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THE RELATION BETWEEN ROTATIONAL VELOCITIES AND SPECTRAL PECULIARITIES AMONG A-TYPE STARS

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ABSTRACT

We obtained new data to determine whether the spectral appearance of A-type stars is entirely determined by their rotational velocities. For this purpose we derived rotational velocities for 1700 northern A-type stars from CCD coudé spectra, calibrated with the new Slettebak et al. system, and new MK classifications based on wide photographic Cassegrain spectra for 2000 northern and some southern stars in the Bright Star Catalogue. In addition we determined the equivalent widths of the λ4481 Mg II lines in the coudé spectra. Tables and graphs show the variations of rotational velocities and λ4481 line strengths as functions of type and luminosity, and frequencies of the normal and abnormal stars.

After deconvolutions of the rotational velocities, assuming random orientations of rotational axes, we find that all rapid rotators have normal spectra and nearly all slow rotators have abnormal spectra (Ap or Am). Those abnormalities are generally attributed to diffusion and can occur only with little rotational mixing. However at all types there are overlaps of these distributions, implying that a given intermediate rotational velocity is insufficient to determine whether the star should have a normal or abnormal spectrum. However, we realized that (1) some of our "standards," such as Vega and α Dra, are really abnormal, causing us to classify similar peculiar stars as "normal," (2) many of the "normal" stars near A2 IV have the characteristics of peculiar stars such as low rotational velocities and weak 4481 Mg II and K lines, and (3) the mean rotational velocities of "normal" stars are depressed just at those types where the Ap and Am stars are most frequent. Therefore we conclude that the overlaps are due to our failure to detect all the abnormal stars and that a specific rotational velocity is probably enough to determine whether a star will have a normal or abnormal spectrum.

Subject headings: stars: chemically peculiar — stars: early-type — stars: fundamental parameters — stars: rotation

1. INTRODUCTION

Among the A-type main-sequence stars there are several types of peculiarities. First, the metallic-line (Am) stars (Titus & Morgan 1940) are mostly very obvious because they have metallic lines as in early F-type stars, strong hydrogen lines as in late A-type stars, and very weak Ca I (λ4427) and Ca II K lines as in early A-type stars. There are also similar peculiarities among the early A's, of which Sirius (Strom, Gingerich, & Strom 1966) is a good example. Such stars show a smaller range in types, for example, for Sirius: Am(K/H/M = B9.5/A0/A1). They are difficult to identify without abundance studies or high-quality classification spectra. The Am stars do not have significant magnetic fields: Conti (1969) found that they are less than 50 G. Am stars are usually found in spectroscopic binaries (Abt 1961).

A second class of peculiar stars are the peculiar A stars (Ap) that have much more extreme abundance anomalies, ranging up to factors of 10^4 or more above or below normal solar abundances, rather than the factors of 10 or so found in the Am stars. Although many of these stars have temperatures and masses of B stars, their underabundances of He has caused spectral classifiers to call them A stars, hence Ap. They have strong magnetic fields (Babcock 1958), except in the case of the HgMn stars. The magnetic Ap stars are infrequently found in close binaries (Abt & Snowden 1973).

The explanations for both kinds of peculiarities seem to be in the occurrence of radial diffusion of ions between the two outer convective zones in the absence of meridional circulation associated with rapid rotation (Michaud 1970). For A-type stars the effects are calculated to show up (Michaud et al. 1976) in 10^4 yr for Sr, 10^5–10^6 yr for He, and longer for heavy metals. The occurrence of such stars in open clusters of various ages (Abt 1979) are consistent with those times of formation.

Based on meridional circulation models of Sweet (1950) and Tassoul & Tassoul (1982), Michaud (1982) found that diffusion in Ap stars should occur only for rotational velocities less than about 90 km s^{-1} and in Am stars (Michaud et al. 1983) with less than about 120 km s^{-1}. Observationally Wolff & Preston (1978) found a maximum rotational velocity of 90 km s^{-1} for HgMn stars; for magnetic Ap stars they note a few

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with $100 < V \sin i < 200$ km s^{-1}. For the Am stars the upper rotational limit is about 120 km s^{-1} (Abt & Moyd 1973). Therefore this agreement between theory and observations is quantitatively excellent.

A third kind of abundance peculiarity is the λ Bootis stars that show underabundances of the metals (Morgan, Keenan, & Kellman 1943; Oke 1967; Baschek & Searle 1969). These stars occur at all rotational velocities (see below). The current best explanation (Venn & Lambert 1990; Charbonneau 1991) involves, rather than a diffusion mechanism, the accretion of gas that has been depleted of certain elements during the process of grain formation. Such a process may not depend upon the stellar rotational velocity except that the metal-underabundant material accreted onto the photosphere will gradually be mixed inward by meridional circulation and diluted. Therefore the effect is a temporary one that shows only as long as the accretion is occurring. The λ Bootis stars would be difficult to distinguish from weak-lined or Population II A-type dwarfs, if there are such stars in the solar vicinity. However of the 23 A5-F2 stars listed below that have λ Bootis or λ4481-weak spectra and with radial velocities given in the Bright Star Catalogue (Hoffleit & Jaschek 1982, hereafter BSC), the mean absolute radial velocity is 12 km s^{-1} and the range is from −22 to +22 km s^{-1}. Such stars do not seem to be Population II stars. Also, their mean rotational velocity is 120 km s^{-1}, which is normal for Population I stars (see § 2.2) but does not sound likely for Population II stars. However, we are not sure that among the F-type stars the ones called λ Bootis or "λ4481-weak" are different than the ones called "wl" or weak-lined.

The final type of peculiarity to be mentioned below is the shell stars. Those have hydrogen emission lines or sharp metallic absorption lines produced in shells or disks; those lines are superposed on stellar spectra that generally show no abundance anomalies. Most, but not all, such stars have very broad lines, indicating the maximum rotational velocities observed among the A stars.

We have found only one star in the BSC of the HR 4049 peculiarity, so we will not discuss that further.

The study by Abt & Moyd (1973) of normal and Am stars showed a nearly complete dichotomy in that all the rapid rotators (after allowance for random inclination effects) have normal spectra and all the slow rotators are Am stars; the overlap was only 1.3% of the stars. They left us with the thought that if one had both excellent measures of the rotational velocities of a statistically large sample of stars and good MK classifications to isolate the peculiar-abundance stars, would there be no overlap? That is, is the stellar rotational velocity the only parameter that determines whether a star will have a normal or abnormal (Ap or Am) spectrum? To answer that question is the primary goal of this project.

