

# A FINDING LIST OF STARS OF SPECTRAL TYPE A7 AND EARLIER IN REGIONS AT HIGH GALACTIC LATITUDES. III. 4 HLF 4

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## SUMARIO

Se ha realizado una búsqueda con prisma objetivo de estrellas de tipo espectral A7 o más temprano sobre una región de 45 grados cuadrados en el área 4 HLF 4 ( $l^{\text{II}} = 180^\circ$ ,  $b^{\text{II}} = -45^\circ$ ) como parte de una investigación de la estructura galáctica en la dirección perpendicular al plano de la galaxia. La presente investigación fue realizada con el prisma de  $4^\circ$  de la cámara Schmidt en Cerro Tololo. Se presenta una lista con las coordenadas y tipos espectrales para 88 estrellas; y para aquellas que son tan débiles que no aparecen en el catálogo Bonner Durchmusterung, se incluyen mapas de identificación.

## ABSTRACT

An objective prism survey has been made of stars of spectral type A7 and earlier in a 45 square degree region in the 4 HLF 4 area ( $l^{\text{II}} = 180^\circ$ ,  $b^{\text{II}} = -45^\circ$ ) as part of an investigation of galactic structure perpendicular to the galactic plane. The survey reported here was made with the  $4^\circ$  prism on the Michigan Curtis Schmidt telescope at Cerro Tololo. A finding list containing positions and spectral types for 88 stars is presented with finding charts for the stars too faint to be included in the Bonner Durchmusterung.

## I. Introduction

As part of a study of galactic structure perpendicular to the galactic plane, surveys are being made of early-type stars in high galactic latitudes. Finding lists have been published for the 1 HLF 4 region (Philip 1967) and the South Galactic Pole (Philip and Sanduleak 1968). In this paper we present spectral types, positions, and  $V$  magnitudes for 88 stars in a 45 square degree region in 4 HLF 4 ( $l^{\text{II}} = 180^\circ$ ,  $b^{\text{II}} = -45^\circ$ ). It is hoped that publication of finding lists will encourage spectroscopic and photometric investigations of these stars. Photometry of such stars from the earlier lists has turned up many interesting halo objects. Ultimately, the goal is to differentiate the various classes of early-type halo objects and to determine their density distribution perpendicular to the galactic plane.

## II. Observations

The survey was made with the  $4^\circ$  objective prism on the Michigan Curtis Schmidt telescope at Cerro Tololo Inter-American Observatory. Some spectral plates were obtained at the Mexican National Observatory at Tonantzintla. One hour exposures made on IIa-0 emulsion reached an average limiting magnitude of  $V = 13.0$ . Short exposures were also made in order to classify the bright stars. The dispersion of the spectra is  $280 \text{ \AA/mm}$  at  $H_\delta$ . The plates were searched independently by each author and all stars of spectral class A7 or earlier were classified according to the criteria set up by Nassau and Seyfert (1946). The spectral classifications of the 4 HLF 4 stars are plotted versus the HD spectral types in Figure 1.

The magnitudes listed for the stars are intended primarily for identification purposes. A photoelectric sequence, set up by Drilling, was used to calibrate the photographic  $V$  magnitudes for all the stars in the catalogue. The mean error of the photographic magnitudes is  $\pm 0.1$  magnitudes.

## II. The Finding List

The stars are listed in Tables 1 and 2. Table 1 lists the stars appearing in the Bonner Durchmusterung. The catalogue number is listed in column one, the BD and HD numbers are listed in columns two and three, the right ascension and declination (Equinox 1950) are listed in columns four and five, the spectral type is listed in column six, and the photographic  $V$  magnitude in column seven. Table 2, which lists the stars that are too faint to be in the BD,

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has a similar format, except that columns two (BD numbers) and three (HD numbers) are missing. An asterisk following the number indicates a note at the end of the table.

