CARBON STARS IN TWO NORTHERN MILKY WAY ZONES*

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ABSTRACT

A catalogue is given of 421 carbon stars, of which 363 are new. This is an extension of a catalogue already published The present survey covers two belts centered at galactic latitudes +4° and −4° Thus the completed survey now covers a zone 12° wide extending in longitude from 333° through zero to 201°. The limiting infrared magnitude of the survey is about 10.0, but a few fainter stars are included. A study of the distribution of all the 693 carbon stars in this and the previous survey was undertaken. Although some definite groupings are present, in general the over-all surface distribution in longitude shows some uniformity, but it is influenced by interstellar absorption. Near the direction of the galactic center the number of carbon stars is minimum The distribution in latitude shows that the carbon stars have a much higher concentration than the late M stars (M5–M10)

I. INTRODUCTION

The present lists of carbon-type stars form an extension of a catalogue already published (Nassau and Blanco 1954*b*). The stars were observed exactly in the same manner as before, with infrared-sensitive plates (Kodak 1-N emulsion with Wratten 89 filter) exposed for 5 minutes with the 2° objective prism attached to the Burrell Schmidt-type telescope. The previous list was based on plates centered at the Lund (Ohlsson 1932) galactic equator, while the present lists are for plates covering two continuous belts centered at galactic latitudes +4° and −4°, respectively. Thus the completed survey now covers a zone 12° wide, in the northern Milky Way, extending in longitude from 333° through zero to 201°.

The selection of the carbon stars has been based uniformly on the criteria previously published. In the present lists, however, no attempt is made to separate the stars into the N and R classes. It should again be emphasized that stars of classes C0, C1, and C2 are difficult to recognize with the dispersion used; thus our catalogues are not complete in this sense. Occasionally a relatively bright carbon star may be missed because of extreme overexposure in the plates. An effort has been made to guard against this possibility by consulting the lists given by Sanford (1944) and by Lee and co-workers (1943, 1947) and also by comparing the overexposed spectra with the existing 4°-prism short-exposure plates. On the other hand, some of the stars, being variable, were missed because they were too faint at the time of observation. Two such cases were the stars EV Gem and V674 Cyg.

II. DESCRIPTION OF CATALOGUE

The numbering in the present lists follows the sequence published previously, thus the first star in Table 1*a* is No. 272. Table 1 contains the stars in the northern belt centered at +4°; Table 2, the stars in the −4° belt. Each of these tables is subdivided into two parts, section *a* containing carbon stars that are listed in the *BD* catalogues and section *b* the rest of the stars. As in the previously published list, for stars that do not appear in the *BD* catalogues, a nearby BD star has been listed, and differential co-ordinates, Δx and Δy, from the BD star to the carbon star in millimeters in the scale of the *BD* charts are given. Δx is in the direction of R.A. and is positive eastward; Δy, the declination co-ordinate, is positive northward. The infrared magnitudes, m_i, are approximate and are estimated from the density of the spectra. They were derived from observed sequences on direct plates in five regions along the belt of the survey.

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The remarks are also organized as in the previously published list. The variable-star designations are from the *General Catalogue of Variable Stars* (Kukarkin and Parenago 1948) and its first six supplements (Kukarkin *et al.* 1949–1954) and from the *Catalogue of Stars of Suspected Variability* (Kukarkin *et al.* 1951). The types of variability given at the end of the "Remarks" for each star are taken from these references. Stars in Sanford's list show the spectral class assigned by Sanford with an asterisk. Stars in the surveys of Lee and co-workers are indicated by the Dearborn number, always preceded by the letter "D," and the Dearborn spectral classes. The question mark implies that the identification of the star is uncertain. New variables were designated by "var." For two stars, Nos. 384 and 401, the remark "em" indicates that an emission-like feature was suspected at λ 8500. The present catalogue contains 421 carbon stars, of which 363 are new.

III. GALACTIC DISTRIBUTION OF CARBON STARS

Figure 1 shows the galactic distribution of all the 693 carbon stars in this and the previous survey (Nassau and Blanco 1954*b*). In addition, it gives the carbon stars from another survey (Nassau and Blanco 1954*c*) along latitude meridians up to ±18° in belts 5° wide and at intervals of 21° in longitude. There are 59 stars in this group. All stars were plotted to the nearest degree. The boundaries of the Milky Way are indicated approximately by a continuous heavy line and were obtained from *Becvar's Atlas of the Heavens*. Although some definite groupings are present and are under investigation, in general the over-all surface distribution (when compared with Milky Way photographs) may be explained by the presence of interstellar obscurations. The region between $l = 130°$ and $l = 150°$ is a good example. North of latitude $-2°$ the number of carbons per square degree is much greater than in the corresponding region south of it.

Table 1a

Carbon Stars

No.	B. D.		1900			m_i	l	b	Remarks
			h m						
272	43°	1278	5h 22.0	+43°	21′	7.7	134°	+6°	CM Aur, N*, I.
273	30	1014	5 41.8	+30	35	5.9	147	+3	FU Aur, N*, I?
274	29	1026	5 46.4	+29	53	7.8	148	+3	
275	30	1079	5 54.4	+30	45	10.4	148	+5	
276	26	1117	6 04.7	+26	03	5.0	153	+5	TU Gem, N*, I.
277	14	1283	6 19.7	+14	47	5.0	163	+3	BL Ori, N*, D46, N, I.
278	12	1177	6 25.3	+12	33	7.7	167	+3	DH Gem, N*, D48, R, SR.
279	16	1194	6 28.6	+16	09	6.2	164	+5	CR Gem, N*, D51, N, I.
280	6	1462	6 53.0	+ 6	18	2.5	176	+6	RV Mon, N*, SR.
281	-7	1901	7 16.1	- 7	22	9.2	191	+4	
282	-18	4634	17 39.1	-18	37	6.6	337	+4	SZ Sgr, SR.
283	4	3779	18 26.4	+ 4	19	6.8	2	+5	TY Oph, D118, N, I.
284	14	3729	18 53.9	+14	14	5.9	14	+4	UV Aql, N*, D126, N, SR.
285	20	4072	19 07.5	+20	27	7.7	21	+4	
286	30	3546	19 20.8	+30	28	9.5	31	+6	
287	32	3522	19 37.2	+32	23	6.0	35	+4	TT Cyg, N*, D213, R, SR.
288	41	3632	20 06.3	+41	12	7.4	45	+4	AY Cyg, N*, D215, N, I.
289	47	3077	20 16.5	+47	35	3.0	52	+7	U Cyg, Ne*, M.
290	50	3255	20 59.9	+51	02	9.2	59	+3	
291	63	2100	23 59.0	+63	44	9.9	86	+2	