The published rotational velocities in compilations such as the BSC come from many different sources, and it is not clear that all those sources succeeded in calibrating consistently to the same system. Therefore we proposed obtaining good quality spectra (with coudé dispersions and CCD detectors) of a large sample of A-type stars and calibrating those against the new standards by Slettebak et al. (1975). We decided to observe all the stars from A0 to F0, inclusive, in the BSC (we used the third edition in selecting the stars) observable from Kitt Peak with the coudé feed telescope, namely, all the stars between declinations −30° and +70°. This sample, which is larger than is necessary to obtain good statistical results, was observed partly as a service to provide a large set of consistent rotational velocities for others to use. This sample includes about 1700 stars.

Similarly, the published MK classifications come from many different observers using a variety of equipment, some of which was incapable of detecting subtle peculiarities, such as the HgMn stars that require fairly high dispersions to show the λ3984 Hg II line. Therefore we obtained a separate set of spectra that are especially suited for visual classification, namely, 39 Å mm^{-1} Cassegrain spectra that are 1.2 mm wide and on fine-grain emulsions. We used the 2.1 m Kitt Peak telescope, which can reach to the north pole; with the CTIO 1.5 m Cassegrain spectrograph we observed some of the stars south of −30°. There are about 2000 stars in this set.

In the course of getting the rotational velocities from Gaussian fittings to line profiles (mostly from λ4481 Mg II), we decided to obtain the equivalent widths of that line. That turned out to be important in distinguishing some peculiar stars because λ4481, being the strongest non-Balmer line in the optical spectra of early A stars and having an equivalent width that is relatively insensitive to spectral type, is an excellent tool for detecting abnormal Mg abundances.

2. THE MEASURED PARAMETERS

2.1. *MK Classifications*

The photographic spectra were classified by the first author on a Boller & Chivens binocular spectracomparator against standards mostly by Morgan, Abt, & Tapscott (1978). We used Kodak IIa-O emulsions, wide (1.2 mm) spectra, and a technique of overexposure and underdevelopment to reduce contrast. Most of the details about our classification terminology are given in Table 1. We did not attempt to distinguish between luminosity classes Va and Vb among the early A's for these field stars because the latter occur only among extremely young stars (Abt 1979).

For normal stars our classifications agree very well with those by Gray & Garrison (1987, 1989a, b); our types are 0.11±1.12 (rms error per measure) subclasses earlier than theirs and 0.06±0.76 luminosity classes less luminous. The systematic differences are not significant, because the estimated errors in the means are ±0.16 and ±0.11, respectively. The random rms differences are one subtype and three-quarters of a luminosity class per star. A comparison of normal stars with the classifications by Cowley et al. (1969) shows our types to be 0.41±0.82 subclass earlier and 0.41±0.75 luminosity classes brighter. In this case the systematic differences are significant because the estimated errors in the means are ±0.12 and ±0.11, respectively. The random errors between our and Cowley et al.'s classifications are about the same as in the comparison with Gray and Garrison.

We used only standards by Morgan and his collaborators. One difficulty with those is that there are insufficient broad-lined standards. To remedy that, Gray & Garrison (1987, 1989a, b) derived new broad-lined standards ($V \sin i$ = 150–275 km s^{-1}), partly by using other known data about those stars. Thus the question naturally arises as to whether our classifications for the broad-lined stars differ systematically from those by Gray & Garrison; we can expect that the random errors will be larger because broad-lined stars are more difficult to classify than sharp-lined stars.

We therefore selected the 63 A0–A2 stars in common with Gray & Garrison (1987) and with $V \sin i > 150$ km s^{-1}. We find that our types are systematically earlier by 0.27±0.16 (mean error in the mean) subclasses, which is less than 2 σ and is not significant, but 0.55±0.10 (mean error in the mean) luminosity classes less luminous, which is significant. Thus our temperature classifications are in agreement with those of Gray & Garrison for both sharp- and broad-lined stars, but our luminosities differ for the broad-lined stars.

However, the larger differences are in that we have detected many more peculiar stars than either Gray & Garrison or Cowley et al. Of the stars we call peculiar, both other sets of authors detected only 45% as peculiar. Many of the remainder have weak λ4481, and because we have the equivalent width measures to confirm our visual estimates, we tend to accept our classifications. We used a higher dispersion (39 Å mm^{-1}) than did Gray & Garrison (67 and 120 Å mm^{-1}) and Cowley et al. (125 Å mm^{-1}) so we could see faint lines better. Also, the latter authors ignored 4481 because it gave erratic results (private communication).

Detailed explanations about our classification terminology are given in Table 1.

The classifications are given in the fourth column of Table 2. The first three columns give the stellar identifications as BSC numbers (HR), Henry Draper numbers (HD), and other designations. The last gives constellation names and double-star names, usually taken from Aitken (1932). The component observed (e.g., A, B, or AB) applies to both the classification spectra and the rotational velocities unless indicated otherwise; for example, see HR 526 where A was observed for the classification and AB for the rotational velocity. Dots indicates that spectra were not available.

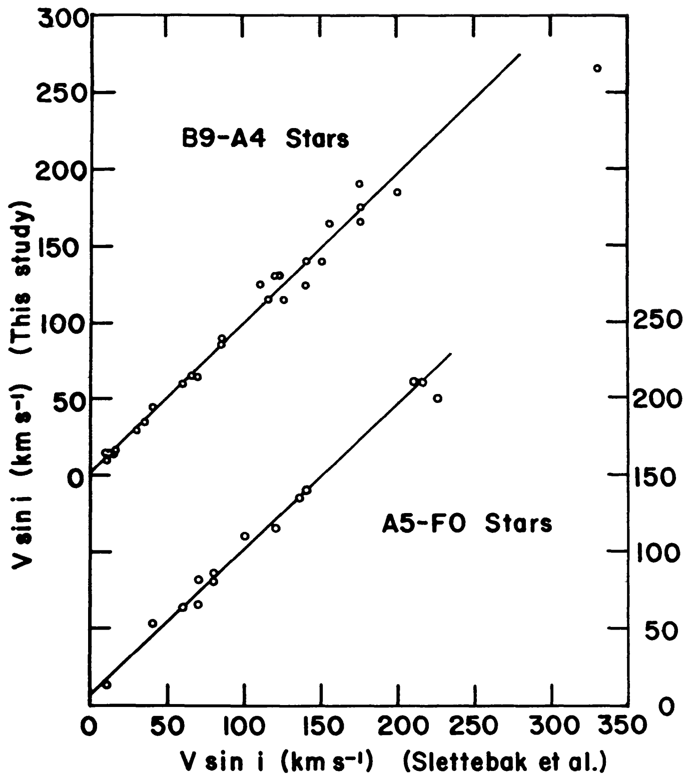

FIG. 1.—Rotational velocities in Table 2 are plotted vertically against those by Slettebak et al. (1975) for 26 B9–A4 stars (*above*) and 14 A5–F0 stars (*below*) that they have in common. The least squares line (ignoring the last point) in the upper panel is given by $2 + 0.979$ $V \sin i$ (Slettebak et al.) and in the lower panel by $7 + 0.958$ $V \sin i$ (Slettebak et al.).