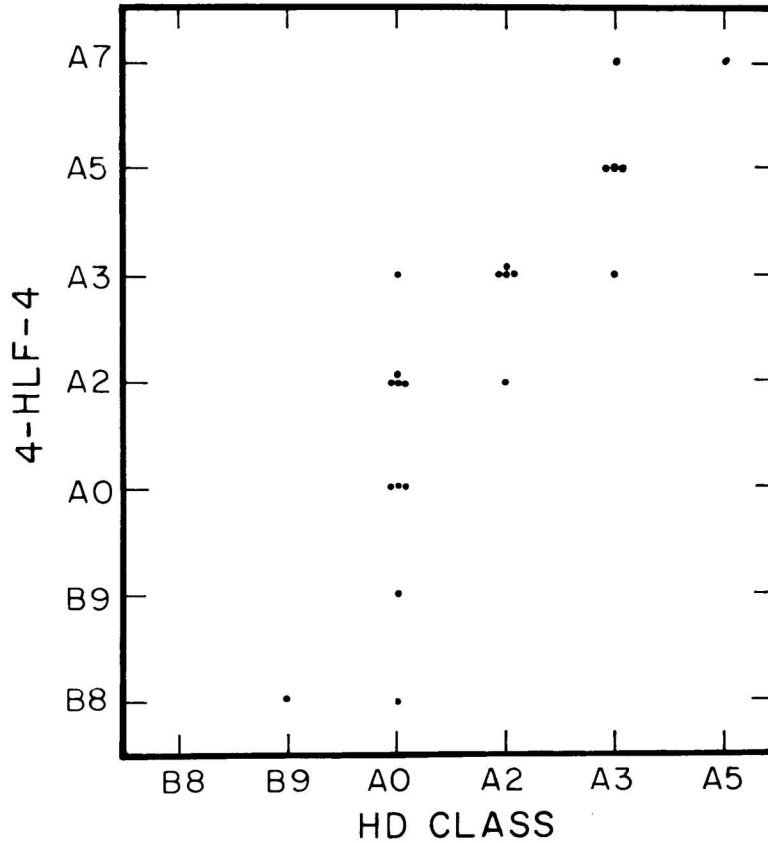


Fig. 1.—4 HLF 4 spectral types versus HD spectral types.

TABLE 1

Stars of type A7 and earlier in 4 HLF 4 which are listed in the BD catalogue

No.	BD	HD	RA (1950) Dec		SP	V
1	+1°502	17780	2 <sup>h</sup> 48 <sup>m</sup> 7	+1°30'	A5	7.9
2	+2 440	17835	2 49.3	+2 42	A5	8.8
3	-1 401	17873	2 49.7	-0 51	A3	7.8
4	+1 512	18216	2 52.9	+1 49	B8:	6.6
5	+2 453		2 53.5	+3 00	A3	9.9
6	+1 514		2 54.0	+1 33	A0	9.8
7	+2 458		2 54.9	+2 42	A0	10.2
8	+0 490	18571	2 56.7	+1 03	A0	8.7
9	-0 473		2 57.8	+0 17	B9	10.1
10	+1 523		2 57.9	+1 59	A5	10.3
11	+0 499	18789	2 58.8	+0 58	A3	7.3
12	+1 528	18806	2 59.1	+1 58	A0	9.0
13	+2 465	18826	2 59.3	+2 57	A0	8.2
14	+1 532		3 01.2	+1 27	A3	10.4
15	+2 478	19346	3 04.2	+2 31	A2	8.0
16	-0 494		3 04.8	-0 11	A3	11.6
17	+1 548		3 04.9	+2 01	B9	10.6

TABLE 1 (Continued)

<i>No.</i>	<i>CD</i>	<i>HD</i>	<i>RA (1950) Dec.</i>		<i>SP</i>	<i>V</i>
18	-2 556	19512	3 05 .6	-2 01	A7	9.4
19	+2 488	19585	3 06 .6	+3 03	B9	8.1
20	+1 557		3 07 .2	+2 01	A0	11.0
21	-2 563	19712	3 07 .8	-1 53	B8:	7.3
22	-0 498	19739	3 08 .1	+0 01	A5	7.3
23	+2 493		3 08 .5	+2 43	A5	11.3
24	-0 504	19910	3 09 .6	-0 17	A2	9.4
25	+2 498	19984	3 10 .2	+2 31	A2	8.0
26	-0 511	20045	3 10 .8	-0 01	A3	8.5
27*	+1 565		3 11 .3	+1 43	A7	10.0
28	+2 501		3 11 .8	+2 46	A2	11.1
29	+2 512		3 14 .5	+2 29	A7	9.4
30	+1 574	20421	3 14 .6	+1 23	A3	7.6
31	-2 607	20744	3 17 .9	-1 56	A3	9.3
32	-0 530	20772	3 18 .2	-0 21	A2	8.2
33	+0 586	21094	3 21 .7	+1 11	A3	8.5
34	-1 484	21102	3 21 .8	-0 53	A7	9.4
35	-2 627	21338	3 23 .9	-1 58	A2	9.3