Table 1b

Carbon Stars

No.	B. D.		Δx	Δy	1900		m_i	l	b	Remarks
					m					
292	66°	66	+0.9	-3.3	0h 45.7	+66° 52'	9.5	91°	+5°	
293	67	76	+1.4	-0.8	0 49.0	+67 57	7.8	91	+5	
294	64	99	+0.3	+1.3	0 50.2	+64 39	9.9	91	+3	
295	63	117	0.0	-1.6	0 50.8	+63 55	9.9	91	+2	
296	66	81	0.0	-1.7	0 53.6	+67 06	10.2	91	+5	
297	66	83	+1.3	+1.1	0 54.5	+66 49	9.0	91	+5	
298	67	88	+0.6	-0.3	0 54.8	+68 11	9.5	91	+6	
299	65	144	-0.5	+1.5	1 07.6	+65 20	8.2	93	+3	
300	61	400	+0.6	+0.6	2 13.2	+62 04	9.4	101	+2	
301	64	332	+0.7	-1.1	2 26.3	+64 53	9.5	101	+5	
302	64	333	+6.5	+0.9	2 29.6	+64 23	9.5	102	+5	
303	61	468	+3.1	-1.8	2 37.0	+61 37	10.2	103	+3	
304	61	474	+2.0	-2.2	2 37.5	+61 44	10.4	103	+3	
305	62	464	-0.7	+0.5	2 40.2	+62 34	9.9	103	+4	
306	63	361	-6.6	-2.3	2 40.7	+63 47	10.1	103	+5	
307	60	575	-1.7	+2.5	2 41.8	+61 18	9.6	104	+3	
308	62	532	+2.9	-2.5	3 05.4	+62 33	9.2	106	+5	
309	61	552	-0.2	-1.9	3 10.6	+61 08	10.1	107	+4	
310	60	695	-4.3	+1.7	3 22.8	+60 28	9.4	109	+5	
311	60	727	-1.1	+0.6	3 32.2	+60 45	9.4	109	+5	
312	55	819	+1.2	+1.2	3 37.3	+56 02	9.0	113	+2	Var.
313	58	680	-2.5	+0.5	3 52.0	+58 28	8.9	113	+5	
314	56	867	+1.7	-1.9	3 52.9	+56 02	9.2	115	+4	
315	55	844	+0.7	-2.5	3 55.3	+55 51	10.6	115	+4	
316	55	844	+0.8	-0.5	3 55.3	+55 57	10.5	115	+4	
317	56	895	-1.9	+1.8	4 06.8	+56 32	9.2	116	+5	
318	56	903	+1.8	-0.6	4 12.1	+56 54	9.5	116	+6	
319	52	810	+2.1	+0.6	4 13.7	+53 08	9.9	119	+4	
320	52	818	+0.3	+2.3	4 18.0	+52 43	9.2	120	+4	
321	51	923	+2.6	+2.1	4 19.1	+51 32	9.2	121	+3	
322	51	938	-1.6	-2.9	4 22.2	+51 14	8.3	121	+3	
323	52	848	-2.2	-0.7	4 25.5	+52 46	9.7	120	+5	
324	52	853	+0.5	-0.2	4 28.2	+52 59	9.6	121	+5	
325	47	1034	+1.7	-1.9	4 38.6	+47 12	9.1	126	+2	
326	49	1251	+3.3	+0.1	4 43.2	+49 25	10.1	125	+4	
327	45	994	+0.6	+2.2	4 45.3	+45 31	9.8	128	+2	
328	47	1064	-3.1	+2.1	4 45.5	+47 54	9.9	126	+4	
329	49	1264	+2.2	+4.3	4 46.5	+49 42	7.7	125	+5	AU Aur, Ne*, D276? R, M
330	48	1192	+1.0	-1.0	4 52.1	+48 22	9.4	126	+5	
331	47	1092	-3.7	+1.2	4 56.2	+47 59	8.3	127	+5	
332	46	959	-2.3	-1.9	4 56.9	+46 41	10.0	128	+5	
333	45	1047	-0.4	+0.6	5 01.3	+45 21	9.5	130	+4	
334	48	1227	+4.8	+6.2	5 03.2	+48 35	9.2	127	+7	
335	46	969	+4.4	-0.3	5 04.2	+46 10	9.2	129	+5	
336	44	1137	-3.2	-2.2	5 06.0	+44 10	9.2	131	+4	
337	40	1209	+1.2	+0.1	5 06.1	+40 48	10.1	134	+2	
338	44	1131	+1.0	+0.8	5 06.5	+44 56	9.2	131	+5	
339	41	1123	-0.5	+0.3	5 07.7	+41 18	10.1	134	+3	
340	40	1220	-1.4	-0.8	5 07.9	+40 44	9.8	134	+3	
341	42	1253	-0.8	+2.3	5 13.7	+42 31	9.2	133	+5	

Table 1b (Continued)