TABLE 1

EXPLANATION OF THE CLASSIFICATION TERMINOLOGY

Designation	Meaning
(standard)	Classification standard star
s	Sharp lined
n	Broad lined
nn	Very broad lined
ksn	The Ca II K line has both sharp and broad components.
st	Strong
wk	Weak
v.	Very
λ Boo	A star in which many of the metals are weak, indicating underabundances.
4481 weak	The 4481 Mg II line is weak. Measures may indicate that other lines are also weak. This may be a mild version of the λ Boo stars.
Am(A3/A7/F0)	A metallic line star in which the spectral type based on the Ca II K line is A3, on the Balmer lines is A7, and on the metallic lines is F0. This is an abbreviation of the form Am(K/H/M = A3/A7/F0).
p(SrEuCr st, CaMg wk)	An Ap star in which the Sr is strongest relative to the standards, Eu is next strongest, etc.; the lines of Ca and Mg are weak relative to those in standards. The type is based on the hydrogen lines.
shell (Ti, Ca)	A shell spectrum that has sharp Ti and Ca absorption lines.
(:)	Uncertainty in the previous symbol

2.2. *Rotational Velocities*

The rotational velocities were derived by the second author from the coudé spectra, using the CCD spectra collected by the first author. The CCD coudé spectra were obtained with a dispersion of 10 Å mm^{-1}, pixel size of 25 μm, resolution of 1.3 pixels, and S/N = 100–200; these gave a resolution of 0.33 Å or 22 km s^{-1}. Because the instrumental and rotational widths add as squares, we cannot resolve rotational velocities smaller than about 10 km s^{-1}. In an IRAF reduction scheme the continuum intensity was selected, the spectral slope was tilted to zero, Gaussian profiles were fitted to the two lines used (λ4481 Mg II, λ4476 Fe I), and half-widths were determined. For stars with $V \sin i > 220$ km s^{-1} the Gaussian fits become inadequate, and the half-widths are underestimated.

All of the northern stars measured by Slettebak et al. (1975) were included in this program. They measured line profiles on high-resolution scanner spectra and compared them with profiles computed from model atmospheres by Collins. For the stars that we have in common with them the relation between their rotational velocities and our measured half-widths were plotted. The plots of the resulting rotational velocities from λ4481 are shown in Figure 1 for the B9–A4 and the A5–F0

TABLE 2

SUMMARY OF STELLAR DATA

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
1	3	ADS 46A	A0 Vn(λ Boo)	210:	0.32
9	203		F1 Vn	155	.52
10	256		A3 Vn + shell (Ca II K + HI cores)	220:	.31
11	315		B9 IVp(Si st)	70	.27
12	319	ADS 89A	A2 Vp(4481 wk)	45	.31
20	431	ADS 102AB	A6 IV	86	.49
41	905	23 And	F0 IVs	36	.47
44	952		A0 III	65	.43
49	1048		A1 IV-V	20	.40
50A	1061	35 Psc ADS 191A	A9 IV	66p 48s	.31p .16s
50B	....	ADS 191B	F4 V	...	...
53	1083		A0 Vn	215:	.49
56	1185	ADS 215A	A2 V	115	.56
63	1280	24θ And	A2 IV	90	.56
66	1343		F2 Vs	13	.28
68	1404	25σ And	A2 V	110	.45
71	1439		A1 III	30	.43
76	1561		A1 IV	50	.43
81	1663	ADS 287AB	A1 IIIs	20	.36
100	2262	κ Phe	A6 Vn	...	...
104	2421		A1 IVs	10	.38
114	2628	28 And ADS 409A	A9 IV	18	.39
118	2696		A4 V	150	.55
125	2834	λ^1 Phe	A1 V	...	...
127	2885	β^2 Tuc	A2 IVs	...	...
128	2888		B9 IVn	170	.39
129	2904		A0 Vnn(λ Boo)	225:	.31
132	2913	51 Psc ADS 449AB	....	165	.49
133	2924		A2 IVp(Ca st, Sr wk)s	20	.46
136	3003		A1 IV	...	...
146	3283		A3 III	100	.49
149	3322		B8.5 IIIp(HgMn st, Mg wk)	15	.21
151	3326		Am (A4/F1/F0)	98	.73
178	3883		Am (A5/F1/F2)	18	0.51
183A	3980	ξ Phe	A3 Vp(SrCr v.st; K sn)	...	...
184	4058	20 Cas	Am (A3/F1/A5)	40p 45s	0.28p .273
191	4150	η Phe	A0 IV	...	...
192	4161	YZ Cas	A3 IVs	...	...
196	4222	ADS 625A	A1 V	25	.41
198	4293		A9 IV-V	...	...
204	4321		A3 IVp(4481 wk)	15	.38
206	4338	ADS 636A	F1 IV	98	.64
214	4490	59 Psc	F0 Vn	170	.67
230	4757	65 Psc ADS 683B	F2 IV	95	.59
231	4758	65 Psc ADS 683A	F0 III	98	.60
232	4772		....	150	.53
233	4775		A0 V + F5 V	25p 24s	.33p .18s
234	4778		A3 Vp(SiSrCrEu st, CaMg wk, K sn)	33	.33
240	4853		A2.5 V	...	...
241	4881		B9.5 IV	65	.32
246	5066		A1 IV	110	.47
250	5128	ADS 735A	Am (A8/A6/F3)	28	.59
254	5267	66 Psc ADS 746AB	B9.5 V	130	.42
261	5357		F1 V	48	.58
262	5382	67 Psc	A5 IV	130	.50
269	5448	37μ And	A6 V	65	.54
277	5641	ADS 805AB	A0 Vp(4481 wk, K sn)	35	.19
278	5715		A3 V	90	.50
282	5788	ADS 824B	A2 Vn	250:	.47
283	5789	ADS 824A	B9.5 Vnn(λ Boo)	230:	.33
286	5914		A2.5 V	...	...
287	6028		A2 IV	85	.49
289	6114	ADS 862AB	A9 V	135	.58
290	6116	39 And ADS 863A	Am (A4/F0/F2)	35	.55
292	6130	ADS 868A	F1 III	23	.51
293	6178	σ Scl	A2 V	...	...
301	6288	26 Cet ADS 875A	F1 V	91	.68
305	6314		F0 Vn	150	.57
309	6416		A5 Vn	150	0.54

