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POLARIMETRIC OBSERVATIONS OF NEARBY STARS IN THE DIRECTIONS OF THE GALACTIC POLES AND THE GALACTIC PLANE

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ABSTRACT

Polarimetric observations for 308 stars were obtained with the rotatable telescope of the Yerkes Observatory. With few exceptions all stars are within 200 pc of the Sun. The position angles of the observed polarization indicate systematic differences in the direction of the interstellar magnetic field, even within 100 pc of the Sun. The galactic longitude of the direction of the magnetic field observed at the two galactic poles was found to be different by 19° ± 4°.

I. INTRODUCTION

A mean direction of the interstellar magnetic field in the vicinity of the Sun was first determined by Behr (1959) from polarimetric observations of nearby stars. Behr found the field within 250 pc to be inclined to the galactic plane by about 20° and directed parallel $l = 62° \pm 5°$ (all galactic coordinates are in the new system). While new polarimetric observations of nearby stars in Cygnus (Appenzeller 1966*b*) were compatible with Behr's results, systematically different directions were found in most investigations of the interstellar Faraday effect and the galactic synchrotron radiation (for a recent review of the radio data see Bingham and Shakeshaft 1967). An attempt was therefore made to redetermine the mean direction of the interstellar magnetic field within 200 pc of the Sun from new polarimetric observations. Assuming that the direction of the field is constant, its galactic longitude can be determined from observations in the direction of the galactic poles, while its inclination to the galactic plane can be derived from observations at low galactic latitude in a direction perpendicular to the plane of vibration observed at the poles. New observations were therefore obtained for stars with galactic coordinates $|b| > 70°$ and $|b| < 10°$, $130° < l < 180°$. In order to make most economic use of the available observing time only bright stars ($m_V \leq 6.5$) were included in the observing program.

II. THE OBSERVATIONS

Since the interstellar polarization of stars within 200 pc is small, it was essential to obtain observations that were free of instrumental polarization. All stars were therefore observed with the rotatable 24-inch reflector of the Yerkes Observatory (Hiltner and Schild 1965). The stars with $b < -70°$ and part of the stars with $b > 70°$ were observed in the summer and fall of 1966. The observing and reduction methods described in an earlier paper (Appenzeller 1966*a*) were used. All stars with $|b| < 10°$ and most of the stars in the direction of the north galactic pole were observed in December, 1966, and spring, 1967. In this case a half-wave plate polarimeter (Appenzeller 1967*b*) was used. For these observations the reduction procedure was slightly modified: Since the observing time for each star was much shorter, the differential drift of the two photomultipliers could be neglected. The linear term in the least-squares solution could therefore be dropped. This resulted in the following much simpler reduction formulae:

$$P_x = 0.1357 \text{ mag} \sum_{\nu=1}^{4} (Q_{4\nu} - Q_{4\nu-2}) , \qquad P_y = 0.1357 \text{ mag} \sum_{\nu=1}^{4} (Q_{4\nu-3} - Q_{4\nu-1}) ,$$

$$P = \sqrt{(P_x^2 + P_y^2)}\ ,$$

$$\theta = 0.5 \text{ arc tan } \left(\frac{P_y}{P_x}\right).$$

The $Q_\nu(\nu = 1, \ldots, 16)$ are the normalized ratios of the photocurrents of the two photomultipliers in the sixteen positions of the half-wave plate (for details see Appenzeller 1966*a*, 1967*b*). Most observations were obtained without filters. In some cases the *V* filter was used.

III. RESULTS

The results of the observations are given in Tables 1 and 2 and in Figures 1, 2, 4, and 5 (see below). In Figures 4 and 5 fifteen stars from the catalogue by Behr (1959) were also included. In Table 1 θ' is the position angle of the plane of vibration in the galactic coordinate system.[1] The "mean error of the position angle" in the last column of Table 1 was computed according to the definition by Behr (1959). The spectral types were taken from the *Catalogue of Bright Stars* (Hoffleit 1964), from the *Catalogue of Stellar Spectra Classified in the Morgan-Keenan System* (Jaschek, Conde, and de Sierra 1964), or were classified from McDonald spectrograms (Appenzeller 1967*a*). The positions and visual magnitudes in Table 1 were taken from the *Catalogue of Bright Stars.*

The two stars in Table 2 were not included in Table 1, since they obviously belong to the class of late-type variables with intrinsic variable polarization. HD 1760 has been observed extensively by Zappala (1967). The two measurements in Table 2 agree well with the results reported by Zappala for fall, 1966. There is a strong suspicion that the polarization observed for the semiregular variable HD 110914 is also intrinsic. The amount of polarization in this case is not incompatible with the high galactic latitude, but the plane of vibration is almost perpendicular to that of the surrounding stars. The polarization which is quoted for HD 110914 in Table 1 was observed on July 20, 1966.

The stars listed in Table 1 are plotted in Figures 1, 2, 4, and 5. If the error in the position angle is not larger than 14° (corresponding to the condition that the observed polarization is at least twice the observational mean error), the polarization and position angle are indicated by the length and orientation of a line. If the error is larger than 14° only the star position is indicated.

Figures 1 and 2 show that the planes of vibration are well aligned at both galactic poles. The mean directions, however, are obviously different for the north galactic pole and the observed region near the south galactic pole. Since there seems to be no systematic change in the plane of vibration within the region $b > 70°$, it is assumed that the planes of vibration in the part of the south polar region that could be observed from Williams Bay are representative for the direction to the south galactic pole. This assumption should be tested, however, with further observations from the southern hemisphere. The difference in the average galactic longitude l_F of the planes of vibration at the galactic poles is shown quantitatively in Table 3. (Again only observations with errors of the position angles not larger than 14° were used for these averages.) *N* is the number of observations. The two distance groups 50–100 pc and 100–200 pc were selected since almost all stars with sufficiently accurate polarization fall into one of these groups and since the two groups correspond to the distance groups II and III that were used in a study of the interstellar polarization in Cygnus (Appenzeller 1966*b*). "All" in Table 3

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[1] θ' was computed by means of the relation

$$\cot(\theta - \theta') = \frac{\cos b \tan b_N - \cos(l - l_N) \sin b}{\sin(l - l_N)}\ ,$$

where θ is the position angle in the equatorial system, l and b are the galactic coordinates of the star, and l_N and b_N are the galactic coordinates of the equatorial north pole (for the equinox of the observations).