Carbon Stars

No.	B. D.		Δx	Δy	1900		m_i	l	b	Remarks
					h m					
342	37°	1151	+0.7	-0.8	5 14.6	+37° 59'	9.2	137°	+2°	EF Aur, I
343	39	1295	-0.5	-0.8	5 18.0	+39 59	10.1	136	+4	
344	39	1296	+0.5	+3.5	5 18.6	+39 47	9.4	136	+4	
345	38	1156	+0.5	+0.6	5 19.3	+38 17	8.0	138	+3	
346	36	1141	-1.7	-0.8	5 20.4	+36 43	10.1	139	+2	
347	37	1195	-0.5	-0.4	5 20.6	+37 59	10.1	138	+3	
348	34	1071	+2.4	-1.0	5 24.6	+34 34	9.2	141	+2	
349	40	1333	-2.3	-1.9	5 26.6	+40 24	9.9	137	+5	
350	40	1332	-1.4	-0.2	5 26.8	+40 37	9.8	137	+6	
351	39	1345	+1.5	-0.8	5 28.5	+39 40	9.4	137	+5	
352	33	1117	-2.0	-1.3	5 33.4	+33 23	9.4	143	+3	
353	34	1137	+1.0	-0.1	5 34.4	+34 34	9.9	142	+4	
354	37	1288	-0.8	-0.7	5 35.0	+37 39	9.5	140	+5	
355	33	1125	+1.3	-1.3	5 36.5	+33 38	9.6	143	+3	
356	30	1015	-1.5	+1.0	5 41.4	+30 32	9.2	147	+3	
357	35	1251	+0.8	-2.3	5 43.2	+35 43	8.3	142	+6	
358	32	1118	-2.5	+0.4	5 46.1	+32 11	9.2	146	+4	
359	29	1026	+0.5	-1.3	5 46.5	+29 49	9.8	148	+3	
360	30	1038	+1.7	-0.1	5 46.6	+30 36	9.2	147	+4	
361	28	935	+0.4	+0.7	5 47.8	+28 37	9.2	149	+3	
362	30	1053	-2.4	-2.1	5 48.2	+30 10	10.1	148	+4	
363	34	1211	+1.0	-1.5	5 48.5	+34 02	8.0	144	+6	
364	31	1039	+0.4	-4.8	5 48.6	+31 27	9.9	147	+4	
365	32	1130	-2.8	-0.9	5 49.4	+32 01	9.2	146	+5	
366	33	1194	-3.8	+0.3	5 49.5	+33 51	8.3	145	+6	
367	29	1047	+0.7	+4.9	5 50.5	+30 07	9.2	148	+4	
368	28	957	+2.2	+3.5	5 51.8	+28 27	7.7	149	+4	
369	28	960	-1.7	-2.0	5 51.9	+28 27	7.7	150	+4	
370	29	1074	+1.8	+0.2	5 55.4	+29 27	7.7	149	+5	BQ Aur, I
371	27	958	-1.0	+1.0	5 55.9	+27 31	7.7	151	+4	
372	29	1083	-1.4	-2.7	5 56.4	+29 39	8.6	149	+5	BR Aur, I
373	26	1044	+0.5	-2.5	5 57.3	+26 00	8.0	152	+3	
374	26	1049	+1.1	-0.6	5 57.7	+26 52	9.2	152	+4	
375	28	997	+3.1	+1.8	5 58.6	+28 24	9.9	150	+5	
376	22	1180	+2.2	0.0	6 02.3	+22 43	9.2	156	+3	
377	24	1151	+1.6	-3.7	6 05.8	+24 16	9.2	155	+4	
378	27	1017	+1.7	+3.6	6 06.4	+27 41	9.8	152	+6	
379	21	1172	-1.8	+0.6	6 09.5	+21 10	9.8	158	+4	
380	21	1175	-2.5	-1.1	6 09.6	+21 53	9.5	157	+4	
381	22	1249	-0.6	+1.1	6 09.7	+22 25	9.2	157	+4	
382	20	1354	-1.5	-0.8	6 11.7	+20 09	10.1	159	+3	
383	20	1371	-2.4	+2.8	6 13.0	+20 11	9.2	159	+4	GL Ori, SR.
384	21	1188	+3.3	-0.7	6 13.1	+21 39	9.9	157	+5	
385	18	1176	+0.5	+2.6	6 13.8	+18 17	9.8	161	+3	
386	21	1235	0.0	-1.7	6 19.8	+21 01	8.9	159	+6	em
387	19	1348	+0.3	-2.4	6 20.3	+19 08	6.8	161	+5	AB Gem, N*, D47, N, I
388	19	1356	+0.6	-0.3	6 21.8	+19 32	9.4	161	+5	
389	12	1175	+2.9	+1.7	6 24.8	+12 20	10.2	167	+3	
390	16	1175	+1.4	+0.5	6 25.8	+16 10	8.0	164	+5	N*, D50, N
391	16	1194	-2.3	-3.1	6 27.7	+15 59	9.8	164	+5	
392	15	1240	-0.4	-0.8	6 28.2	+14 59	8.3	165	+5	
393	14	1343	+1.6	-0.3	6 28.4	+14 21	8.9	166	+4	
394	11	1247	-0.3	-0.7	6 31.3	+11 32	9.7	169	+4	
395	13	1353	+2.5	+1.0	6 34.4	+14 00	10.1	167	+5	
396	10	1252	-0.1	-1.6	6 39.4	+ 9 57	10.1	171	+5	

Table 1b (Continued)

Carbon Stars

No.	B. D.	Δ x	Δ y	1900		m_i	l	b	Remarks
				m					
397	9° 1374	+1.4	-0.2	6h 40.0	+ 9° 47'	8.1	171°	+5°	D57, N
398	7 1448	+0.4	+1.2	6 42.1	+ 7 19	9.2	174	+4	
399	4 1462	-0.4	+0.2	6 44.0	+ 4 11	9.8	177	+3	DH Mon, I
400	3 1421	-1.5	+1.2	6 44.4	+ 3 5	9.2	178	+3	
401	8 1531	+0.7	+1.1	6 45.9	+ 8 41	10.1	173	+5	
402	2 1428	+0.4	-1.1	6 46.1	+ 2 29	9.3	178	+3	
403	5 1445	-0.3	+2.1	6 46.1	+ 5 21	8.3	176	+4	CG Mon, D62, N?, M, em
404	5 1448	+0.7	+2.1	6 46.6	+ 5 19	9.1	176	+4	DL Mon, I
405	9 1426	+3.5	+2.5	6 48.2	+ 9 28	9.9	173	+6	
406	7 1501	-2.0	+1.2	6 48.1	+ 7 17	9.2	174	+5	
407	1 1574	0.0	+0.8	6 48.4	+ 1 35	9.5	180	+3	
408	9 1428	-0.8	-2.1	6 48.6	+ 9 07	9.0	173	+6	IT Mon, I
409	6 1438	+0.6	+1.9	6 50.1	+ 6 30	7.2	175	+5	CL Mon, Ne*, D65, N, M
410	3 1470	-0.4	+1.0	6 51.2	+ 3 51	9.5	178	+4	
411	3 1468	+0.3	+2.8	6 51.2	+ 3 52	9.2	178	+4	
412	6 1448	+1.6	-3.4	6 51.6	+ 6 29	7.7	176	+6	CO Mon, D69, N, LP
413	5 1489	-2.6	-2.6	6 51.7	+ 5 37	9.2	176	+5	
414	- 1 1473	+0.7	-1.6	6 52.6	- 1 19	9.2	183	+2	
415	+ 2 1530	+2.4	+2.3	6 58.7	+ 2 42	8.9	180	+5	
416	- 3 1718	+1.6	+1.4	7 00.2	- 3 28	9.5	185	+3	
417	- 5 1973	-0.4	-1.3	7 02.4	- 5 12	9.5	187	+3	
418	- 0 1621	-1.5	+1.1	7 03.8	- 0 06	9.4	183	+5	
419	- 1 1578	+2.1	-0.5	7 05.9	- 1 08	9.4	184	+5	
420	+ 0 1844	+0.5	-2.0	7 06.4	+ 0 20	8.2	183	+6	
421	- 5 2002	+3.2	-0.1	7 06.5	- 6 02	9.2	188	+3	
422	- 5 2049	-0.2	+1.1	7 12.0	- 5 08	9.5	188	+5	
423	- 7 1874	+0.2	0.0	7 14.0	- 7 37	9.2	191	+4	
424	- 7 1904	+2.2	-0.3	7 16.7	- 7 59	9.2	191	+4	
425	-10 2019	-0.7	-2.0	7 18.2	-10 27	9.5	194	+3	
426	-11 1940	-3.2	+0.1	7 21.6	-11 09	9.6	195	+4	
427	- 7 1970	-0.5	-1.3	7 22.0	- 7 38	9.5	192	+6	
428	- 8 1920	-0.6	+0.3	7 22.5	- 8 27	9.5	192	+5	
429	-11 1972	-1.0	+1.2	7 25.2	-11 46	9.4	196	+4	
430	-11 1973	+0.3	-1.9	7 25.8	-12 11	9.4	196	+4	
431	- 8 1951	+0.8	+0.6	7 26.4	- 8 18	9.5	193	+5	
432	- 9 2087	-0.1	+1.5	7 26.5	-10 04	9.0	195	+5	KQ Mon?, I
433	-14 1984	-0.2	-0.8	7 30.9	-14 53	8.9	199	+4	BF Pup, I
434	-11 2055	+3.1	-1.3	7 36.2	-11 54	9.2	197	+6	
435	-11 2062	+1.2	-1.0	7 36.8	-12 05	9.2	198	+7	
436	-16 4616	-2.1	+1.5	17 42.0	-16 45	10.0	339	+4	
437	-12 4891	+2.9	-2.4	17 55.8	-12 43	8.8	344	+4	
438	- 6 4722	+1.3	+0.8	18 06.9	- 6 01	9.5	351	+4	
439	- 7 4575	+0.3	+3.8	18 08.4	- 7 26	8.8	350	+3	
440	- 5 4612	-1.3	+1.9	18 10.5	- 4 58	8.9	352	+4	
441	- 5 4621	-1.3	-1.2	18 12.7	- 6 04	9.8	351	+3	
442	- 6 4378	-1.9	-3.3	18 13.2	- 6 54	8.3	351	+3	
443	1 3676	-1.2	+0.7	18 21.9	+ 1 05	8.3	359	+4	
444	11 3583	+1.6	0.0	18 40.2	+11 44	8.3	10	+5	
445	9 3858	-0.5	-2.0	18 40.8	+ 9 34	10.2	9	+4	
446	9 3865	+1.9	+1.5	18 42.5	+ 9 58	9.8	9	+4	
447	11 3226	-0.7	+1.0	18 45.0	+11 46	8.0	11	+4	478 Aq1, D121, N, I
448	17 3904	-0.2	+0.7	19 11.2	+17 14	8.6	19	+2	
449	25 3762	+0.8	-0.6	19 11.4	+25 03	8.2	26	+5	
450	27 3309	+0.4	-1.8	19 12.0	+27 38	9.0	28	+6	
451	21 3719	-2.9	+2.1	19 12.9	+21 44	6.8	23	+3	CG Vul, N*, I?