Notes to Table 1

\*27 Possible Ap star.

TABLE 2

Stars of type A7 and earlier in 4 HLF 4 which are not listed in the BD catalogue

<i>No.</i>	<i>Name</i>		<i>RA (1950) Dec</i>		<i>SP</i>	<i>V</i>
1	+0°	469 N1	2 <sup>h</sup> 47 <sup>m</sup> 1	+0 52	A3	11.9
2*	+0	475 W1	2 49 .1	+1 03	A7	10.4
3	+1	503 E1	2 49 .9	+2 00	A7	13.6
4	-1	406 E1	2 51 .3	-1 21	A3	13.1
5	-1	411 W1	2 51 .5	-0 37	A2:	13.8
6	-2	511 E1	2 51 .6	-1 49	A3	13.1
7	-0	458 N1	2 53 .6	+0 01	A2:	14.0
8	+0	483 E1	2 54 .7	+0 31	A2:	13.9
9	-0	463 W1	2 54 .8	+0 07	A2	11.8
10	-0	461 W1	2 55 .0	-0 10	A7	12.6
11*	-1	423 N1	2 55 .7	-1 35	A3	11.5
12	-1	427 N1	2 56 .9	-0 39	A2	12.5
13	+0	490 E1	2 57 .1	+1 00	A5	12.8
14	-2	532 N1	2 57 .3	-1 54	A0	12.1
15	-0	472 S1	2 58 .2	-0 37	A0	13.4
16	+1	531 N1	2 59 .8	+2 09	A5	11.9
17	-2	542 W1	3 00 .6	-1 41	A5	12.2
18	+2	469 E1	3 01 .0	+2 43	A3	12.9
19	+0	502 E1	3 01 .1	+0 29	A0	12.8
20*	+0	502 E2	3 01 .2	+0 30	A3	12.4
21	-1	438 N1	3 01 .6	-1 16	A0	13.5
22	+0	512 W2	3 02 .3	+1 02	A2	13.3

TABLE 2 (Continued)

No.	Name	RA (1950) Dec	SP	V	
23	+0 512 W1	3 02.4	+1 09	A0	12.3
24	-0 492 E1	3 03.0	-0 12	A7	12.4
25	+0 511 E1	3 03.0	+0 38	A5	13.3
26	+2 476 E1	3 04.0	+2 45	A0	11.6
27	-0 496 S1	3 06.1	-0 04	A0	13.5
28	-1 446 N1	3 06.7	-0 58	A2	11.6
29	+1 554 S1	3 06.7	+1 47	A2	12.7
30	+0 529 E1	3 06.9	+0 57	B9:	14.5
31	-1 459 W1	3 10.5	-0 46	A0	13.1
32	-2 577 E1	3 11.4	-1 55	A5	13.2
33	-1 465 W1	3 11.8	-1 28	A0	11.9
34	-0 515 N1	3 11.9	+0 23	A2	12.0
35	+1 573 W1	3 14.1	+2 07	A0	11.3
36	-1 469 W1	3 14.5	-0 59	A0:	14.2
37	-0 520 N1	3 14.5	+0 12	A7	11.7
38	+1 573 E1	3 14.8	+2 03	B9	13.3
39	-2 593 N1	3 14.9	-1 32	A7	12.0
40	-0 524 W1	3 15.3	-0 28	A0:	14.1
41	+0 567 W1	3 17.0	+1 20	A2	12.6
42	-0 526 E1	3 17.1	-0 22	A0	13.7
43	-1 476 W1	3 17.3	-1 05	A2	11.7
44	+1 586 N1	3 21.4	+2 08	A0	12.7
45	-1 482 E1	3 21.6	-1 15	A2	13.3
46	+0 585 S1	3 22.0	+1 03	A7	13.1
47	-2 618 N1	3 22.1	-2 20	A0	12.5
48	-1 486 E1	3 22.6	-1 41	A2	13.4
49	+0 583 E1	3 22.8	+0 32	A0	13.5
50	-1 490 E1	3 23.4	-0 51	A7	11.9
51	-1 492 E1	3 23.6	-1 25	A5	11.8
52	+1 594 E1	3 24.3	+1 35	A2	12.8
53	+1 595 E1	3 24.3	+1 54	A3	11.6