TABLE 1

JOURNAL OF OBSERVATIONS

HR	HD	Position(1900)		l	b	m_V	Sp. Type	P	m. e.	θ	θ'	m.e.
		α	δ									
18	402	$0^h\ 3^m 27^s$	$-18^\circ\ 8'$	$74^\circ 39'$	$-76^\circ 15'$	6 37	M1 III	0^m0061	$\pm 0.^m0012$	155°	19°	$\pm 6^\circ$
31	645	0 5 35	-13 8	87 39	-72 36	5. 94	K0 IV	0 0015	0. 0008	138	169	14
33	693	0 6 10	-16 1	82 12	-75 3	4 88	F6 V	0. 0014	0. 0008	131	168	15
37	787	0 7 4	-18 30	76 15	-77 6	5. 28	K5 III	0. 0041	0. 0007	136	179	5
48	1038	0 9 34	-19 29	75 5	-78 13	4. 42	M1 III	0. 0026	0. 0013	135	179	13
51	1064	0 9 48	-10 8	95 1	-70 27	5. 74	B9 V	0. 0026	0. 0012	132	157	13
74	1522	0 14 20	- 9 23	98 57	-70 12	3. 56	K2 III	0. 0010	0. 0007	135	157	18
115	2630	0 24 48	-15 25	99 31	-76 45	6. 13	F5 V?	0. 0007	0. 0018	141	162	34
188	4128	0 38 34	-18 32	111 13	-80 41	2. 04	K1 III	0. 0010	0 0005	144	155	14
194	4188	0 39 9	-11 9	116 40	-73 23	4. 75	K0 III	0. 0007	0. 0009	130	136	27
235	4813	0 45 7	-11 11	121 47	-73 31	5. 20	F8 V	0. 0010	0. 0006	147	148	15
267	5437	0 51 1	-11 48	127 1	-74 6	5. 30	K4 III	0. 0040	0. 0007	140	136	5
315	6482	1 0 36	-10 31	134 38	-72 32	6. 13	K0 III	0. 0013	0. 0007	88	78	15
317	6530	1 1 4	-10 23	134 54	-72 23	5. 57	A0 IV	0. 0030	0. 0006	140	129	6
329	6706	1 2 44	-10 19	136 11	-72 14	5. 87	F5 IV	0. 0015	0. 0007	152	140	12
334	6805	1 3 34	-10 43	137 7	-72 35	3. 44	K3 III	0. 0012	0. 0009	152	139	19
346	6976	1 5 11	- 9 26	137 27	-71 15	6. 41	K0 III	0. 0033	0. 0009	138	125	7
365	7389	1 9 20	- 8 27	139 45	-70 3	6. 20	K1 V	0. 0019	0. 0015	169	154	19
366	7439	1 9 22	- 8 28	139 47	-70 4	4 99	F5 V	0. 0010	0. 0007	155	140	17
388	8121	1 15 30	-11 46	147 33	-72 43	6. 30	K1 III	0 0022	0. 0008	158	136	10
412	8705	1 20 42	-15 7	157 3	-75 10	4. 89	K3 III	0. 0008	0. 0009	137	106	23
421	8829	1 21 56	-13 35	155 10	-73 41	5 68	F1 V	0. 0013	0. 0007	151	122	13
433	9132	1 24 48	-22 9	182 40	-79 44	5. 12	A1 V	0. 0013	0 0014	132	76	24
451	9672	1 29 45	-16 11	166 18	-74 47	5. 64	A2 V	0. 0019	0. 0008	147	107	11
459	9856	1 31 6	-15 55	166 36	-74 22	5. 48	K2 III	0. 0024	0. 0008	129	89	10
470	10110	1 33 51	53 22	130 9	- 8 19	6. 50	K5 III	0. 0236	0. 0013	100	89	2
499	10543	1 37 41	57 2	130 0	- 4 37	6. 11	A3 V	0. 0023	0. 0012	99	88	14
502	10587	1 38 11	56 35	130 9	- 5 3	6. 14	A2 V	0. 0026	0. 0012	106	94	12
509	10700	1 39 25	-16 28	173 16	-73 26	3. 50	G8 Vp	0 0011	0. 0008	126	80	18
529	11151	1 44 33	51 26	132 11	- 9 53	5. 83	F5 V	0. 0018	0. 0013	73	59	17
540	11408	1 47 11	55 6	131 43	- 6 13	6. 46	Am	0. 0007	0. 0013	36	22	31
561	11857	1 51 28	61 12	130 48	- 0 10	5. 99	B6 V	0. 0209	0. 0011	117	102	2
567	11946	1 52 15	64 8	130 9	2 42	5. 11	A0 V	0. 0006	0. 0009	128	113	29
585	12274	1 55 18	-21 34	195 29	-73 15	3. 99	M1 III	0. 0021	0 0013	147	81	16
586	12279	1 55 25	64 25	130 25	3 4	5. 87	A0 V	0. 0012	0. 0007	112	96	15
598	12468	1 57 9	64 37	130 33	3 18	5. 58	A0 V	0. 0016	0. 0007	107	91	11
621	13137	2 3 25	53 22	134 29	- 7 16	6 26	G8 III	0. 0063	0. 0008	118	100	4
640	13474	2 6 38	66 3	131 5	4 58	6. 08	F2 + A2	0. 0227	0. 0008	120	102	1
645	13530	2 6 57	50 36	135 51	- 9 44	5 32	K0 III	0. 0004	0. 0006	114	95	28
661	13982	2 10 55	57 26	134 15	- 3 4	5. 75	K3 III	0. 0061	0. 0008	125	106	4
662	13994	2 11 2	57 3	134 23	- 3 26	6. 00	G7 III	0. 0264	0. 0010	141	122	1
668	14171	2 12 32	63 52	132 22	3 5	6. 47	A1 p	0 0105	0. 0009	121	101	3
699	14872	2 18 57	49 50	137 56	- 9 50	4. 72	K4 III	0. 0021	0. 0005	105	84	6
707	15089	2 20 49	66 57	132 7	6 17	4. 51	Ap	0. 0005	0. 0003	109	88	15
709	15138	2 21 9	50 7	138 10	- 9 26	6. 14	F4 V	0 0007	0. 0009	122	101	26
716	15253	2 22 22	55 5	136 33	- 4 44	6. 52	A2 III	0. 0167	0. 0011	127	105	2
747	16024	2 29 26	65 19	133 33	5 5	5. 91	K5 III	0. 0068	0. 0009	104	81	4
785	16727	2 35 53	54 41	138 30	- 4 22	5 65	B6 V	0 0039	0. 0005	141	117	4
787	16735	2 35 56	53 6	139 9	- 5 48	5. 97	K0 II - III	0. 0036	0. 0008	119	94	6
791	16769	2 36 13	67 24	133 20	7 16	5. 79	Am	0. 0019	0. 0006	109	84	9
799	16895	2 37 22	48 48	141 9	- 9 37	4. 12	F7 V	0. 0002	0. 0003	161	136	30
839	17581	2 44 15	57 54	138 12	- 0 57	6. 38	Am	0. 0012	0. 0011	44	17	21
849	17818	2 46 32	48 9	142 50	- 9 33	6. 38	G5 I	0. 0182	0. 0010	103	76	2
860	17948	2 48 1	61 7	137 12	2 9	5. 56	F4 V	0. 0003	0. 0006	76	49	31
861	17958	2 48 7	63 55	135 57	4 39	6 51	K3 Ib	0. 0705	0. 0020	109	82	1
864	18153	2 49 50	50 51	142 5	- 6 54	6. 36	K5 III	0. 0192	0. 0009	99	72	1
915	18925	2 57 33	53 7	142 4	- 4 21	2. 90	G8 III ? +A3 ?	0. 0012	0. 0006	134	105	13
920	18991	2 58 12	55 41	140 55	- 2 3	6. 36	G9 III	0. 0003	0. 0008	166	137	36
922	19065	2 58 57	63 40	137 8	4 59	5. 80	B9 V	0. 0112	0. 0009	132	103	2
930	19268	3 0 53	51 50	143 8	- 5 13	6. 16	B5 V	0. 0150	0. 0007	91	61	1
933	19279	3 0 56	46 55	145 35	- 9 29	6. 32	A2 V	0. 0008	0. 0008	130	100	23
949	19735	3 5 31	47 22	146 3	- 8 42	6. 33	K5 III	0. 0057	0. 0020	150	119	9
956	19845	3 6 27	47 50	145 56	- 8 14	5. 90	G9 III	0. 0008	0. 0007	113	81	20