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
317	6530	28 Cet	A1 III	30p 35s	0.23p .20s
324	6658	41 And	Am (A2/A5:/A3)	73	.55
325	6668		Am (A4/F0/F0)	70	.55
328	6695	79ψ^2 Psc	A3 V	135	.55
331	6767	υ Psc	A4 V	...	...
333	6798		A1 Vn	190	.51
336	6829	31 Cas	A0 Vp(4481 wk)nn	315:	.37
343	6961	33θ Cas	A7 V (standard)	91	.65
349	7034	82 Psc	F0 IV	85	.63
359	7312		F0 IV	...	...
361	7344	86ζ Psc ADS 996A	A7 IIIn	180	.52
362	7345	ζ Psc B	F7 V	...	...
378	7804	89 Psc	A2.5 V	100	.53
379	7853	ADS 1055A	Am (A5/F1/F2)	47	.53
381	7925		F0 Vn	...	...
382	7927	34ϕ Cas ADS 1073A	F0 Ia (standard)	23	.69
383	7964	90υ Psc	A2 V	80	.44
384	8003	35 Cas ADS 1088A	A2 Vnn	285:	.60
395	8374	47 And	Am (A1/F1/F2)	33p <10s	.41p .16s
398	8424		B9.5 IVn	...	...
401	8511	44 Cet	A7 Vn	195	.68
403	8538	37δ Cas	A5 III-IV (standard)	110	.61
418	8801	ADS 1151A	Am (A5/F1/F2)	68	.56
428	9030		Am (A1/A3/A3)	75	.54
432	9100	97 Psc	A2.5 V	110	.46
433	9132	48 Cet ADS 1184A	A1 IV	20	.38
444	9484		A0 III	15	.38
451	9672	49 Cet	A2 Vn	195	.64
457	9780		F0 V	115	.63
463	9919	102π Psc	F1 V	105	.54
465	9996		A2: Vp(SiSrCrEu st, CaMg wk)	23	.18
473	10148		F2 Vn	170	.59
476	10204		A9 V	105	.71
478	10221	43 Cas	A0 Vp(SiSrEuHgMn st, CaMg wk)	10	.21
480	10250	42 Cas	B9.5 IV	135	.52
499	10543	ADS 1359AB	A3 V	90	0.55
502	10587		A1 V	180	0.53
515	10845		F0 V	85	.58
526	11031	ADS 1438AB	A: A2.5 V	AB: 40	AB: .47
534	11257	AB	F0: Vp(4481 wk)	21	.34
538	11335		A1 V	155	.47
540	11408		A5 III	53	.61
541	11413		A1 Vp(λ Boo)	...	...
545	11503	5γ^1 Ari ADS 1507B	A0 Vp(λ Boo)n	185	.32
546	11502	5γ^2 Ari ADS 1508A	A2: Vp(SiHgMn st, CaMg wk)	45	.34
547	11522		F0 IV	120	.53
553	11636	6β Ari	A4 V	65	.59
558	11753	ϕ Phe	A0 III	...	...
567	11946	ADS 1571A	A0 Vp(4481 wk)n	290:	.39
569	11973	9λ Ari ADS 1563A	F0 IV	95	.64
575	12111	48 Cas ADS 1598AB	A5 V	70	.52
578	12140		A6 V	120	.57
579	12173	ADS 1606A	A5 III	31	.52
580	12216	50 Cas	A1 V	85	.40
581	12230	112 Psc	F0 V	...	...
586	12279	52 Cas	A1 IVp(4481 wk)n	255:	.41
591	12311	α Hyi	F0 IV	...	...
595	12446	113α Psc ADS 1615B	.....	73	.49
596	12447	113α Psc ADS 1615A	.....	70	.36
597	12467		A1.5 V	...	...
598	12468		A0 V	170	.46
599	12471	3ϵ Tri ADS 1621A	A2 V	95	.48
604	12534	57γ^2 And	B9.5 V + A0 V	185	.41
607	12573	60 Cet	A5 III	95	.54
612	12767	ν For	B9.5 IIIp(Si st, Mg wk)s	35	.17
613	12869	12κ Ari	Am (A2/A5/A7)s	10	.45
618	12953		A1 Ia	30	.62
620	13041	58 And	A3 V	120	.54
622	13161	4β Tri	A5 III	65	.45
629	13295	59 And ADS 1683B	A2 Vn	215:	0.38