Table 1b (Continued)

Carbon Stars

No.	B. D.		Δx	ΔY	1900		m_i	l	b	Remarks
					m					
452	24°	3730	-3.3	-1.8	19h 19.4	+24° 16'	9.5	26°	+3°	
453	23	3657	-0.9	+0.3	19 23.0	+23 24	7.7	26	+2	D 210? N
454	28	3379	-1.9	+2.3	19 28.8	+28 25	9.7	31	+3	
455	31	3711	+1.1	-0.6	19 36.4	+31 32	8.3	34	+4	HV Cyg, N*, D212?, N, SR
456	34	3680	+1.1	-0.6	19 39.9	+34 09	9.5	37	+4	
457	37	3588	+1.5	-0.7	19 41.3	+37 55	9.3	40	+6	
458	31	3766	+2.3	+1.4	19 43.3	+32 10	9.3	35	+3	IQ Cyg, M
459	37	3685	-0.5	+0.7	19 52.7	+37 36	9.3	41	+4	PU Cyg, I
460	39	4002	+2.8	+1.6	19 58.3	+39 44	7.5	43	+4	N*
461	37	3733	+0.3	+0.6	19 59.1	+37 19	9.3	42	+3	
462	46	2923	+2.3	-0.8	20 19.2	+46 13	10.1	51	+5	
463	47	3091	0.0	+1.3	20 19.9	+47 18	9.2	52	+5	
464	45	3203	-0.7	+1.3	20 27.7	+46 02	9.8	52	+3	
465	46	2958	+2.0	+0.4	20 28.4	+46 27	9.2	52	+4	
466	48	3163	-1.6	+0.4	20 30.7	+48 59	8.5	54	+5	D 324? N
467	48	3179	+1.4	-1.6	20 34.5	+48 35	8.5	54	+4	D 326, N
468	47	3167	+0.5	-3.1	20 38.2	+47 46	7.1	54	+3	V Cyg, Ne*, D327, N, M
469	46	3035	-0.5	-1.3	20 41.4	+46 41	9.9	54	+2	
470	52	2787	+3.0	-0.2	20 42.0	+52 55	9.8	59	+6	
471	50	3199	+1.9	+3.1	20 45.1	+51 12	7.7	57	+4	D 329, R
472	53	2513	-3.3	+0.3	20 50.0	+53 21	9.6	60	+5	
473	50	3232	-0.3	0.0	20 52.9	+50 41	10.4	58	+3	
474	53	2592	+1.7	+0.6	20 54.3	+54 04	var	61	+5	
475	53	2529	-2.2	+2.2	20 55.0	+53 52	9.6	61	+5	
476	54	2456	-2.1	+3.2	20 56.5	+54 59	9.5	62	+6	
477	50	3248	+1.3	+1.7	20 58.5	+50 44	9.0	59	+3	
478	50	3264	-5.4	+3.3	21 01.7	+51 11	9.8	59	+3	
479	51	2995	-5.4	-3.7	21 01.9	+51 25	9.9	59	+3	
480	53	2577	-3.1	-0.3	21 10.0	+53 54	9.5	62	+4	
481	54	2502	-1.3	-0.3	21 13.0	+54 57	9.8	63	+4	
482	56	2551	-2.6	+3.8	21 13.7	+56 32	9.5	64	+5	
483	55	2551	-2.1	+1.9	21 14.7	+55 32	9.3	64	+4	
484	56	2569	+0.7	-3.0	21 21.8	+56 52	9.6	65	+5	
485	56	2597	-3.0	-1.6	21 31.4	+56 35	10.1	66	+4	
486	58	2292	+0.5	-1.0	21 32.0	+58 09	10.1	67	+5	
487	58	2297	-0.3	-3.8	21 34.2	+58 02	9.9	67	+4	
488	58	2322	+1.5	+1.2	21 42.9	+58 35	9.5	68	+4	
489	59	2432	+1.0	-1.2	21 52.5	+59 27	10.1	70	+4	
490	61	2224	0.0	+0.6	21 54.7	+61 13	9.5	71	+5	
491	58	2377	+1.2	-2.3	21 59.8	+58 56	9.9	71	+3	
492	61	2239	-0.8	-2.9	22 00.3	+61 49	9.8	72	+5	
493	61	2244	0.0	-0.4	22 01.5	+61 35	9.5	72	+5	
494	59	2467	+0.4	+1.4	22 03.8	+59 41	9.7	72	+4	
495	60	2347	+0.6	-0.9	22 05.9	+60 28	9.2	72	+4	
496	59	2486	+0.2	-1.7	22 09.2	+59 53	9.8	72	+3	
497	59	2496	-0.5	+1.4	22 11.2	+59 34	10.2	72	+3	
498	62	2097	-0.2	-3.2	22 30.7	+63 02	9.9	76	+5	
499	64	1688	+1.7	-2.1	22 34.1	+64 31	9.6	77	+6	
500	64	1763	+1.2	-1.3	23 05.8	+64 44	9.9	80	+5	
501	62	2263	+1.3	-2.1	23 34.7	+63 02	9.5	83	+2	