TABLE 1 - Continued

HR	HD	Position(1900)		l	b	m_V	Sp Type	P	m. e	θ	θ'	m e.
		α	δ									
967	20104	$3^h\ 8^m\ 46^s$	$65^\circ 17'$	$137^\circ 14'$	$6^\circ 55'$	6.32	A3 V	$0^m.0063$	$\pm 0^m.0008$	138°	106°	$\pm 4^\circ$
969	20123	3 9 3	50 34	144 53	- 5 40	5.05	G5 II	0.0309	0.0004	98	66	0
985	20336	3 11 11	65 17	137 27	7 3	4.78	B2 Ve	0.0093	0.0005	141	108	1
1001	20675	3 14 47	48 43	146 40	- 6 45	6 10	F6 V	0.0001	0.0005	23	171	41
1009	20797	3 15 59	64 14	138 27	6 26	5.35	M0 II	0 0509	0.0007	138	104	0
1020	21004	3 18 19	53 34	144 30	- 2 22	6.34	A9 III - IV	0.0002	0.0011	12	159	39
1029	21071	3 18 51	48 45	147 13	- 6 21	6.07	B6 V	0 0096	0.0015	115	81	4
1033	21203	3 20 15	59 54	141 15	3 5	6.45	B9 V	0 0237	0.0018	132	99	2
1046	21447	3 22 22	55 6	144 9	- 0 46	5.08	A1 V	0.0006	0.0009	180	144	28
1052	21552	3 23 31	47 39	148 29	- 6 50	4.47	K3 III	0.0002	0 0006	108	73	36
1056	21620	3 24 20	48 52	147 54	- 5 45	6 27	A0 V	0.0087	0.0009	154	119	3
1059	21661	3 24 40	49 4	147 50	- 5 33	6.31	B7 V	0.0305	0.0005	127	92	0
1068	21769	3 25 31	58 26	142 38	2 14	6.21	A4 II - III	0.0019	0.0009	131	96	13
1069	21770	3 24 30	45 43	149 52	- 8 14	5.30	F4 III	0.0003	0.0005	116	80	28
1071	21794	3 25 46	57 32	143 10	1 31	6.34	F7 V	0.0010	0.0007	74	39	18
1077	21903	3 26 50	59 42	142 3	3 23	6.40	F5 V	0.0018	0.0008	172	137	12
1094	22316	3 30 28	56 36	144 14	1 7	6.25	B9 p	0.0042	0 0007	155	119	5
1105	22649	3 33 28	62 54	140 50	6 26	5 14	$S5_3$	0.0045	0.0008	126	89	5
1112	22764	3 34 28	59 39	142 52	3 54	5.84	K4 Ib	0.0335	0 0011	137	100	1
1124	23005	3 36 33	66 53	138 41	9 49	5.75	F0 IV	0.0005	0.0008	83	45	30
1127	23049	3 36 56	48 13	149 59	- 5 4	6.15	K4 III	0.0108	0.0010	113	76	3
1129	23089	3 37 17	63 2	141 6	6 48	4.78	F5 + A	0 0232	0.0006	140	102	1
1130	23139	3 37 40	45 47	151 33	- 6 56	5.99	A7 V	0 0112	0.0012	149	111	3
1141	23300	3 38 59	45 22	152 0	- 7 7	5.60	B5 V	0.0104	0.0011	147	109	3
1147	23383	3 39 42	55 37	145 51	1 5	5.99	A1 ? V (p)	0.0023	0.0011	157	119	13
1155	23475	3 40 22	65 13	140 1	8 45	4 49	M1 II ?	0.0386	0.0006	133	95	0
1160	23552	3 41 0	50 26	149 10	- 2 54	6 13	B7 V	0 0119	0.0014	144	106	3
1161	23594	3 41 21	56 49	145 18	2 11	6.46	A0 V	0.0137	0.0007	177	139	2
1170	23728	3 42 14	43 39	153 31	- 8 7	5.85	A9 V	0.0006	0.0009	52	13	28
1176	23838	3 43 7	44 40	153 1	- 7 13	5.66	G2 ? + A ?	0.0008	0.0007	31	174	21
1192	24141	3 45 36	57 41	145 13	3 13	5.76	Am	0.0017	0.0006	102	63	11
1198	24240	3 46 24	48 21	151 9	- 3 59	5 79	K0 III	0.0039	0.0007	179	139	5
1204	24479	3 48 36	62 47	142 16	7 25	4.87	B9 V	0.0014	0.0005	146	105	10
1207	24504	3 48 46	47 35	151 56	- 4 20	5.35	B6 V	0.0095	0.0004	156	116	1
1210	24546	3 49 10	50 24	150 12	- 2 7	5.27	F5 IV	0.0011	0.0008	164	124	18
1255	25602	3 58 49	53 45	149 10	1 24	6.21	K0 III - IV	0.0036	0.0017	118	77	13
1261	25642	3 59 8	50 5	151 37	- 1 20	4.29	B9 V	0.0065	0.0006	163	121	3
1270	25877	4 0 59	59 38	145 29	6 0	6 32	G8 II	0.0244	0.0016	149	107	2
1528	30453	4 42 51	32 25	170 1	- 7 47	5.88	Am	0.0004	0.0016	121	70	39
1529	30454	4 42 48	31 16	170 54	- 8 32	5.64	K2 III	0.0020	0 0021	146	96	23
1535	30557	4 43 38	48 34	157 47	2 47	5.63	G9 III	0.0012	0.0014	132	82	25
1550	30823	4 45 44	42 25	162 43	0 55	5.72	A2 III	0.0177	0 0020	12	141	3
1555	30958	4 46 53	55 6	153 4	7 21	5.51	B9 V	0.0068	0.0015	152	100	6
1558	31069	4 47 40	43 54	161 48	0 19	6.09	B9.5 V	0.0026	0.0018	106	55	17
1561	31134	4 48 12	52 42	155 3	5 59	5.64	A2 V	0.0022	0 0019	178	127	20
1627	32428	4 58 8	32 11	172 14	- 5 25	6.40	Am	0.0016	0.0008	3	131	14
1632	32480	4 58 23	27 33	175 59	- 8 11	6.48	A7 V	0.0010	0.0010	119	66	22
1637	32537	4 58 51	51 28	157 3	6 30	4.94	F0 V	0.0010	0.0007	58	5	17
1641	32630	4 59 30	41 6	165 21	0 16	3.17	B3 V	0.0004	0.0001	106	53	11
1644	32655	4 59 41	43 2	163 50	1 28	6.16	F2 II ? p ?	0.0301	0.0008	167	114	1
1668	33167	5 3 16	46 50	161 12	4 17	5.51	F5 V	0.0012	0.0008	161	107	17
1670	33204	5 3 28	27 54	176 23	- 7 5	6.01	Am	0.0006	0.0006	113	59	23
1689	33641	5 6 35	38 22	168 21	- 0 18	4.74	Am	0.0006	0.0006	104	50	23
1706	33959	5 8 54	32 34	173 18	- 3 22	5.06	A9 V	0.0007	0 0005	131	77	18
1729	34411	5 12 6	40 1	167 39	1 32	4.74	G0 V	0.0003	0 0004	22	148	28
1732	34452	5 12 25	33 39	172 51	- 2 8	5.38	Ap	0.0005	0.0004	149	94	20
1749	34759	5 14 44	41 42	166 34	2 55	5.09	B5 V	0.0020	0.0004	172	117	5
1750	34762	5 14 43	27 51	177 53	- 5 5	6.26	B8 V	0.0166	0.0007	45	170	1
1752	34790	5 14 51	29 28	176 34	- 4 8	5.72	A2 V	0.0012	0.0008	64	8	17
1768	35076	5 17 3	28 50	177 22	- 4 6	6.38	B9 V	0.0015	0.0012	83	27	19
1773	35186	5 17 51	37 18	170 31	0 53	5.02	K4 III	0.0014	0.0006	113	57	11
1775	35238	5 18 12	31 8	175 37	- 2 35	6.22	K1 III	0.0078	0.0014	21	147	5
1776	35239	5 18 12	31 3	175 41	- 2 38	5.90	B9 III	0.0076	0.0006	49	174	2
1779	35295	5 18 34	34 46	172 41	- 0 27	6.34	K1 III - IVp	0.0014	0.0009	69	12	17
1805	35620	5 21 1	34 23	173 17	- 0 15	5.12	K3 p	0 0008	0 0004	119	63	12