Notes to Table 2

- 2 Possible metallic-line star  
11 Possible metallic-line star  
20 Classified F2 with some metallic lines visible on plate taken 11/12 August 1969.

A colon after the spectral type indicates that the classification is doubtful, usually because of faintness, but sometimes because of overlap. Finding charts for the stars which are not listed in the Bonner Durchmusterung will be found in Figures 2-6. The catalogue stars are indicated by a number and dash on either side of the star. Stars from Table 1 are indicated by a single dash without a number. The direct plates did not cover exactly the same area as the spectral plates; therefore, a few stars from Table 2 are not shown in Figures 2-5. Individual charts are shown in Figure 6 for these stars.

#### IV. Remarks

The distribution of spectral type with apparent magnitude is shown in Figure 7 for spectral classes B8-A0 and in Figure 8 for classes A2-A7. The distributions found in the other areas investigated so far are also indicated in the graphs. (SGP: Philip and Sanduleak 1968; anticenter region: McCuskey 1967).

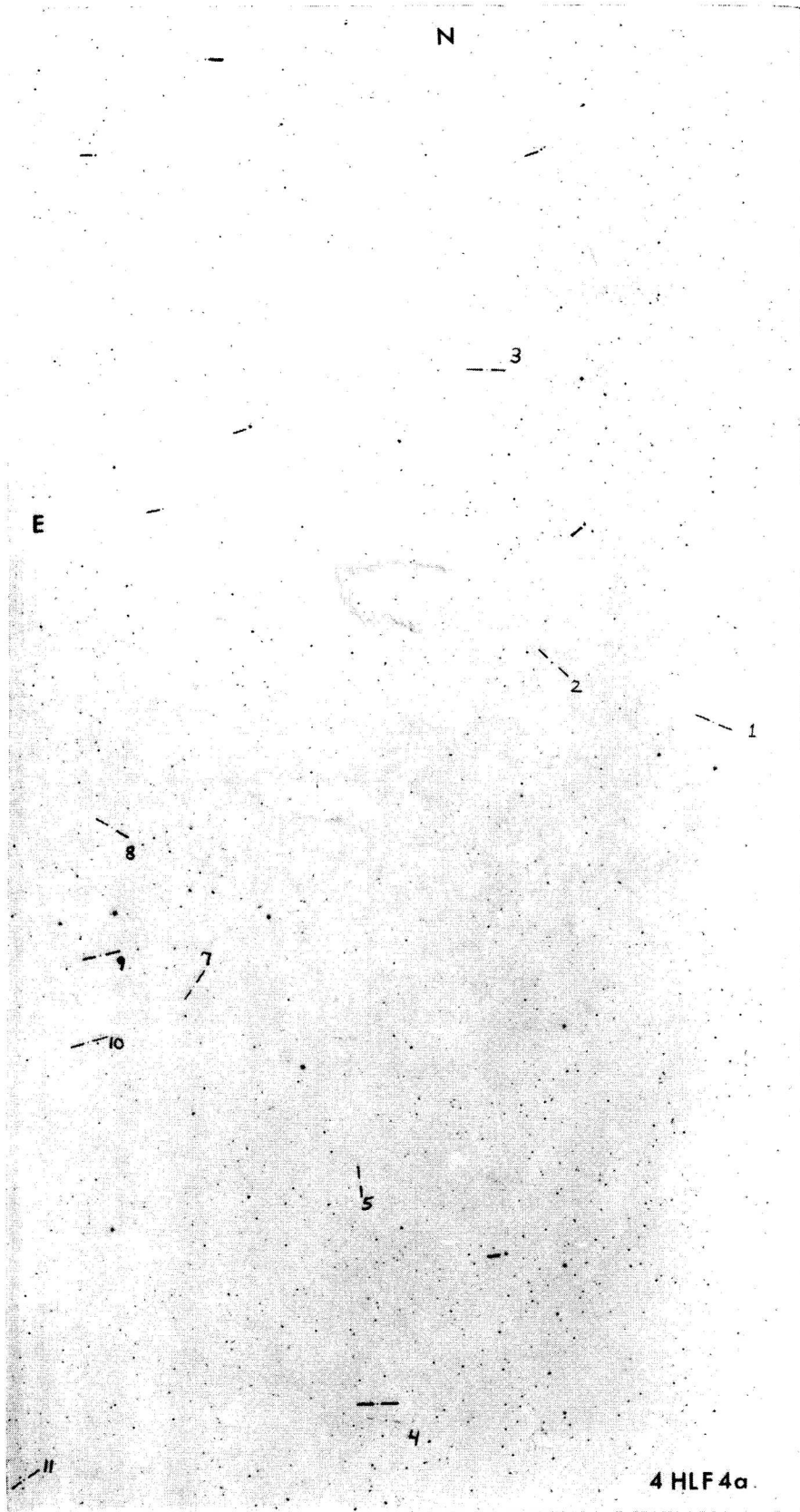


Fig. 2.—W portion of 4 HLF 4a. The plate is 5 degrees across.