Table 2a

Carbon Stars

No.	B. D.		1900			m_1	l	b	Remarks
			h	m					
502	57°	165	0	49.0	+58° 01'	7.7	91°	-4°	W Cas, M
503	40	917	4	09.6	+40 09	7.8	128	-6	
504	34	911	4	42.6	+34 48	6.6	136	-5	R4*
505	24	862	5	28.3	+24 47	7.6	150	-3	
506	19	1047	5	37.9	+19 10	9.2	156	-4	
507	20	1083	5	39.7	+20 39	4.5	155	-3	Y Tau, N*, D30, N, SR
508	15	921	5	39.8	+15 29	7.1	159	-5	CP Tau, N*, D31, R, I
509	- 0	1246	6	12.8	- 0 12	7.7	177	-6	N*, D39, N
510	- 3	1441	6	23.2	- 3 04	8.3	181	-5	
511	-16	4904	18	24.5	-16 58	7.4	344	-5	SS Sgr, SR
512	-13	5083	18	38.7	-13 20	7.7	348	-6	RV Sct, R3*?
513	- 8	4726	18	44.8	- 8 01	4.7	353	-5	S Sct, N*, I
514	- 8	4764	18	49.9	- 8 19	6.5	354	-6	T Sct, N*, SR
515	39	4293	20	40.0	+40 2	9.4	48	-2	
516	41	4114	21	18.6	+41 57	7.1	55	-6	YY Cyg, N*, D331, R, SR
517	49	3673	21	51.6	+50 02	9.9	64	-4	LW Cyg, R3*, D343, N, Cst?
518	53	3033	22	51.9	+53 42	6.8	74	-5	TV Lac, N*, D354, R, I
519	56	3126	23	54.1	+56 25	7.7	84	-5	Ne*, D364, R

Table 2b

Carbon Stars

No.	B. D.		Δx	Δy	1900			m_i	l	b	Remarks
					h	m					
520	58°	37	-1.5	-4.0	0	16.0	+58°41'	10.1	87°	-3°	
521	58	34	+4.5	-0.8	0	17.1	+58 38	7.8	87	-3	FR Cas, D 237, N, I
522	57	113	-4.3	-0.1	0	29.9	+57 28	9.4	89	-4	
523	56	100	-0.8	-2.0	0	32.4	+56 39	8.5	89	-5	FX Cas, LP
524	58	101	-1.1	+1.2	0	40.3	+59 05	9.9	90	-3	
525	55	161	-0.7	+2.2	0	41.0	+56 08	10.1	90	-6	GW Cas, I
526	59	129	+3.1	+0.1	0	46.3	+59 47	9.5	91	-2	
527	57	243	0.0	-0.8	1	12.6	+57 38	9.1	94	-4	
528	56	269	-0.2	+0.4	1	18.8	+57 09	9.4	95	-4	
529	58	247	+0.8	-4.1	1	23.1	+58 22	8.8	96	-3	D 242, R
530	57	325	-1.2	-0.5	1	27.1	+57 15	6.6	96	-4	WW Cas, N*, D 243, N, I
531	57	325	+0.7	-1.1	1	27.6	+57 13	9.0	97	-4	
532	55	368	+3.2	-0.1	1	31.7	+55 28	8.4	97	-6	156, I?
533	57	371	-0.6	-0.5	1	35.5	+57 26	10.1	97	-4	
534	58	289	-1.6	-1.8	1	37.3	+58 11	9.2	98	-3	
535	56	359	+1.0	-1.3	1	44.3	+56 59	9.1	99	-4	
536	56	368	+0.5	-1.5	1	45.6	+56 29	9.9	99	-4	EW Per, I
537	58	353	-1.1	-0.4	1	53.7	+58 45	9.9	99	-2	
538	57	449	+1.4	-1.1	1	54.4	+57 48	8.0	100	-3	
539	57	452	+1.1	-1.6	1	54.9	+57 21	8.0	100	-3	BT Per, I
540	56	427	-2.9	+0.4	1	59.7	+56 22	8.2	101	-4	CN Per, M
541	55	636	-3.5	+1.0	2	22.4	+55 45	9.5	104	-3	
542	55	654	+1.5	+0.7	2	28.0	+55 42	7.7	105	-3	DY Per, SR
543	52	602	-0.6	+3.3	2	30.6	+52 33	8.8	107	-6	
544	55	679	-0.6	-2.6	2	31.5	+55 19	7.8	106	-3	VZ Per, R4*, D 250, R, Cst?
545	52	626	-1.2	+1.5	2	40.5	+52 37	10.1	108	-5	
546	53	584	-0.4	-2.4	2	45.6	+54 00	8.5	108	-4	D 252?, N
547	53	631	-1.2	+0.2	3	04.2	+54 09	10.1	110	-2	
548	51	728	+3.7	-2.3	3	17.6	+51 17	9.2	113	-3	D 258, N
549	50	771	+4.1	+1.0	3	24.7	+50 44	9.9	115	-3	
550	47	894	+3.0	-1.0	3	43.5	+47 19	5.9	119	-4	
551	43	846	-2.2	-1.5	3	49.4	+43 31	7.8	123	-6	D 269, R
552	48	1022	-3.8	-3.2	3	49.6	+48 18	10.1	119	-3	
553	45	857	-0.8	+2.3	3	52.4	+46 11	8.9	121	-4	FL Per, D 271, N, I
554	43	916	-2.5	+1.7	4	03.7	+44 11	8.8	124	-4	D 273, N
555	43	916	+2.0	-0.9	4	05.0	+44 03	9.7	124	-4	
556	43	926	+0.5	+2.1	4	07.2	+43 39	10.2	125	-4	
557	43	927	+0.5	+1.6	4	07.7	+43 31	9.1	125	-4	
558	45	897	+0.4	-2.6	4	08.5	+45 25	9.9	124	-2	
559	40	932	-0.6	-0.5	4	13.1	+40 53	7.4	128	-5	GM Per, N*, D 274, N, M
560	39	1003	0.0	+2.1	4	22.5	+39 20	9.4	130	-5	
561	39	1004	+1.1	+0.6	4	22.9	+39 39	6.8	130	-5	GI Per, N*, I
562	41	883	-1.4	+0.5	4	23.1	+41 37	7.8	128	-3	
563	41	888	-2.5	+1.1	4	24.0	+41 21	9.2	128	-3	
564	40	1013	+0.5	-0.1	4	32.6	+40 19	10.1	131	-3	
565	38	922	+3.3	-2.4	4	33.0	+38 50	8.4	132	-4	
566	39	1043	+2.1	+1.6	4	34.4	+39 14	9.4	132	-3	HN Per, LP
567	35	909	+2.3	+0.6	4	43.5	+36 00	9.9	135	-4	
568	37	976	+3.2	-2.8	4	45.9	+37 51	8.4	134	-2	EX Aur, LP
569	32	857	+0.5	-3.4	4	51.2	+31 58	8.0	139	-5	

Table 2b (Continued)