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TABLE 1 - Continued

HR	HD	Position(1900)		l	b	m_V	Sp. Type	P	m e	θ	θ'	m.e
		α	δ									
1824	36040	$5^h 23^m 45^s$	$41^\circ 23'$	$167^\circ 47'$	$4^\circ 8'$	5.96	K0 p	0^m0017	$\pm 0^m0008$	115°	58°	±12°
1825	36041	5 23 47	39 45	169 9	3 13	6 38	G9 III	0.0014	0.0010	11	136	18
1850	36484	5 26 55	32 44	175 20	- 0 10	6.48	Am	0.0018	0.0007	133	76	11
1854	36499	5 27 0	34 39	173 45	0 55	6 00	A4 V	0.0012	0.0011	124	67	20
1884	36891	5 29 53	40 7	169 29	4 24	6.00	G3 I b	0.0174	0.0013	11	135	2
1902	37098	5 30 54	26 52	180 43	- 2 40	5.69	B8 III	0.0017	0.0008	65	8	13
1914	37269	5 32 13	30 26	177 53	0 29	5.43	G5 III ? + A3	0.0010	0.0009	15	138	21
1938	37519	5 34 8	31 18	177 22	0 20	6 01	B7 V	0.0087	0 0008	42	166	3
2012	39003	5 44 34	39 7	171 50	6 16	4.06	K0 III	0.0007	0.0003	83	24	13
2018	39045	5 44 55	32 6	177 54	2 42	6 24	M3 III	0 0188	0.0009	50	172	1
2025	39182	5 45 42	39 33	171 35	6 41	6.40	A3 III	0.0101	0.0008	15	136	2
2028	39225	5 46 3	33 53	176 30	3 50	6.21	M2 II	0.0062	0 0007	51	173	3
2046	39586	5 48 30	31 41	178 39	3 9	5.76	A5 IV	0.0012	0.0020	12	134	30
4412	99373	11 21 5	34 0	188 43	70 38	6.20	F5 V	0.0025	0.0012	101	178	13
4452	100470	11 28 38	37 22	177 30	70 58	6.40	K0 III	0.0032	0.0006	37	102	5
4465	100808	11 31 2	28 20	206 20	73 19	6.31	A8 V	0.0014	0.0009	154	66	16
4482	101151	11 33 16	34 11	186 0	73 1	6.18	K2 III	0.0020	0.0010	28	100	13
4501	101606	11 36 22	32 18	191 50	74 7	5 66	F4 V	0.0015	0.0009	7	84	16
4505	101688	11 36 54	22 46	226 28	73 31	6 54	F2 IV - V	0.0013	0.0008	45	157	16
4512	101980	11 39 1	25 47	216 18	74 48	6.02	K5 III	0.0007	0.0012	174	94	31
4527	102509	11 42 50	20 46	235 0	73 56	4.55	A + G5 III	0.0005	0.0005	155	94	25
4531	102590	11 43 30	14 50	251 3	70 31	5.86	A9 V	0.0006	0.0011	135	89	31
4535	102660	11 44 5	16 48	246 47	71 56	5.97	Am	0.0006	0.0005	151	101	21
4536	102713	11 44 30	35 29	178 34	74 40	5.72	F5 IV	0.0003	0.0006	111	175	33
4545	102942	11 45 58	33 56	183 36	75 34	6.11	Am	0 0008	0.0004	20	88	12
4550	103095	11 47 13	38 26	168 19	73 35	6.45	G8 VI	0.0002	0.0008	137	10	39
4562	103500	11 50 4	37 19	170 26	74 42	6.37	M0 III	0.0008	0.0006	18	73	19
4564	103578	11 50 32	16 12	251 39	72 41	5.47	A3 V	0.0062	0.0003	72	26	1
4572	103799	11 52 6	40 54	159 47	72 40	6.52	F6 V	0.0009	0.0006	24	69	17
4574	103928	11 52 59	32 50	185 44	77 20	6.25	A9 V	0.0014	0.0015	167	56	24
4581	104075	11 54 9	33 43	181 36	77 13	5.83	K2 III	0.0011	0.0007	171	56	17
4584	104179	11 54 49	34 35	177 52	76 57	6 18	A9 III	0.0009	0.0013	25	86	27
4593	104438	11 56 32	36 36	169 44	76 10	5.46	K0 III	0.0006	0.0005	93	146	20
4594	104513	11 57 2	43 36	151 54	71 12	5 00	Am	0.0006	0.0005	58	94	21
4602	104827	11 59 9	22 1	238 10	77 51	5.70	Fm	0.0002	0.0006	176	116	35
4632	105778	12 5 26	17 22	258 16	76 0	6.30	A2 V	0.0029	0.0004	55	14	4
4633	105805	12 5 41	27 50	209 38	80 57	6.04	A3 V	0.0008	0.0014	152	64	30
4642	106022	12 6 56	29 6	201 24	81 10	6.30	F3 IV	0.0007	0.0018	134	37	34
4643	106057	12 7 4	21 6	247 3	78 52	5.56	K0 II - III	0.0020	0 0017	130	78	20
4650	106251	12 8 20	10 49	273 8	70 54	5.79	Am	0.0007	0.0005	16	170	18
4666	106690	12 11 7	41 13	149 0	74 37	5.60	M1 III	0.0003	0.0004	57	88	28
4667	106714	12 11 17	24 30	232 51	81 28	4.88	K0 III	0.0008	0.0015	57	172	30
4668	106760	12 11 29	33 37	172 40	80 23	5.35	K1 III	0.0017	0.0019	28	82	24
4673	106887	12 12 28	29 30	197 18	82 17	5.66	A4 V	0.0007	0.0009	73	151	26
4676	106926	12 12 39	15 42	268 0	75 41	6.40	K4 III	0.0021	0.0006	52	20	9
4680	107054	12 13 29	30 49	187 31	82 7	6.09	A9.5 III	0.0017	0.0008	155	43	12
4684	107131	12 14 0	26 34	219 49	82 40	6.48	A4 V	0.0014	0.0013	70	171	22
4688	107213	12 14 29	28 43	202 44	82 51	6.20	F7 V	0.0021	0.0015	110	13	18
4693	107325	12 15 18	27 11	215 14	83 2	5 47	K1 III	0.0018	0.0019	44	141	24
4694	107326	12 15 17	26 34	220 14	82 57	6.08	F0 III - IV	0 0009	0.0010	93	14	24
4705	107655	12 17 9	25 19	231 1	83 0	6.01	A0 V	0.0004	0 0007	17	129	31
4707	107700	12 17 29	26 24	222 27	83 24	4.83	G0 III - IV	0.0003	0.0015	160	83	38
4715	107904	12 18 52	43 6	141 14	73 35	5.93	F0 III	0.0003	0.0005	9	31	29
4719	108007	12 19 26	26 8	225 43	83 45	6 42	A9 V	0.0008	0 0006	52	159	18
4725	108123	12 20 13	24 29	239 50	83 17	6 03	K0 III	0 0013	0.0005	68	8	11
4733	108283	12 21 24	27 49	210 4	84 25	4.95	F0 p	0.0007	0.0003	174	84	11
4738	108382	12 21 59	27 23	214 37	84 32	5.00	A4 V	0.0002	0 0003	26	121	28
4741	108471	12 22 37	9 10	284 56	70 39	6.30	G8 III	0.0015	0.0006	71	55	11
4750	108642	12 23 39	26 47	221 34	84 49	6 45	Am	0.0003	0.0005	91	12	28
4751	108651	12 23 45	26 27	225 12	84 46	6 55	Am	0.0012	0 0011	139	63	21
4752	108662	12 23 55	26 28	225 8	84 49	5.29	Asi	0.0011	0.0004	129	53	10
4753	108722	12 24 27	24 40	242 56	84 12	5.47	F5 IV	0.0006	0.0004	136	78	17
4756	108765	12 24 42	21 27	263 12	82 2	5.72	A3 V	0.0007	0.0003	39	2	13
4766	108945	12 26 1	25 7	240 51	84 44	5.46	Ap	0.0004	0.0004	49	170	21