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
634	13372	5 Tri	Am (A1/A6/A7)	15p	0.26p
				10s	.25s
641	13476		A2 Iab	20	.60
655	13869	7λ Tri	A0 V	...	...
658	13936		A0 Vp(4481 wk)n	235:	.29
664	14055	9γ Tri	A0 Vn	235:	.40
668	14171		A0 Vp(SiSr st, Ca wk)	20	.30
669	14191	22θ Ari	A0 Vn (standard)	170	.40
670	14212	62 And	A1 III	75	.44
671	14213		A3: Vp(4481 wk)	60	.33
673	14221		F3 V	15	.25:
675	14252	10 Tri	A2 IVs	15	.38
		ADS 1770A			
676	14262		F1 IV	110	.58
682	14392	63 And	B9 Vp(Si st, CaMg wk)	70	.27
684	14417		A3 IV	50	.51
685	14489	9 Per	A1 Ia	25	.66
		ADS 1802A			
691	14690	70 Cet	F0 Vn	185	.63
692	14691		F1 V	105	.58
701	14943		A6 III	...	...
704	15004	71 Cet	B9 III:nn + shell (HI)	200:	.29
705	15008	δ Hyi	A2 V	...	...
707	15089	ι Cas	A2: Vp(SrCr st, K sn)	40	.43
710	15144	ADS 1849A	A3 Vp(Sr v.st, CrEu st)	23	.42
716	15253	ADS 1878A	B9.5 Vn + shell (TiFeCaHI)	160	.25
717	15257	12 Tri	F1 Vwl(met: A3, Ca: A2)	83	.65
723	15385		A9 IV	21	.64
724	15427	φ For	A2.5 V	...	...
729	15550	26 Ari	A9 V	170	.63
730	15588	ADS 1906A	F0 IV	41	.73
732	15633		A6 III	31	.51
733	15634		F0 IV	141	.72
769	16350		A0 III	15	.39
773	16432	32ν Ari	A6 V	120	.66
778	16555	η Hor	A7 V	...	...
782	16628	33 Ari	A3 V	95	.55
		ADS 2033A			
789	16754		A1 V	...	...
791	16769		Am (A4/A5V/F0)	30	.50
793	16811	34μ Ari	A0 Vn	160	0.40
		ADS 2062AB			
797	16861		A2 IVp(?)s	15	0.42
803	16955	ADS 2082A	A2 V	160	.50
804	16970	86γ Cet	A2 Vn	170	.52
		ADS 2080A			
812	17093	38 Ari	A7 III	75	.52
813	17094	87μ Cet	F0 III-IV	53	.66
815	17138		A3 V	60	.48
816	17163		A9 III	108	.75
825	17378		A5 Iab	25	.64
837	17566	ζ Hyi	A2 IV	...	...
839	17581		Am (A1/A6V/A9)	18	.44
845	17729	γ^2 For	A0 V	135	.42
852	17848	ν Hor	A2.5 V	...	...
859	17943		A8 V	125	.52
873	18296	21 Per	A2 Vp(SiEu st, CaMg wk)s	10	.18
875	18331		A1 Vn	220:	.44
879	18411	22π Per	A2 Vn	170	.43
883	18454	4 Eri	A8 III	95	.70
887	18519	48ε Ari	A3 IVs	50	.46
		ADS 2257B			
888	18520	48ε Ari	A2 IV	50	.47
		ADS 2257A			
891	18538	ADS 2270B	.....	155	.50
892	18543		A2 IVs	40	.45
895	18557		Am (A2/A6:/F0)	15	.39
897	18622	θ^1 Eri	A3 V	...	...
898	18623	θ^2 Eri	A2 V	...	...
901	18692	ζ For	F3 IV	98	.67
905	18769	49 Ari	Am (A2/A6/A7)	43	.59
906	18778		A7 III	43	.59
909	18866	β Hor	A6 III	...	...
916	18928		A9 Vn	160	.50
919	18978	11τ^3 Eri	A2.5 V	120	.49
925	19107	10ρ^3 Eri	A5 V	170	.56
932	19275		A1 Vn	...	...
933	19279		A2 Vn	285:	.46
943	19545		.....	80	.63
945	19600		A0 III	60	.44
954	19832	56 Ari	B9.5 Vp(Si st, CaMg wk)n	85	.16
961	19978		A7 V	...	...
964	20041	ADS 2424A	A1 Ia	25	.63
967	20104	ADS 2436AB	A2 V	145	0.51

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
971	20149		A1 IV	15	0.42
972	20150	58ζ Ari	A0 IV	120	.46
975	20193	ADS 2431A	F1 Vs	15	.30
976	20210	ADS 2433A	Am (A1/F0/F2)s	13	.34
979	20283	ADS 2443A	B9.5 Vn	215:	.37
980	20293		.....	190	.46
981	20313	A	A9 III	...	...
984	20320	13ζ Eri	Am (A3/A6/A7)	71	.50
986	20346		A3 IIIs	15	.40
993	20606		F0 IV	130	.64
1002	20677	32 Per	.....	130	.51
1018	20980		A1 V	35	.48
1020	21004		F0 V	131	.58
1026	21038		A2 V	120	.41
1027	21050	65 Ari	A0 IIIs	20	.40
1036	21335	AB	A3 Vp(4481 wk)n	200:	.45
1040	21389		A0 Ia (standard)	30	.57
1041	21402		A2 IV	35	.46
1043	21427	ADS 2563A	A2 V	105	.53
1046	21447	ADS 2565A	A1 Vn	175	.51
1055	21610		A0 Vn	190	.44
1056	21620		A0 Vp(4481 wk)n	200:	.33
1062	21688		A4 IV	200:	.52
1065	21743	ADS 2582AB	A2 V	A: 105	A: .56
				B: 85	B: .55
1068	21769	ADS 2592A	A5 III	81	.62
1073	21819		A2 Vp(4481 wk)	160	.37
1075	21882		A5 Vn	...	...
1078	21912		Am (A3/A5/A5)	91	.59
1081	21981		A2.5 V	...	...
1082	21997		A3 V	60	.54
1086	22091	7 Tau ADS 2616AB	A3 IVs	25	.48
1091	22243		A0 V	160	.47
1100	22470	20 Eri	B9.5 p(λ Boo)	65	.21
1102	22522		A4 IV	65	.54
1103	22615		A3 III-IV	28	.54
1114	22789	τ For	A0 V	135	.46
1118	22805	11 Tau	A2 IV-V	60	.45
1128	23055		A2.5 V	70	.51
1129	23089	AB	A0 + G0: II-III	18p	.29p
				18s	0.29s
1130	23139		A8 IV	81	0.63
1133	23193		A2.5 V	33	.50
1137	23258		A0 Vp(λ Boo)	110	.29
1138	23277		Am (A2/A6V/A7)	41p	.42p
				13s	.30s
1139	23281		A5 III-IV	81	.60
1148	23401	γ Cam	A2 Vn	175	.70:
1158	23523		A3 Vn	250:	.49
1161	23594		A1 IVn	...	...
1170	23728		F0 Vp(4481 wk)	91	.45
1171	23738	σ For	A3 V	160	.58
1177	23848	42 Per	A3 V	80	.49
1181	23878	28τ[7] Eri	A3 Vs	18	.43
1188	23985	ADS 2799AB	A2 IVp(4481 wk)	40p	.28p
				35s	.13s
1189	24071		A1 IVs	...	...
1190	24072		B9.5 Vn	...	...
1192	24141		A7 IV	53	.67
1196	24164		A9 IV	35	.38
1197	24167		A5 V	165	.56
1211	24554	32 Eri ADS 2850B	A1 V	195	.63
1217	24712		A9 Vp(SrEuCr st, CaMg wk)	<10	.61
1223	24809		A7 V	140	.56
1224	24817		A0 Vn	265:	.46
1225	24832		F0 V	150	.64
1229	24982	ADS 2910AB	B9.5 IV	105	.49
1238	25202		F1 V	160	.59
1240	25267	36τ[9] Eri	B7: Vp(SiSr st, HeCa wk)	20	.27
1242	25291		F0 III	13	.50
1246	25371		A1 V	...	...
1248	25425		Am (A3/F0/A7)	18	.51
1251	25490	38ν Tau	A2 V	65	.38
1268	25823	41 Tau	B6 IIp(He v. wk, 4481 wk)	15	.20
1272	25910		A1 V	140	.48
1275	25945		F1 IV	61	.50
1296	26553		Am (A3/A7/A5)	<10	.44
1300	26591		Am (A2/A5V/F2)	25	.28
1302	26612	δ Hor	F2 Vn	...	...
1308	26677	ADS 3063A	A3 III	83	.67
1314	26764		A1 Vn	230:	.55
1324	26961		A2 V	70	0.53

