths of the total area in the published portion of the *Bergedorf Spektral-Durchmusterung*,[1] the number of samples is ten times as large.

The spectra were obtained for use in connection with the second general proper-motion program now being prepared for publication at this observatory. The program contains 441 regions, each covering 0.46 square degree, which are distributed fairly uniformly from the north pole to $-20°$ in declination. The regions were selected without any regard to apparent features of the Milky Way, such as star clouds, absorbing matter, etc.

All the spectra were classified by the senior author from plates taken with the 10-inch Cooke prismatic camera, the dispersion being about 300 A/mm at $H\gamma$. The observational technique, the criteria used for the classification of spectra, and the relation of the McCormick system of classification to other systems have been described elsewhere.[2] The limiting magnitude of these spectral plates averages about $12^{m}.0$ photographic.

Inasmuch as the proper motions were determined with a photovisual telescope, the use of photovisual magnitudes is necessary. The system of the magnitudes has been carefully investigated by E. R. Dyer,[3] who found it very close to the international photovisual system in scale, zero point, and color, so that any systematic error arising from a combination of these three causes is probably not greater than $0^{m}.1$. This is confirmed by the satisfactory agreement between the McCormick spectral statistics and those of Bergedorf, as is shown in Figure 1 of the next paper. The disadvantage of using photovisual magnitudes in presenting spectral statistics is that incompleteness sets in among the K and M stars at much brighter magnitudes than among the early-type stars. Thus, there were many early-type stars which could have been classified on the spectral plates but which were not included because they were too feeble to be measured on the proper-motion plates; conversely, late-type stars of photovisual magnitude 11 were sometimes too faint to be classified on the spectral plates.

Since the stars measured for proper motion are not complete beyond photovisual magnitude $11^{m}.5$, the counts presented in the left-hand side of Table 1 have been limited accordingly. It will be seen that the proportion of unclassified stars is rather large in the low-latitude zones of the last magnitude group. This is caused chiefly by the overlapping of spectra. Since we deal with photovisual magnitudes, it is easily seen that this overlapping would affect the late spectral classes much more than the early ones. This is quite obvious in the case of a partial overlap between an A and a K star, both of

[1] Bergedorf, 1935 and 1938.

[2] Vyssotsky, *Ap. J.*, **93**, 425, 1941.

[3] Master's thesis, University of Virginia Library, May, 1940.

photovisual magnitude 11.0, as the A star will be easily classified; but the K star, being of the twelfth photographic magnitude, will be blotted out. Accordingly, in order to compute the complete number of stars per 100 square degrees which are given in the right side of Table 1, we have distributed the unclassified stars, assigning 5 per cent of them to class F, 20 per cent to class G, 50 per cent to class K, and 25 per cent to class M. When

TABLE 1

Latitude Zone	No. of Regions	No. of Square Degrees	Total Numbers									Number per 100 Square Degrees						
			B0–B5	B8–A2	A5–F2	F5–G0	G5–K2	K5–M8	Pec.	*	Total	B0–B5	B8–A2	A5–F2	F5–G0	G5–K2	K5–M8	Total
			8.5–9.4															
61°–90°	55	25.3	...	2	5	21	19	....	...	....	47	....	8	20	83	75	....	186
41 –60	89	40.9	...	6	14	20	43	5	...	....	88	....	15	34	49	105	12	215
21 –40	104	47.8	...	9	22	35	64	27	...	....	157	....	19	46	73	134	56	328
11 –20	87	40.0	2	49	20	27	57	20	...	3	178	5	122	50	68	148	53	450
6 –10	45	20.7	3	27	13	19	32	15	...	6	115	14	130	63	97	169	82	550
0 – 5	61	28.1	13	54	24	26	54	15	1	4	191	46	192	85	96	199	57	680
			9.5–10.4															
61 –90	55	25.3	...	2	5	42	50	3	1	5	108	....	8	20	170	209	16	420
41 –60	89	40.9	...	4	27	82	101	18	...	3	235	....	10	66	200	251	46	570
21 –40	104	47.8	...	17	49	95	166	30	...	7	364	....	36	102	201	355	67	760
11 –20	87	40.0	1	73	55	94	148	44	...	25	440	3	182	140	248	400	125	1100
6 –10	45	20.7	...	65	35	43	76	25	...	19	263	....	314	174	227	410	145	1270
0 – 5	61	28.1	23	171	65	81	120	33	1	34	528	82	610	239	313	490	146	1880
			10.5–11.4															
61 –90	55	25.3	...	1	2	109	70	9	...	19	210	....	4	12	450	312	....	830
41 –60	89	40.9	...	3	17	164	163	19	...	56	422	....	7	49	430	470	....	1030
21 –40	104	47.8	...	31	51	281	304	30	1	139	837	....	65	121	650	780	....	1750
11 –20	87	40.0	3	77	85	268	266	43	1	241	984	8	192	242	790	....	....	2460
6 –10	45	20.7	1	137	72	136	109	19	2	181	657	5	660	391	830	....	....	3170
0 – 5	61	28.1	41	289	117	210	128	24	1	348	1158	146	1030	480	1000	....	....	4100

* Numbers in this column are counts of stars which could not be classified, usually because the spectrum was obscured by an overlapping spectrum. Before the right half of the table was computed, the unclassified stars were apportioned to spectral classes, as explained in the text. When, by this apportionment, the number of stars was increased more than 33 per cent, no figure is tabulated.

this apportionment increases the number of stars in any group more than 33 per cent, no figure is tabulated.

A comparison of the material in Table 1 with the Bergedorf statistics, together with an analysis of both sets of statistics, will be found in the paper immediately following.

The measurement and reduction of the magnitudes was carried through by E. R. Dyer and R. G. Reed. The compilation of these statistics was performed by Miss Pauline Yancey.