TABLE 1 - Continued

HR	HD	Position(1900)		l	b	m_v	Sp. Type	P	m. e.	θ	θ'	m.e
		α	δ									
4777	109217	$12^h 27^m 59^s$	10°51'	287°35'	72°37'	6.34	G8 III	$0^m.0010$	$\pm 0^m.0006$	74°	60°	±17°
4780	109307	12 28 35	24 50	247 6	85 4	6 29	A4 V	0.0004	0.0005	67	13	26
4784	109345	12 28 52	33 56	153 14	82 40	6.21	K1 III	0.0008	0.0007	41	74	20
4789	109485	12 29 52	23 11	262 2	84 8	4.76	A0 IV	0.0005	0 0005	117	78	24
4792	109511	12 30 7	18 56	278 47	80 29	5.18	K2 III	0.0017	0.0003	63	41	5
4793	109519	12 30 8	22 26	266 42	83 35	5.93	K1 III	0.0064	0.0006	94	59	3
4801	109742	12 31 57	17 38	283 43	79 25	5 68	K5 III	0.0047	0.0005	76	58	3
4811	109980	12 33 58	41 25	132 54	76 1	6.37	A5 V	0 0006	0.0004	8	19	17
4812	109996	12 34 4	23 13	269 56	84 44	6.34	K1 III	0.0007	0 0006	138	106	20
4815	110024	12 34 9	21 37	277 20	83 19	5.39	G9 III	0.0005	0.0003	11	167	15
4816	110066	12 34 25	36 30	138 34	80 48	6.50	Ap	0.0030	0.0005	77	94	5
4843	110834	12 39 44	44 39	127 14	72 58	6.22	F5 III	0 0012	0.0005	45	50	11
4846	110914	12 40 26	45 59	126 28	71 39	4.80	$C5_4$	0.0061	0.0021	138	143	10
4847	110951	12 40 34	8 13	298 35	70 30	5.17	Am	0.0001	0.0003	154	150	38
4849	111028	12 41 18	10 6	298 45	72 23	5.67	K1 IV	0.0002	0.0005	30	26	31
4851	111067	12 41 39	17 7	296 38	79 23	5.15	K3 III	0.0005	0.0003	73	67	16
4855	111164	12 42 12	12 30	298 58	74 48	6.05	A3 V	0.0003	0.0005	74	70	29
4864	111395	12 43 55	25 23	288 11	87 38	6.32	G7 V	0.0004	0.0005	21	6	25
4869	111469	12 44 25	28 6	171 1	89 21	5.70	A2 V	0.0009	0.0003	156	24	10
4873	111591	12 45 21	23 24	299 13	85 43	6 33	K0 III	0.0009	0.0005	84	81	15
4875	111604	12 45 26	38 4	124 20	79 36	5 90	A4 V	0.0011	0.0004	55	57	11
4884	111862	12 47 14	17 37	303 56	79 57	6.38	M0 III	0.0028	0.0007	58	59	7
4886	111893	12 47 29	16 40	304 11	79 0	6.22	A5 V	0.0005	0.0004	124	125	21
4894	112033	12 48 22	21 47	307 4	84 6	4.97	G8 III + F6 ?	0.0006	0.0004	159	162	18
4900	112097	12 48 49	12 58	305 12	75 17	6 25	Am	0 0007	0.0005	100	102	16
4904	112171	12 49 27	34 5	117 48	83 33	6.27	A5 V	0.0003	0.0004	149	143	26
4919	112570	12 52 34	46 44	119 56	70 54	6.10	G9 III	0.0012	0.0005	48	44	12
4924	112989	12 55 29	31 19	95 42	85 52	4 90	G9 ? II - III	0.0003	0.0005	64	35	26
4926	113022	12 55 45	18 55	317 2	81 0	6.05	F5 V	0.0009	0.0004	19	32	12
4943	113797	13 1 4	36 20	104 31	80 49	5.00	B9 V	0.0011	0.0003	65	44	9
4945	113847	13 1 22	45 48	114 53	71 38	5.60	K1 III	0.0011	0.0005	50	40	12
4946	113848	13 1 29	21 41	333 20	83 8	5.94	F4 V	0.0007	0 0005	32	61	16
4948	113865	13 1 24	29 34	64 16	86 14	6.39	A3 V	0.0006	0.0006	61	0	21
4949	113866	13 1 31	23 9	340 36	84 22	5.66	M5 III	0.0020	0.0008	48	84	11
4954	113996	13 2 23	28 10	42 9	86 29	4.74	K5 III	0.0007	0.0003	68	166	13
4956	114092	13 3 7	28 5	40 33	86 20	6.22	K4 III	0.0016	0.0006	79	176	10
4962	114326	13 4 53	17 22	326 16	78 52	6.05	K5 III	0.0018	0.0005	53	74	8
4964	114357	13 5 2	37 57	103 39	79 1	6 00	K3 III	0.0018	0.0005	34	12	8
4967	114376	13 5 6	39 4	105 35	77 58	6.10	B7 III	0.0015	0.0004	41	21	7
4968	114378	13 5 7	18 3	327 56	79 29	5.22	F5 V	0.0011	0.0007	166	9	17
4971	114447	13 5 28	39 2	105 13	77 58	5.98	A9 III - IV	0.0007	0.0011	151	131	29
4984	114724	13 7 20	24 47	2 26	84 32	6.31	K3 III	0.0014	0.0008	123	1	15
4987	114793	13 7 43	19 17	334 10	80 19	6.38	G8 III	0.0033	0 0007	76	105	6
4992	114889	13 8 21	19 15	334 51	80 13	6.27	G8 III	0.0030	0.0005	81	110	5
4997	115004	13 9 11	40 41	104 52	76 11	4.89	K0 III	0.0013	0.0004	50	28	9
4998	115046	13 9 32	11 52	322 58	73 19	5.67	M0 III	0.0021	0.0003	68	86	4
5004	115271	13 11 2	41 23	104 36	75 24	5.59	A7 V	0.0002	0.0004	98	76	31
5007	115319	13 11 23	19 35	339 26	80 8	6.37	G8 III	0.0031	0.0005	66	100	5
5010	115365	13 11 41	20 19	342 20	80 41	6.24	A7 V	0.0028	0 0006	93	130	6
5011	115383	13 11 49	9 57	322 48	71 19	5.23	F8 V	0 0005	0 0003	2	20	15
5013	115478	13 12 19	14 12	328 20	75 16	5 42	K3 III	0.0008	0.0006	117	140	18
5017	115604	13 13 4	41 6	102 46	75 31	4.71	F0 II - III p	0.0002	0 0003	35	11	27
5022	115723	13 13 50	34 37	84 48	80 56	5.80	K4 - 5 III	0 0029	0 0006	65	24	6
5025	115810	13 14 28	35 39	88 14	80 4	5.92	A9 III	0.0005	0.0010	108	70	31
5032	116010	13 15 50	40 41	100 9	75 40	5.55	K1 III	0.0019	0.0008	38	11	12
5045	116303	13 17 41	44 26	104 45	72 7	6.32	Am	0.0024	0.0006	56	33	7
5052	116581	13 19 22	37 33	90 17	77 57	6.17	M3 III	0.0006	0 0014	159	121	33
5053	116594	13 19 34	12 57	332 20	73 23	6.36	K0 III	0 0028	0.0006	62	88	6
5057	116706	13 20 21	24 23	11 33	81 44	5.63	A3 V	0.0007	0.0004	103	168	15
5077	117261	13 24 2	41 15	96 1	74 24	6.41	G8 III	0.0017	0.0007	64	32	11
5081	117304	13 24 16	11 20	333 19	71 26	5.68	K0 III	0.0011	0.0005	32	59	12
5096	117710	13 26 56	42 37	96 59	72 57	5.94	K2 III	0.0009	0.0010	85	53	24
5102	117876	13 28 4	24 52	18 39	80 18	6.11	K0 III	0.0010	0.0006	70	141	14
5108	118156	13 29 57	39 18	88 6	75 18	6.12	A8 V	0.0024	0.0007	65	24	8
5114	118266	13 30 35	10 43	336 34	70 9	4.31	K1 III	0.0027	0.0007	75	105	8