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
1329	27045	50ω^2 Tau	Am (A5/F0/F2)	68	0.67
1330	27084		A7 IV	138	.58
1331	27176	51 Tau	F0 V	83	.65
1334	27236		A5 III-IV	85	.59
1339	27295	53 Tau	B9 Vp(4481 wk)s	10	.28
1341	27309	56 Tau	A0 Vp(Si st, Mg wk)	35	.29
1342	27322		A2 IV-V	130	.52
1351	27397	57 Tau	F0 IV (standard)	98	.68
1352	27402	ADS 3146A	A2: V	165	.53
1353	27411		Am (A7/F0/F2)	18	.46
1356	27459		F0 IV	78	.64
1361	27505		A4 V	120	.53
1367	27616		A0 V	155	.53
1368	27628	60 Tau	Am (A6/F0/F2)	25	.41
1376	27749	63 Tau	Am (A2/F0/F2)	15	.38
1380	27819	64δ^2 Tau	A8 V	45	.55
1381	27820	66 Tau	A3: IV	70	.48
1382	27855	ADS 3203A	B9.5 III	120	.43
1383	27861	42ξ Eri	A2 V	165	.47
1385	27901		F2 V	145	.64
1387	27934	65κ^1 Tau	A6 V	83	.62
		ADS 3201A			
1388	27946	67κ^2 Tau	A6 Vn	175	.65
		ADS 3201B			
1389	27962	68δ^2 Tau	A2 IV	15	.46
		ADS 3206A			
1392	28024	69υ Tau	A8 Vn	225:	.58
1394	28052	71 Tau	A6 Vn	205:	.60
1401	28204	ADS 3267A	Am (A8/F0/F2)	23	.46
1403	28226	AB	Am (A6/A9/F0)	93	.73
1408	28294	76 Tau	F2 V	88	.60
1410	28312	ADS 3230AB	A5 V	145	.51
1412	28319	78θ^2 Tau	A7 III (standard)	80	.62
1414	28355	79 Tau	A7 V	93	.64
1422	28485	80 Tau	F0 Vn	165	.63
		ADS 3264A			
1427	28527		A7 V	75	.61
1428	28546	81 Tau	Am (A7/A8/F2)	31	.51
1432	28677	85 Tau	F2 V	135	.63
1438	28763	ADS 3284A	A2.5 V	85	.54
1440	28780		A1 III	20	.38
1444	28910	86ρ Tau	A7 V	130	0.59
1445	28929	ADS 3304A	.....	40	0.27
1448	28978		A2 IVp(?)	15	.40
1456	29116	ν Men	F2 III	...	...
1458	29140	88 Tau	Am (A4/A6/A7)	28	.41
		ADS 3317A			
1460	29173	ADS 3318A	A2 IIIs	18	.48
1465	29305	α Dor	B9.5 Vp(Si v. st, Sr st, CaMg wk)	...	...
1466	29316	2 Cam	F2 V	125	.66
		ADS 3358AB			
1472	29375	89 Tau	F2 V	145	.66
1473	29388	90 Tau	A6 V	78	.58
1474	29391	51 Eri	F0 IV	73	.59
1477	29459		A3 Vn	180	.48
1478	29479	91σ^1 Tau	Am (A4/A5/A7)	53	.61
1479	29488	92σ^2 Tau	A6 V	115	.64
1480	29499		A9 III	75	.83
1482	29526		B9.5 V	90	.44
1483	29573		Am (A1/A3V/A3)s	31	.52
1486	29606	ADS 3391AB	A8 V	105	.56
1490	29646	ADS 3379A	A1 V	120	.54
1494	29722	59 Per	A0 Vn	195	.45
1501	29867		F1 V	73	.50
1507	30034		A9 IV	98	.58
1511	30121	4 Cam	Am (A3/A7/F2)	65	.73
		ADS 3432A			
1513	30127		A2 Vn	180	.49
1515	30144		F2 V	66	.68
1519	30210		Am (A3/A7/F0)	63	.72
1522	30321		A1 IV	120	.57
1525	30422		A3 Vp(4481 wk)	100	.41
1528	30453		Am (A7/F0/F2)	15	.43
1530	30478	κ Dor	A5 III	...	...
1544	30739	2π^2 Ori	A0 Vp(λ Boo)n	195	.33
1546	30752		A1 V	90	.44
1547	30780	97 Tau	A9 V	165	.66
1550	30823		A1 IVn + shell (Ti, Ca K)	215:	.45
1555	30958	5 Cam	B9.5 IV	90	.39
		ADS 3508A			
1559	31093		A2 V	...	...
1560	31109	61ω Eri	A9 IVn	170	.62
1561	31134		A1 Vp(4481 wk)	45	0.26