Carbon Stars

No.	B. D.		ΔX	Δy	1900		m_i	l	b	Remarks
					h m					
570	29°	821	-0.4	-0.7	5 03.0	+29°48'	8.9	143°	-5°	
571	34	956	+3.2	-1.3	5 03.2	+34 28	10.1	139	-2	
572	29	830	-0.5	-1.8	5 04.9	+29 31	8.0	143	-4	ER Tau, I
573	27	744	+1.2	-0.5	5 10.9	+27 34	8.5	145	-5	
574	23	914	0.0	-0.8	5 20.3	+23 59	8.5	150	-5	
575	23	929	0.0	+2.0	5 25.6	+23 28	9.9	151	-4	
576	20	977	-0.6	+0.5	5 25.9	+20 43	10.1	153	-5	
577	22	967	-0.8	+2.7	5 31.9	+22 46	7.7	152	-3	
578	21	913	-1.6	+1.8	5 31.9	+22 03	10.4	153	-4	
579	19	997	+2.0	+2.9	5 33.5	+20 07	9.9	155	-4	
580	21	954	-1.5	-1.1	5 38.4	+21 51	7.7	154	-2	
581	16	850	+3.0	-0.4	5 38.4	+16 38	9.9	158	-5	
582	14	1035	-0.5	-1.9	5 43.7	+14 38	9.2	160	-5	
583	17	1034	-1.0	+0.7	5 45.3	+17 21	10.1	158	-4	
584	12	967	-2.5	-0.4	5 52.5	+12 17	9.7	164	-5	
585	12	969	-2.5	-1.5	5 52.9	+12 36	9.7	163	-4	
586	10	990	+3.0	-1.3	5 59.1	+10 11	9.1	166	-4	709, D 34, N?, I?
587	11	1027	-3.4	-0.3	6 00.6	+11 58	9.9	165	-3	
588	4	1141	-2.5	-2.1	6 03.9	+ 4 38	9.1	172	-6	
589	4	1146	+0.6	+2.5	6 05.0	+ 4 08	9.9	172	-6	
590	7	1209	-1.5	-0.2	6 10.1	+ 7 07	9.0	170	-3	
591	6	1175	+0.2	+2.5	6 10.7	+ 6 49	9.5	170	-3	
592	5	1186	+2.9	-1.1	6 14.5	+ 5 23	9.0	172	-3	
593	6	1202	+1.1	-2.1	6 15.3	+ 5 56	9.6	172	-3	
594	4	1215	-0.3	-1.5	6 15.3	+ 3 56	9.1	174	-4	
595	2	1210	-0.5	+0.2	6 17.9	+ 2 49	10.1	175	-3	
596	- 0	1289	-0.9	-2.3	6 20.9	- 0 49	8.3	179	-5	
597	+ 0	1432	-0.4	+0.5	6 22.7	+ 0 34	10.1	178	-3	
598	- 5	1658	+3.6	+1.3	6 26.1	- 5 27	8.9	183	-6	
599	- 0	1321	+0.4	-1.2	6 26.4	- 0 28	8.8	179	-3	CR Mon, I
600	- 4	1592	+1.5	-0.4	6 33.2	- 4 20	9.7	183	-3	
601	- 8	1507	-1.5	+2.5	6 33.8	- 8 49	9.4	187	-5	
602	- 4	1622	0.0	-0.6	6 37.2	- 4 05	10.2	183	-2	
603	-10	1653	+0.2	+1.5	6 37.7	-10 16	9.9	189	-5	
604	- 8	1529	+3.0	-2.3	6 38.5	- 8 40	7.1	187	-4	N*
605	- 5	1762	+2.3	-3.1	6 38.8	- 5 26	9.5	185	-3	
606	-12	1622	-2.6	+0.6	6 41.7	-12 47	7.4	191	-6	N*
607	-10	1694	+1.1	+2.4	6 42.8	-10 02	8.3	189	-4	
608	-11	1643	+0.4	-0.7	6 43.9	-11 22	9.4	190	-4	
609	-12	1666	-1.3	-1.4	6 47.2	-12 16	9.4	192	-4	
610	-11	1673	-0.7	-0.2	6 48.2	-12 02	8.9	191	-4	
611	-10	1766	+1.0	-0.7	6 51.7	-10 33	9.7	191	-2	
612	-21	4875	-0.3	-1.8	18 03.3	-21 41	9.2	336	-3	
613	-19	4886	+1.6	-0.4	18 05.4	-19 53	10.1	338	-2	
614	-19	4980	-3.1	+3.2	18 16.1	-19 04	9.5	340	-4	
615	-14	5067	-0.7	-1.3	18 22.7	-14 17	10.7	346	-3	
616	-13	4993	-1.3	-1.7	18 22.7	-13 39	10.4	346	-3	
617	-15	5001	+0.9	+3.1	18 26.2	-15 06	9.4	345	-4	
618	- 6	4893	-0.1	+2.4	18 41.2	- 6 40	9.1	354	-4	
619	- 4	4583	-2.9	-1.5	18 42.0	- 6 43	9.7	354	-3	

Table 2b (Continued)