TABLE 1 - Concluded

HR	HD	Position(1900)		l	b	m_V	Sp. Type	P	m. e.	θ	θ'	m.e
		α	δ									
5116	118295	$13^h\ 30^m\ 59^s$	$44°43'$	$98°31'$	$70°47'$	6.63	A9 III	$0^m.0026$	$\pm 0^m.0008$	65°	34°	± 8°
5123	118508	13 32 17	25 7	21 40	79 28	5.68	M2 III	0.0019	0.0007	73	146	10
5127	118623	13 33 1	36 48	78 59	76 37	4.86	A7 III	0.0004	0.0004	1	131	22
5137	118839	13 34 14	18 46	356 26	75 55	6.31	K3 III	0.0023	0.0012	52	100	14
5138	118889	13 34 39	11 15	339 53	70 5	5.46	F0 V	0.0005	0.0004	107	140	19
5143	119035	13 35 43	31 31	55 52	78 39	5.96	G5 II ?	0.0018	0.0010	64	172	14
5144	119055	13 35 54	20 28	3 6	76 39	5.57	A1 V	0.0013	0.0004	77	132	8
5145	119081	13 36 2	28 35	40 47	79 4	6.22	K3 III	0.0018	0.0013	104	16	18
5149	119126	13 36 19	23 0	13 16	77 51	5.63	G9 III	0.0023	0.0004	66	131	5
5160	119445	13 38 13	42 11	90 32	72 5	6.13	G6 III	0.0028	0.0006	71	31	6
5161	119458	13 38 16	35 30	71 47	76 31	5.83	G5 III	0.0005	0.0007	39	162	28
5164	119584	13 39 2	23 12	15 19	77 21	6.27	K4 III	0.0044	0 0006	60	127	4
5179	120047	13 41 59	41 35	87 32	72 4	5.71	A5 V	0.0004	0.0006	160	116	29
5180	120048	13 41 59	39 0	81 8	73 51	5.86	G9 III	0.0018	0.0008	67	17	12
5182	120064	13 42 5	26 12	29 29	77 33	5.84	F6 IV-V	0.0007	0.0009	97	178	26
5186	120164	13 42 41	39 3	80 57	73 42	5.43	K0 III	0.0011	0.0004	95	45	10
5195	120420	13 44 8	31 41	54 22	76 53	5.65	K0 III	0.0004	0.0004	131	55	24
5201	120539	13 44 59	21 46	12 16	75 30	4.94	K4 III	0.0023	0 0004	72	135	5
5204	120600	13 45 24	37 8	74 11	74 25	6.32	A7 IV	0.0008	0.0007	67	10	20
5214	120818	13 46 40	35 16	67 32	75 8	6.65	A4 V	0.0013	0.0005	33	150	11
5215	120819	13 46 44	35 10	67 10	75 10	5.02	M2 III	0.0013	0.0009	59	176	17
5219	120933	13 47 23	34 56	66 7	75 9	4.79	K5 III	0.0008	0.0006	74	10	17
5225	121107	13 48 26	18 26	3 19	73 4	5 59	G5 III	0.0033	0.0005	58	112	4
5229	121164	13 48 38	29 8	42 52	76 17	5.80	A7 V	0.0003	0.0007	125	37	35
5235	121370	13 49 55	18 54	5 19	73 3	2.69	G0 IV	0.0002	0.0003	47	103	26
5243	121560	13 51 1	14 34	355 10	70 7	6.10	F6 V	0.0010	0.0005	27	73	15
5245	121682	13 51 45	32 31	56 2	75 7	6.18	F4 IV - V	0.0004	0.0009	113	38	34
5247	121710	13 52 0	27 59	38 9	75 33	5.04	K3 III	0.0023	0.0004	63	151	5
5254	121980	13 53 50	15 8	357 44	70 0	6.01	K5 III	0.0020	0.0007	66	114	10
5255	121996	13 53 58	22 11	17 2	73 47	5.66	A0 V	0.0034	0.0004	62	129	3
5263	122405	13 56 38	27 52	37 54	74 31	6.12	A7 III	0.0014	0.0006	50	136	12
5304	123999	14 5 50	25 34	30 51	72 11	4.82	F8 IV	0.0003	0.0007	1	80	33
5310	124186	14 6 54	32 45	54 20	71 57	6.10	K4 III	0.0010	0.0005	75	177	13
5333	124713	14 10 3	22 20	21 56	70 23	6.37	A8 V	0.0009	0.0005	53	124	14
5374	125658	14 15 46	30 53	47 51	70 20	6.31	Am	0.0008	0 0004	34	129	14
8932	221357	23 26 28	-21 55	46 12	-70 57	6.24	A9 III	0.0019	0.0008	123	12	12
8980	222547	23 36 23	-18 35	58 44	-71 30	5.60	K5 III	0.0058	0.0009	157	34	5
8982	222574	23 36 34	-18 22	59 23	-71 26	4.80	G0 Ib	0.0051	0.0006	154	30	3
8987	222643	23 37 17	-16 0	65 30	-70 10	5.26	K4 III	0.0025	0.0008	153	24	9
8998	222847	23 39 1	-19 50	59 8	-72 10	5.24	B8 V	0.0014	0.0007	157	34	13
9021	223428	23 44 22	-16 25	67 52	-71 45	6.41	K1 III (p)	0.0035	0.0009	142	11	7
9029	223559	23 45 24	-14 57	71 46	-70 56	5.92	K5 III	0.0040	0.0010	142	7	7
9031	223640	23 46 11	-19 28	60 30	-73 56	5.16	A si	0.0021	0 0008	149	25	11
9037	223774	23 47 22	-14 48	73 7	-71 10	6.00	K3 III	0.0032	0.0008	158	23	7
9095	225045	23 57 49	-20 36	62 52	-76 50	6.27	F7 V	0.0008	0.0011	163	39	26
9098	225132	23 58 37	-17 54	72 2	-75 16	4.54	B9 IV	0.0020	0.0008	156	23	11
9101	225197	23 59 12	-17 5	74 39	-74 47	5.80	K2 III	0.0018	0.0007	131	174	11
9103	225212	23 59 23	-11 4	87 2	-70 3	5.16	K3 Ib	0.0040	0.0005	136	168	4

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TABLE 2

Two Stars with Intrinsic Polarization

HD	Sp Type	Date (U T.) 1966	*P* (±m e) (mag)	*θ* (±m e.)
1760 .	M5e II	October 25	0 0113±0 0013	146°±3°
		October 26	0112± .0012	145 ±3
120499	M6e	May 22	.0288± 0028	22 ±3
		June 25	0180± 0020	21 ±3
		July 8	0187± 0021	20 ±3
		July 21	0 0158±0 0022	27 ±4