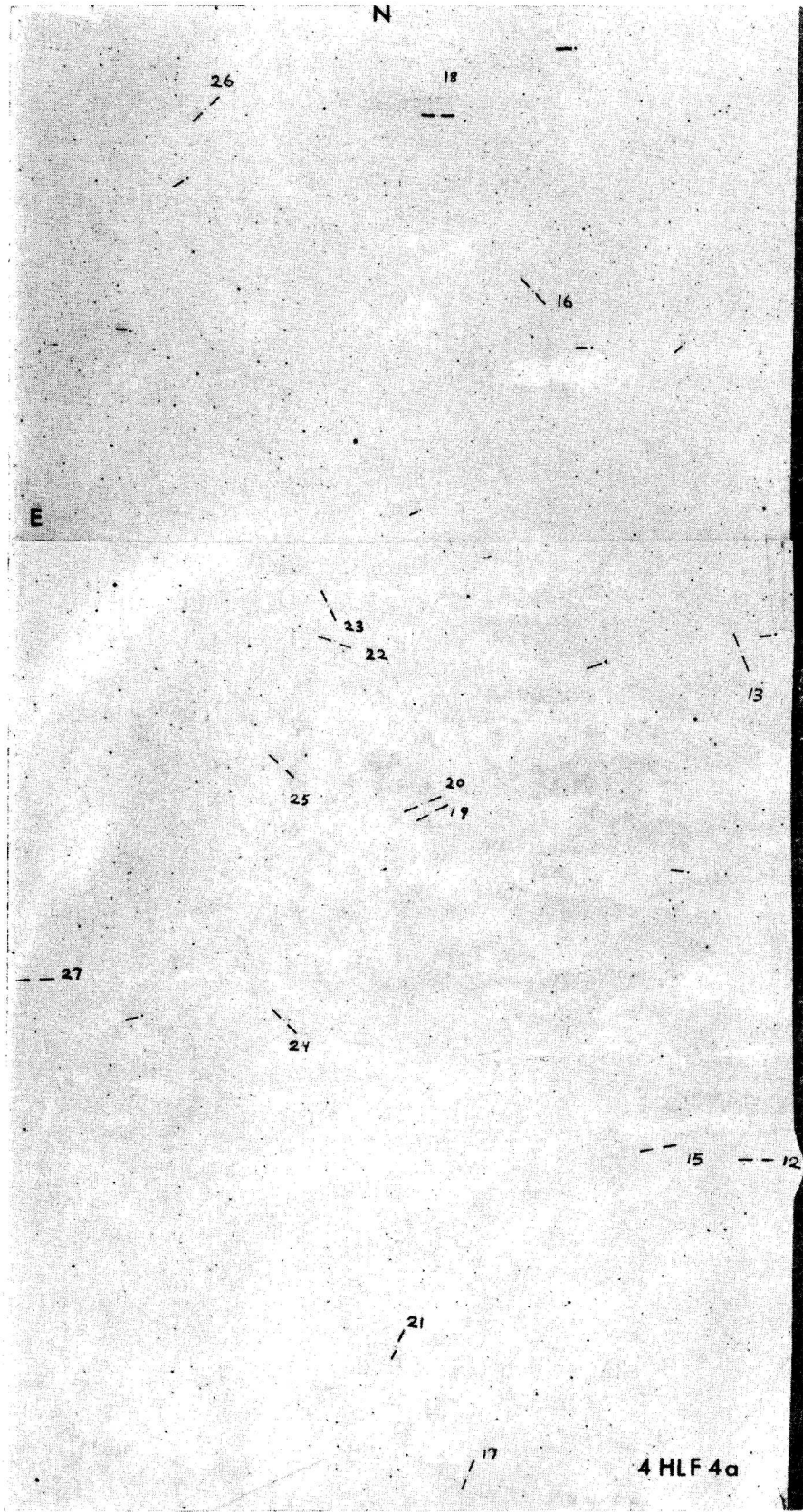


Fig. 3.—E portion of 4 HLF 4a.



Fig. 4—N portion of 4 HLF 4.