Carbon Stars

No.	B. D.	Δx	Δy	1900		m_i	l	b	Remarks
				h m					
620	- 6° 4928	+0.7	+1.0	18h 45.4	- 6°51'	8.2	354°	-4°	AI Sct, M
621	- 1 3618	+2.5	+0.6	18 54.7	- 1 44	7.7	0	-4	
622	+ 5 4027	+1.2	0.0	19 01.4	+ 5 32	8.5	7	-2	
623	6 4027	+1.4	+0.8	19 03.7	+ 6 57	9.1	9	-2	
624	6 4076	-2.2	-0.2	19 11.4	+ 6 44	9.6	10	-4	
625	8 4035	+1.3	+2.0	19 13.1	+ 8 43	8.9	12	-3	
626	7 4037	-0.9	-1.3	19 16.5	+ 7 28	9.5	11	-4	
627	16 3892	-1.3	-2.5	19 29.0	+16 18	9.4	20	-3	
628	16 3972	+3.6	-1.6	19 38.7	+16 32	8.9	22	-5	4786, LP
629	18 4210	+0.6	+3.5	19 39.1	+19 03	8.9	24	-3	
630	19 4132	-2.0	+2.5	19 39.4	+19 18	8.9	24	-3	CO Vul, I
631	21 3923	+0.5	+2.5	19 44.0	+21 25	8.2	26	-3	
632	21 3935	-0.5	-0.5	19 45.3	+21 34	9.7	27	-3	
633	21 3941	+1.6	-3.5	19 46.5	+21 41	9.1	27	-4	
634	21 3995	+2.3	+0.5	19 54.1	+21 54	9.0	28	-5	
635	28 3646	-0.9	-0.5	20 06.3	+29 02	8.8	36	-3	
636	27 3654	-2.3	+1.2	20 09.1	+28 07	9.2	35	-3	
637	27 3688	-2.6	-1.2	20 14.6	+27 41	9.2	35	-4	
638	30 4014	-1.8	+0.6	20 19.5	+30 56	9.7	39	-5	
639	35 4185	-0.4	-0.8	20 32.3	+35 20	9.7	44	-4	
640	36 4158	-2.5	+2.0	20 33.8	+36 30	7.7	45	-3	N*, D 222, N
641	36 4231	-1.5	-0.9	20 42.2	+36 35	9.5	46	-5	
642	43 3815	-1.8	-0.9	21 04.2	+43 18	9.7	54	-3	
643	44 3747	+0.5	+1.0	21 10.7	+44 16	10.2	55	-3	
644	42 4025	+0.6	+0.7	21 11.6	+43 02	9.1	55	-4	701 Cyg, I
645	41 4067	-0.4	+0.7	21 12.6	+41 52	9.9	54	-5	
646	45 3495	-1.8	-1.2	21 15.7	+45 19	8.0	57	-3	
647	44 3775	+0.7	-1.4	21 16.3	+44 15	9.7	56	-4	
648	45 3516	+0.9	+1.6	21 19.6	+45 25	10.2	57	-4	
649	44 3805	-4.1	+2.9	21 20.6	+44 23	8.0	57	-5	
650	43 3910	-1.0	-0.7	21 20.9	+43 22	9.1	56	-5	
651	43 3905	+1.9	+1.2	21 21.0	+44 12	10.1	57	-5	
652	43 3964	+0.3	+1.9	21 29.4	+43 29	6.8	57	-6	624 Cyg, D 334, N, I
653	45 3607	-0.7	+1.2	21 33.4	+46 04	9.2	60	-5	
654	47 3501	+1.1	+0.4	21 34.3	+47 41	9.9	61	-3	637 Cyg, M
655	45 3621	-3.2	-1.3	21 34.7	+45 15	9.9	59	-5	
656	46 3399	+1.1	-1.2	21 35.1	+46 19	9.2	60	-5	
657	44 3901	-1.6	+2.9	21 36.3	+45 00	8.3	59	-6	644 Cyg, LP
658	45 3632	-1.5	-2.3	21 36.9	+45 53	9.2	60	-5	
659	45 3632	+0.3	+1.4	21 37.4	+46 04	9.9	60	-5	
660	48 3485	-0.8	+0.8	21 39.7	+48 28	8.2	62	-3	
661	45 3489	-2.4	-2.4	21 40.0	+48 42	9.9	62	-3	
662	45 3674	+1.2	-1.6	21 43.8	+45 26	8.3	61	-6	
663	47 3568	+1.3	-1.2	21 46.5	+47 20	7.7	62	-5	D 340, R
664	47 3589	-2.1	-1.4	21 48.4	+47 21	10.1	62	-5	
665	46 3470	+0.3	-2.3	21 48.6	+46 55	7.8	62	-6	D 341, R
666	49 3700	-3.0	+1.2	21 53.4	+49 26	9.9	64	-4	
667	48 3558	+2.6	+0.3	21 54.6	+49 10	9.8	64	-4	
668	52 3082	+0.1	+0.4	21 58.2	+52 29	10.2	67	-2	
669	49 3726	0.0	+0.2	21 59.8	+49 18	9.4	65	-5	

Table 2b (Continued)

Carbon Stars

No.	B. D.	Δx	Δy	1900		m_i	l	b	Remarks
				$22^h\ 02^m.4$	$+52^\circ 22'$				
670	52° 3111	-1.7	+1.3			9.9	67°	-3°	
671	47 3692	+2.7	+4.2	22 02.7	+47 58	7.7	65	-6	CT Lac, D346, R, I
672	49 3750	0.0	+1.1	22 05.2	+49 58	10.4	66	-5	
673	50 3599	-1.8	0.0	22 06.3	+51 11	10.2	67	-4	
674	52 3247	-1.4	+3.0	22 31.2	+52 50	9.4	71	-4	
675	54 2854	-0.7	-1.8	22 41.6	+54 33	7.6	73	-4	TX Lac, R6*, I
676	54 2864	+0.5	-0.5	22 44.5	+54 24	9.9	74	-4	
677	56 2887	-1.8	-1.1	22 47.2	+56 20	9.1	75	-2	
678	53 3021	-1.2	-1.3	22 49.2	+53 11	9.4	74	-5	
679	55 2853	+1.2	+1.0	22 53.4	+55 51	10.1	75	-3	
680	55 2883	-0.5	-1.7	22 59.7	+56 00	9.1	76	-3	
681	56 2952	+2.1	-0.2	23 04.9	+56 38	10.2	77	-3	
682	54 2928	+0.9	-1.5	23 07.7	+55 06	10.2	77	-5	
683	56 2969	-2.3	+0.4	23 07.8	+56 56	9.7	78	-3	
684	55 2952	-1.1	-2.9	23 18.8	+55 37	6.8	79	-5	D360, N.
685	56 3012	-1.0	-0.2	23 23.6	+56 55	8.2	80	-4	
686	56 3044	-1.5	-1.3	23 32.5	+56 53	9.1	81	-4	DU Cas? M
687	55 2992	+0.3	+1.7	23 33.3	+55 29	8.2	81	-5	LS Cas, M
688	58 2628	-1.8	+1.1	23 34.9	+59 02	7.7	82	-2	DX Cas, M
689	57 2789	-0.7	-1.9	23 38.4	+59 40	8.0	82	-3	
690	58 2643	-2.4	+0.7	23 40.5	+58 31	9.5	82	-3	
691	57 2822	+1.1	+2.4	23 47.3	+57 33	8.5	83	-4	
692	57 2838	0.0	+3.2	23 53.6	+57 48	8.4	84	-4	
693	56 3127	+0.1	0.0	23 54.4	+57 07	8.0	84	-4	

There are more than a dozen small conspicuous groups of four or five stars, each with a diameter of about 1° or less. Also a number of pairs with a separation of less than 0°.2.

The galactic-longitude distribution of the 693 carbon stars found between the latitude limits ±6° is shown in Figure 2. The dotted bars indicate the percentage distribution of the 7963 M5–M10 stars (Nassau, Blanco, and Cameron 1956). The number of M stars decreases as the anticenter of the Galaxy is approached, while near the direction of the galactic center the number of carbon stars is minimum. This has already been pointed out by Nassau and Blanco (1954*c*), in whose work the region under investigation was imited to the central zone of 4° wide. From $l = 333°$ to $l = 45°$ the ratio of the number of M to carbon stars is 31, and the corresponding ratio for the region between $l = 105°$