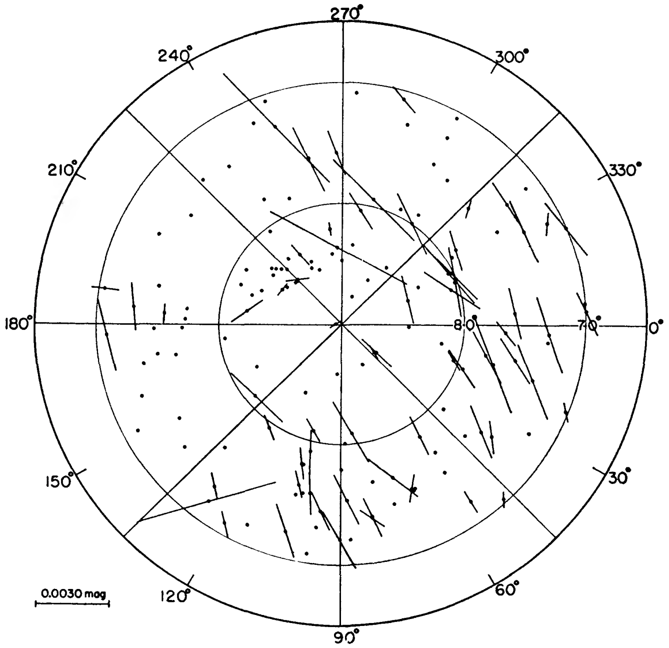

Fig. 1.—Interstellar polarization in direction of north galactic pole

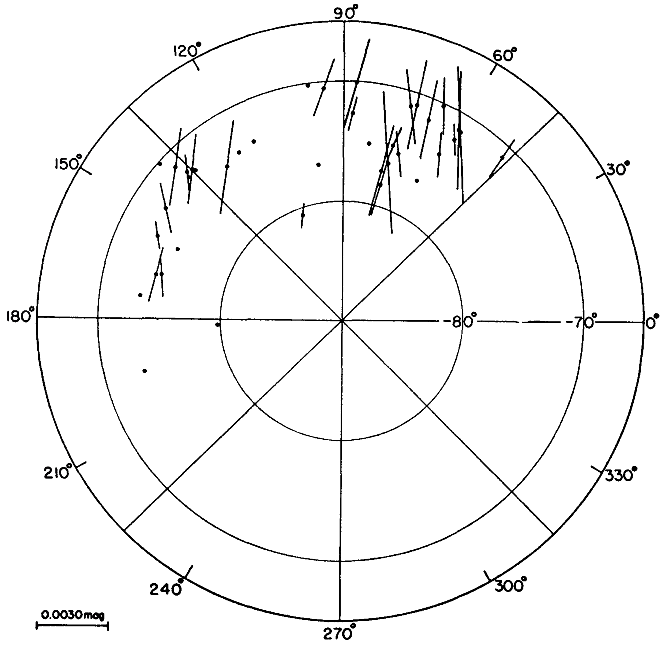

Fig. 2.—Interstellar polarization in direction of south galactic pole

refers to all stars with sufficiently accurate polarization, regardless of their distance. No significant change could be detected between the two distance groups of each polar region. But the difference between the two poles (19° ± 4°) is significant.

Figure 3 and Table 4 show the increase in the amount of polarization with increasing distance of the polar regions. In order to decrease the scatter produced by the observational errors, only observations with m.e. $\leq$ 0.0010 mag at the north pole and $\leq$0.0014 mag at the south pole were included in Table 4 and Figure 3. In Figure 3 the average mean errors of the plotted observations are indicated by dashed lines. $\langle P\rangle$ in Table 4 is the arithmetic mean of the observed values of the amount of polarization. $\langle P_0\rangle$ is the corresponding value corrected for the observational error (Appenzeller 1966*b*). The relatively smooth increase of $\langle P_0\rangle$ with increasing distance and Figure 3 indicate that the polarization is not produced at a discrete distance but in a magnetic field that extends rather uniformly to at least 160 pc of the Sun. The smaller values of $\langle P_0\rangle$ and

TABLE 3

AVERAGE GALACTIC LONGITUDE l_F OF PLANES OF VIBRATION AT GALACTIC POLES

Distance	N	l_F
	North Galactic Pole	
50–100 pc	40	64°±4°
100–200 pc	21	64 ±5
All ..	68	64 ±3
	South Galactic Pole	
50–100 pc	9	79°±5°
100–200 pc	13	86 ±3
All .	27	83 ±3

TABLE 4

AVERAGE AMOUNT OF INTERSTELLAR POLARIZATION AT GALACTIC POLES AS FUNCTION OF DISTANCE

DISTANCE (pc)	NORTH GALACTIC POLE (mag)		SOUTH GALACTIC POLE (mag)	
	$\langle P\rangle$	$\langle P_0\rangle$	$\langle P\rangle$	$\langle P_0\rangle$
0– 20	0 0004	0 0000	0 0011	0 0006
20– 40	0007	.0005	.0012	.0008
40– 60	0011	0010	.0015	0012
60– 80	0008	0006	0016	0013
80–100	0015	0014	0019	.0017
100–120	0015	0014	.0029	0028
120–140	0011	0010	0042	0041
140–160	0020	0019	0 0040	0 0039
160–180	0024	0023		
180–200	0 0018	0 0017		

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the large scatter of the planes of vibrations in the north polar region may be due to a larger scatter of the local directions of the magnetic field, or to a smaller angle between the line of sight and the mean direction of the field, or to a smaller average density and at the same time less uniform distribution of the interstellar dust along the line of sight. Since the reddening of the stars in the polar regions is too small to obtain independently a reliable estimate on the density or distribution of the interstellar dust, it seems impossible to decide which of these explanations is the correct one.

In spite of the large scatter of the position angles in Figure 4 the inclination to the galactic plane of the average plane of vibration for nearby stars (Behr 1959; Appenzeller 1966*b*) is indicated. If we assume that the magnetic field is perpendicular to the line of sight at $l = 150^\circ$, $b = 0^\circ$ (see § IV), the angle between the mean direction of the field and the galactic plane is found to be $19^\circ \pm 7^\circ$. Between 100 and 200 pc of the Sun (Fig. 5) the inclination is already much smaller. The dense group of bright stars in Figure 5 near $l = 146^\circ$, $b = -6^\circ$ is the α Per cluster. The magnetic field in the vicinity of the cluster is obviously well oriented but with a mean direction different from that of the surrounding "undisturbed" interstellar space. This result is similar to that reported for the Orion aggregate (Appenzeller 1966*b*). Another interesting feature of Figure 5 is the apparent convergence of the planes of vibration to a point near $l = 180^\circ$, $b < -10^\circ$.

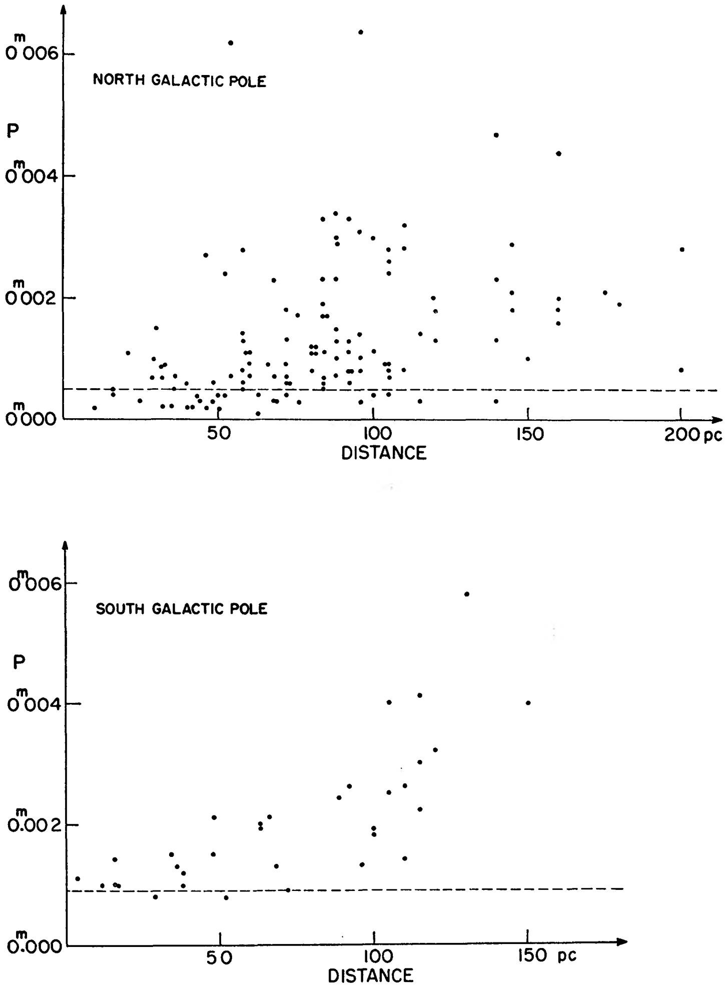

FIG. 3.—Amount of interstellar polarization as function of distance for stars with $|b| > 70^\circ$. Dashed lines indicate average observational mean errors.