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
1563	31203	Pic A	F0 IV	...	...
1565	31209		A0 Vp(4481 wk)n	250:	0.35
1566	31236		F1 V	111	.64
1568	31278	7 Cam	B9.5 V	25	.38
		ADS 3536AB			
1569	31283	6 Ori	A3 V	160	.52
1570	31295	7π^1 Ori	A0 Vp(λ Boo)	105	.22
1575	31362		F2 V	65	.55
1578	31411		B9.5 V	95	.30
1583	31517		F0 V	45	.67
1589	31590		A0.5 V	...	...
1590	31592	98 Tau	Am (B9.5/A0/A1)	...	...
		ADS 3547A			
1592	31647	4ω Aur	A1 V	95	.53
		ADS 3572A			
1596	31739	ADS 3570A	A5 V	125	.56
1605	31964	7ε Aur	F0 Ia	45	.76
		ADS 3605A			
1609	32039	ADS 3597B	B9 Vnn	320:	.39
1610	32040	ADS 3597A	B9 Vp(λ Boo)nn	320:	.32
1611	32045	64 Eri	A8 IV	195	.67
1613	32115		A9 V	15	.42
1615	32188		A3 III	15	.39
1616	32196		Am (A4/F0/F2)	...	...
1619	32273	ADS 3623A	B7 V	90	.22
1620	32301	102ι Tau	A7 V	118	.63
		AB			
1627	32428		Am (A7/A9/F2)	68	.72
1632	32480		A9 V	130	.61
1637	32537	9 Aur	F1 Vp(4481 wk)	23	.32
		ADS 3675A			
1638	32549	11 Ori	A1 Vp(SiCr st, CaMg wk)	30	.26
1639	32608		A5 IV	75	.58
1642	32642	ADS 3672AB	A7 IV	53	.68
1643	32650		B9.5 Vp(Si st, CaMg wk)	15	.17
1645	32667		.....	130	.59
1658	32977	106 Tau	A5 IV	100	.70
1661	32996		A1 Vp(Si st, Ca wk)	15	.38
1664	33054	14 Ori	Am (A2/F2/F3)	35	.50
		ADS 3711AB			
1666	33111	67β Eri	A3 III	190	.54
1670	33204	ADS 3730A	Am (A9/A9/F2)	45	.66
1672	33254	16 Ori	.....	13	0.42
1675	33266		A2 IV	10	0.40
1678	33296	14 Cam	A7 Vn	290:	.50
1683	33541		.....	<10p	.23p
				10s	.16s
1689	33641	11μ Aqr	Am (A3/A8V/A8)	81	.59
1692	33654		A0 III	50	.38
1701	33883	ADS 3799AB	A4 V + F2 III:	28p	.26p
				13s	.16s
1702	33904	5μ Lep	.....	<10	.28
1704	33948		B5 V	...	...
1706	33959	14 Aur	Am (A9/A9/F2)	21	.43
1711	34053	108 Tau	A1 IV	100	.47
1714	34109		A0 V	...	...
1718	34203	18 Ori	A0 III	60	.37
1724	34317		Am (B9/A0V/A1)	65	.33
1732	34452		B5 Vp(Si v. st, Fe II st, He wk)	40	.42
1734	34499	18 Aur	A7 IV	111	.57
		ADS 3893A			
1736	34533	ADS 3903A	Am (A2/F0/F3)	15	.33
1738	34557		A2 Vn	200:	.50
1740	34578	19 Aur	A5 Ib-II	10	.46
1745	34653		A6 IV	...	...
1751	34787	16 Cam	B9.5 Vp(λ Boo)n	200:	.26
1752	34790	AB	A1 V + A1 V	43	.19
1758	34868		A1 IV	90	.48
1760	34904		A2 V	140	.47
1762	34968	ADS 3930A	B9 III	70	.43
1774	35189	110 Tau	A2 IV	10p	.28p
				15s	.17s
1777	35242		A1 Vp(4481 wk)	75	.26
1792	35505		A0 V	135	.52
1795	35520		A1 III	80	.43
1807	35656		B9.5 V	...	...
1809	35693		A1 III	80	.46
1819	35909		A4 V	150	.46
1821B	.....	ADS 4068B	A0 Vn	...	...
1827	36060		Am (A5/A9V/F2)	...	...
1832	36162		A2 V	200:	.49
1835	36187		A1 V	...	...
1849	36473	10 Lep	A0 V	45	.31
1850	37484		A1 IIs	41	0.52

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
1853	36496		A5 Vn	180	0.43
1854	36499		Am (A3/A6/A6:)	85	.42
1857	36570	19 Cam ADS 4177A	A0 Vb	...	...
1865	36673	11α Lep ADS 4146A	F0 Ib (standard)	13	.53
1869	36719		F2 V	63	.63
1872	36777	38 Ori	.....	140	.46
1888	36965		B9.5 IVn	220:	.35
1901	37077	45 Ori ADS 4196A	A9 III	55	.52
1905	37147	122 Tau	.....	118	.62
1915	37286		A5: V	60	.44
1919	37306		A1 V	130	.46
1926	37430	ν^1 Col	A9 V	155	.56
1929	37439		A1 Vp(4481 wk)n	210:	.30
1937	37507	49 Ori	A4 IV	170	.44
1940	37594		F0 Vp(MgCa wk)	15	.36
1955	37788		F0 IVs	28	.39
1968	38090	12 Lep	A3 IVn + shell (Ca K, Ti)	205:	.47
1969	38091	26 Cam	A3 Vp(4481 wk)nn	230:	.39
1971	38104	27o Aur	A1 IVp(Cr st, CaMg wk)	21	.29
1974	38189		A3 V	83	.47
1975	38206		A0 IIIs	25	.41
1976	38284	ADS 4376AB	A2.5 V	145	.50
1978	38309	ADS 4333A	F0 IV	75	.67
1989	38545	131 Tau	A2 IVn + shell (Ti II, Ca K, HI)	175	.42
1992	38618	29 Cam ADS 4412A	A3 V	110	.52
1998	38678	14ζ Lep	A3 Vn	200:	.48
1999	38710	52 Ori ADS 4390AB	A7 III	73	.62
2001	38735		A2 Vp(4481 wk)	25p 10s 45t	.13p .08s .26t
2015	39014	δ Dor	A9 V	...	...
2020	39060	β Pic	A6 V	...	...
2025	39182		A1 IIIn + shell (Ti, Ca K)	220:	.38
2026	39190		A3 V	65	.53
2027	39220	31 Cam	A1 V	65	.44
2029	39283	30ξ Aur	A1 IVp(4481 wk)	55	.36
2033	39317	137 Tau	A0 Vp(SiSrCr st, CaMg wk)	30	0.29
2034	39357	136 Tau ADS 4474AB	A0 V + A0 V (SB2)	15p 25s	0.28p .08s
2039	39421		A2 Vp(4481 wk)	215:	.41
2045	39551		A3 Vn	215:	.50
2046	39586		A6 V	90	.60
2050	39662		A1 V	150	.44
2060	39789		A3 Vn	180	.49
2066	39866		A2 III	10	.43
2071	39927		A2 V	80	.52
2074	39970		A0 Ib	35	.61
2079	40062		Am (A4/F0/F2)	85	.75
2085	40136	16η Lep	F2 IV	18	.35
2088	40183	34β Aur ADS 4556A	A2 V + A2 V (SB2)	41	.46
2092	40248	σ Col	F2 III	...	...
2094	40292		F0 III-IV	...	...
2095	40312	37θ Aur ADS 4566B	A0 Vp(Si v. st, CaMg wk)	...	...
2100	40372	59 Ori ADS 4555A	A7 III	71	.63
2102	40394	36 Aur	A1 Vp(Si st, CaMg wk)	10	.22
2103	40446	60 Ori	A1 V	20	.35
2108	40536	2 Mon	Am (A4/A5/A7)s	48	.62
2110	40588		A1 Vp(4481 wk)	110	.23
2111	40589	ADS 4589A	A0 Iab	...	...
2112	40626		A0 IIIs	10	.41
2118	40745		F2 V	33	.43
2123	40873	ADS 4633A	A7 V	121	.60
2124	40932	61μ Ori ADS 4617AB	Am(A4/A5/A7)s	18	.45
2127	40924		B8.5Vp:(Ca st)	125	.41
2129	40972		A1 V	190	.40
2132	41074	39 Aur	F1 V	95	.61
2138	41214		B9 V	...	...
2143	41357	40 Aur	Am (A7/A9/F2)	61	.64
2148	41511	17 Lep	B9 IV + shell	105	.56
2155	41695	18θ Lep	A2 Vn	250:	.56
2160	41759		B9.5 Vn	...	...
2163	41841	ADS 4704A	A2 IV:	48	.48
2164	41843		A1 V	200:	.52
2172	42083		A5 III	25	.54
2174	42111	ADS 4749A	A1 Vn + shell (HI,Ca,Ti)	245:	0.46