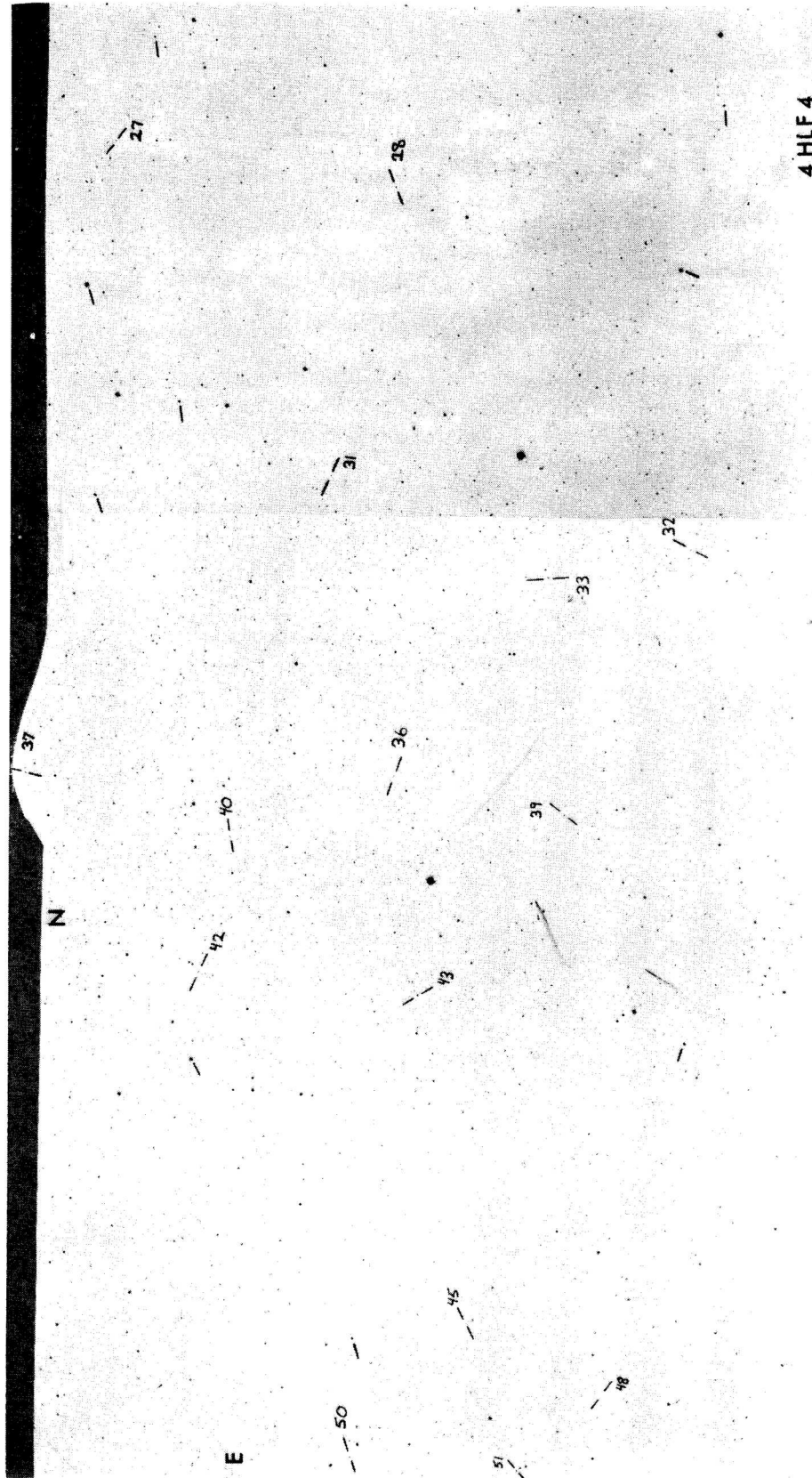


Fig. 5.—S portion of 4 HLF 4.



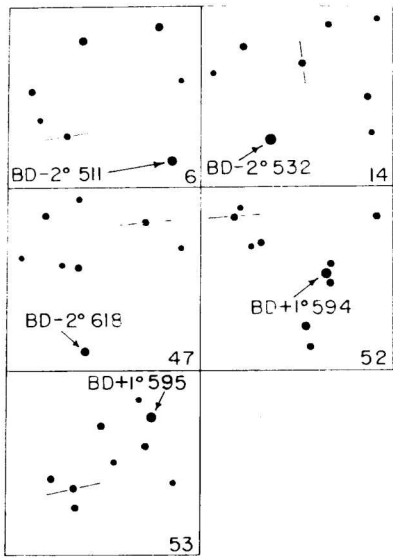


Fig. 6.—Individual charts for stars not shown in Figures 2-5. The charts are 15' on a side; North is up and East is to the left. The catalogue star is marked by a dash on either side.

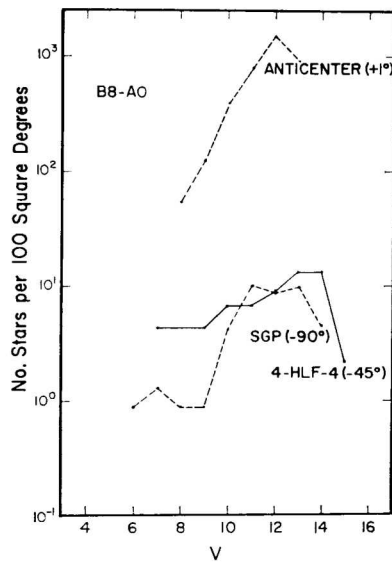


Fig. 7.—The number of stars per unit interval in apparent magnitude per 100 square degrees versus V magnitude for spectral classes B8-A0. The dashed lines indicate the distributions for the SGP and anticenter regions; the solid line marks the distribution for 4 HLF 4.

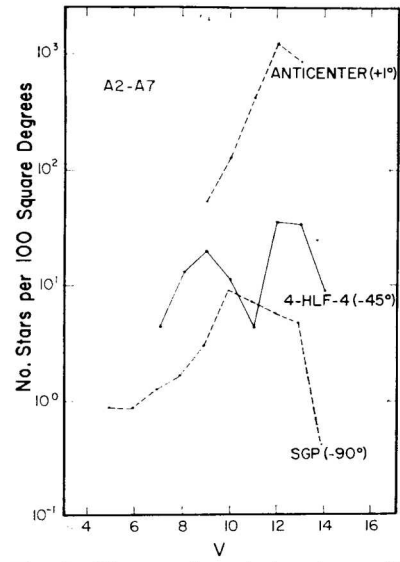


Fig. 8.—The number of stars per unit interval in apparent magnitude per 100 square degrees versus V magnitude for spectral classes A2-A7. The dashed lines indicate the distributions for the SGP and anticenter regions; the solid line marks the distribution for 4 HLF 4.

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