Because of the small reddening of the stars in this region it is difficult to determine the angle between the line of sight and the magnetic field. A crude and very uncertain estimate (using the *UBV* date of the *Catalogue of Bright Stars* and the relations derived in an earlier paper; Appenzeller 1966*b*) indicates an angle of only about 30°. If this result is correct, the field at $l = 180°$ does not run perpendicular to the galactic plane but parallel to the direction to $l = 180°$ with an inclination to the galactic plane of only about 30°. This would fit well to the strong Faraday rotation and outflowing gas motions observed near $l = 180°$, $b = -30°$ (Gardner, Whiteoak, and Morris 1967).

IV. THE DIRECTION OF THE INTERSTELLAR MAGNETIC FIELD IN THE VICINITY OF THE SUN

One may expect that the galactic longitude of the direction of the magnetic field at the position of the Sun is approximately $l = 73°$, the mean between the two values of l_F found in the directions of the galactic poles. However, earlier observations in Cygnus (Appenzeller 1966*b*) show that the foreground field (15–200 pc) at $70° \leq l \leq 90°$,

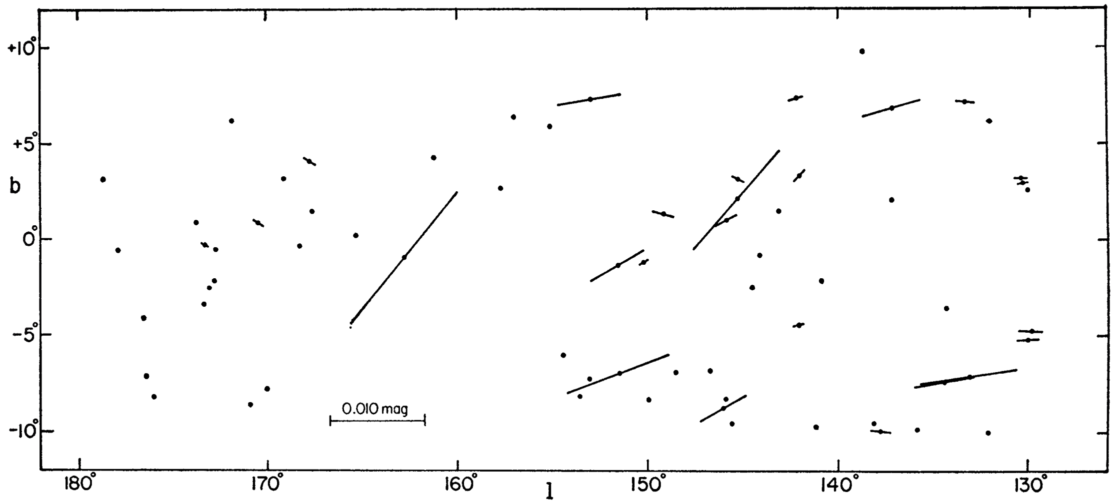

FIG. 4—Interstellar polarization in Perseus within 100 pc of the Sun

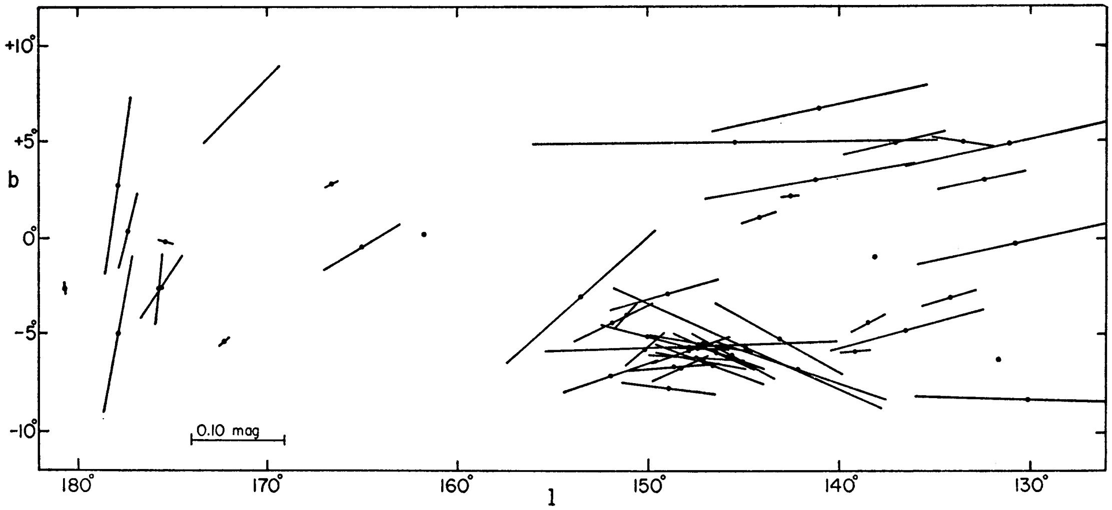

FIG. 5.—Interstellar polarization in Perseus between 100 and 200 pc

$|b| < 5^\circ$ is certainly not directed toward $l = 73^\circ$. The analysis of the ratio of polarization to interstellar extinction and of the position angles in Cygnus indicate a direction of about $l = 45^\circ$. This value is, however, rather uncertain for the foreground field, because of the small reddening. But the position angles alone show definitely that the field cannot be directed toward any galactic longitude between 65° and 95°. Even the stars within 50 pc of the Sun show no convergence of the planes of vibration toward 73°. Assuming that the foreground field in Cygnus is directed toward $l = 60^\circ$, its inclination to the galactic plane (derived from the position angles observed in Cygnus) would be about 20°, which would fit well to the value observed for the foreground stars in Perseus. This may indicate that the field in the galactic plane at the position of the Sun is approximately parallel to the direction of $l = 60^\circ$, $b = 20^\circ$. However, since the direction of the field in the vicinity of the Sun is obviously not constant, it is necessary to map the magnetic field in all details, before a reliable and meaningful mean direction can be derived. For this purpose many more observations are necessary.

Following Behr's (1959) suggestion of a helical field, one may try to explain the different galactic longitudes of the field direction observed in the two polar regions by helical lines of force with a pitch angle of about 80° and an axis of the helices pointed toward $l = 73^\circ$. However, again the position angles observed for the foreground stars in Cygnus contradict such an explanation.

A direct comparison of the results presented here with the radio-astronomical results is difficult, since the distance in which the Faraday effect and the synchrotron emission take place is not known well enough. But it seems interesting to note, that the radio-astronomical determinations of the direction of the magnetic field conducted in the southern hemisphere (Mathewson and Milne 1965; Mathewson, Broten, and Cole 1966; Gardner and Davis 1966) or based largely on southern observations (like the analysis of the Faraday rotation by Berge and Seielstad [1967], which gives a significant result only for the galactic southern hemisphere) give values between $l = 70^\circ$ and $l = 95^\circ$, while investigations based on data obtained in the northern hemisphere (Berkhuijsen, Brouw, Muller, and Tinbergen 1965; Bingham and Shakeshaft 1967) lead to values between $l = 50^\circ$ and $l = 70^\circ$. This discrepancy may be a confirmation of the different field directions observed optically at the galactic poles.

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