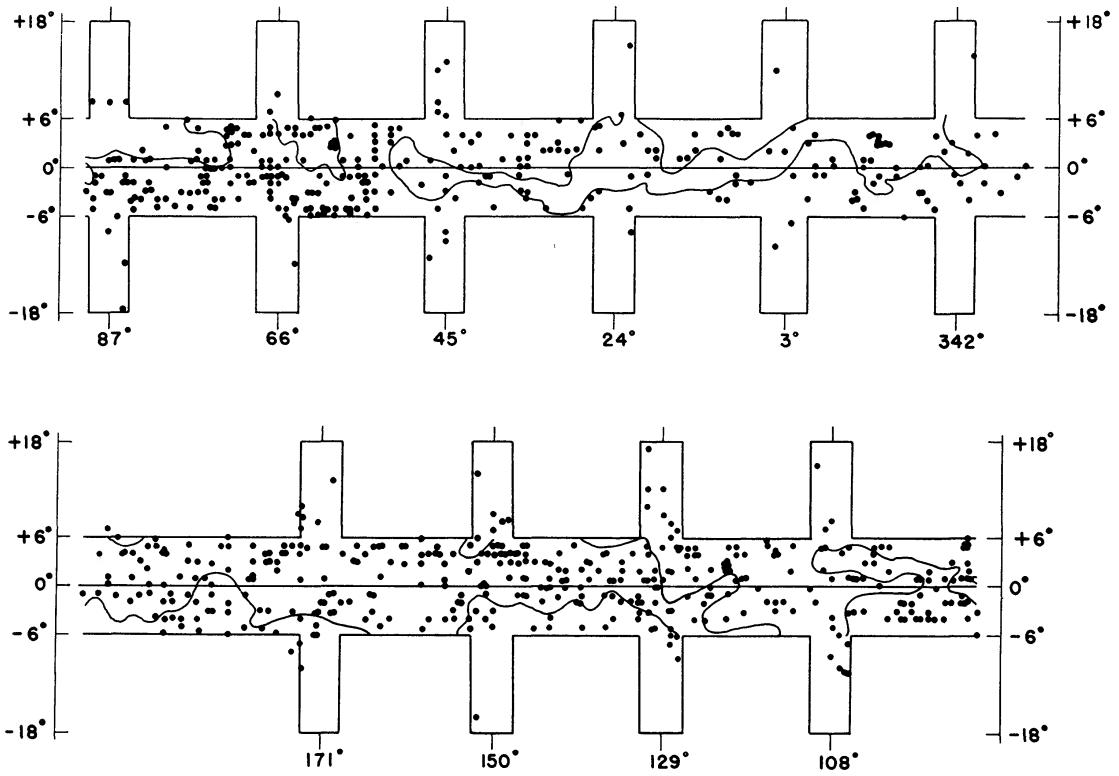

FIG. 1.—Distribution of carbon stars in the galactic belts The continuous lines indicate the boundaries of the Milky Way and they are obtained from *Becvar's Atlas of the Heavens*

and $l = 201°$ is 5.5. The average ratio for the galactic belt is 11. The limiting magnitude of the M and carbon stars is about the same. It is of interest to point out that for all the BD stars in the belt (Nassau and Blanco 1954*a;* Nassau, Blanco, and Cameron 1956) this ratio is equal to 3.9, and for all the known variables up to photographic magnitude 15.0 at maximum (Cameron and Nassau 1956) it is 4.7.

The over-all galactic-latitude distribution of the carbon stars is shown in Figure 3. Here the high-latitude regions were included after suitable adjustment for the limited area of the survey. The marked galactic concentration is apparent. The average ratio of the M to the carbon stars for the region of $b = +6°$ to $b = +18°$ and $b = -6°$ to $b = -18°$ and for the longitudes indicated in Figure 1 is 37, while the corresponding ratio for the galactic zone of 12° wide is 11. The relative scarcity of carbon stars near the

direction of the galactic center remains for the high-latitude regions. The ratio of M to carbon stars for the high-latitude regions from $l = 342°$ to $l = 45°$ is 88, and for the regions from $l = 66°$ to $l = 171°$ it is 21. Although the number of carbon stars is small, the ratio at the high-latitude regions is more meaningful, as the influence of interstellar absorption is nearly negligible.

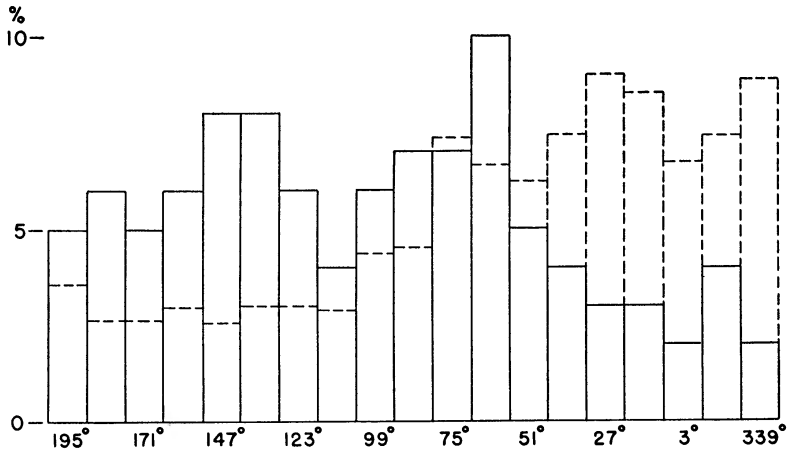

FIG. 2.—The percentage galactic-longitude distribution of the 692 carbon stars. The dotted bars indicate the distribution of the 7963 M5–M10 stars.

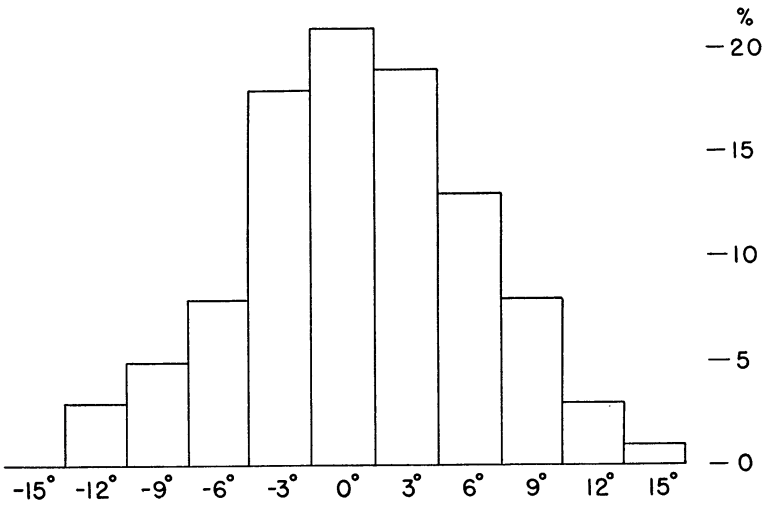

FIG. 3.—The distribution of carbon stars in latitude

A comparison was made of the distribution of the carbon stars and the OB stars (Nassau and Morgan 1950) in the same 12°-wide galactic zone. The distribution of the carbon stars is much less irregular than that of the OB stars. Areas rich in OB stars, as a rule, do not contain large numbers of carbon stars. The only region in which a large number of carbon stars is present and which is moderately rich in OB stars is at $l = 140°$–$150°$ and between $b = +2°$ and $b = +6°$. This region is near the aggregate I Aur, according to Morgan, Whitford, and Code (1953).

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