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s⁻¹	4481 W(A)
2175	42126	41 Aur	A7 III-IV	120	0.68
		ADS 4773B			
2176	42127	41 Aur	A2 V	125	.60
		ADS 4773A			
2179	42278		F0 III	18	.29
2180	42301		A0 Vn	225:	.39
2181	42303	π^2 Col	A0 V	...	...
2182	42327		B9.5 IVnn	355:	.31
2195	42536		A1 Vp(SrCr st, CaMg wk)	25	.37
2206	42729		B9.5 V	20	.36
2209	42818		A0 Vnn	220:	.37
2210	42824		A2 V	120	.51
2214	42954		A4 III	15	.27
2228	43244	42 Aur	A6 Vp(4481 wk)n	210:	.55
2234	43319	ADS 4865A	A3 V	65	.66
2238	43378	2 Lyn	A2 V	35	.44
2247	43525	75 Ori	.....	225:	.50
		ADS 4890AB			
2253	43683	ADS 4901A	A1 IVn	180	.51
2255	43760	6 Mon	F1 IV	15	.39
2257	43812	4 Lyn	A2 Vp(4481 wk)	150	.34
		ADS 4950AB			
2258	43819		B9.5 V:p(SiSrCr st)	10	.34
2262	43847		A5 II	...	...
2265	43940		A2 Vn	...	...
2272	44092		A1 IV	45	.44
2280	44333	ADS 4971AB	A9 V	175	.59
2285	44472	ADS 5039A	A6 V	95	.56
2287	44497		F1 V	95	.58
2291	44691		Am(A3/A8/A6)	21	.42
2295	44756		A1 IV-V	...	...
2298	44769	8ε Mon	A7 V	135	.59
		ADS 5012A			
2300	44793		B8 Vn + shell (Hi,Ca K)	270:	.40
2304	44927		A0 Vp(4481 wk)s + A?n	20	.21
2312	45050	AB	B9 V	115	.37
2320	45229	ν Pic	Am (A2/A7V/A7)	...	...
2321	45239		A2 Vp(4481 wk)	135	.44
2324	45320		A2 Vp(4481 wk)n	250:	.43
2327	45357		A0 Vn	210:	.47
2328	45380	ADS 5070A	B9.5 V	220:	.43
2330	45394	16 Gem	A2 IV	15	0.39
2345	45557		A0 V	...	...
2346	45560		A1 V	...	...
2350	45618		Am (A5/A7/A7)	...	...
2351	45638		F0 IV	35	0.49
2362	45927		B9 IVp(4481 wk)	55	.33
2371	46031	19 Gem	F0 V	115	.57
2372	46052		Am (A2/A5/A7) SB2	35p	.35p
				55s	.27s
2375	46089		A5 Vp(4481 wk)	110	.40
2383	46251		A2 V	145	.51
2385	46300	13 Mon	A0 Ib	10	.44
2386	46304	A	A6 Vp(4481 wk)n	200:	.47
2402	46590	11 Lyn	A1 V	80	.44
2404	46642	14 Mon	A0 IV	40	.41
		ADS 5211A			
2414	46933	5ξ² CMa	A0 V	85	.42
2417	47020		A2 Vn	190	.47
2421	47105	24γ Gem A	A2 IV	10	.41
2425	47152	53 Aur AB	A2 Vp(λ Boo)	25	.20
2448	47561		A2 V	35	.42
2449	47575	ADS 5302A	A2.5 V	75	.53
2455	47827	AB	B9 Vp(4481 wk)	15	.26
2457	47863		A0 III	25	.41
2466	48097	26 Gem	A2 V	90	.54
2470	48250	12 Lyn	A2.5 V	125	.47
		ADS 5400A			
2470	48250	ADS 5400B		140	.51
2471	48272		A1 III	150	.47
2481	48501	ADS 5377A	F5 Vwl (met: A9)	38	.41
2489	48843	32 Gem	A9 II	13	.45
2491	48915	9α CMa	Am (B9.5/A0/A1)s	15	.42
		ADS 5423A			
2498	49048		A1 V	190	.46
2499	49050	ADS 5447AB	A2 V	80	.52
2502	49147		B9.5 IV	120	.44
2528	49891	ADS 5498A	A1 IV	30	.45
2529	49908	36 Gem	A1 V	105	.46
		ADS 5511A			
2532	49949		A5 Vp(4481 wk)n	225:	.50
2534	49976		A7: Vp(SrCr st, CaMg wk)	23	.39
2539	50018	59 Aur	F2 V	150	0.68
		ADS 5534A			

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
2540	50019	34θ Gem	A2 IV	120	0.56
		ADS 5532A			
2543	50062		A2 IV	40	.48
2551	50277		A8 Vn	215:	.53
2557	50420		F1 IV	28	.48
2564	50635	38 Gem	A8 V	145	.56
		ADS 5559A			
2565	50644		F1 IV	13	.45
2566	50643		Am (A5/A9/F0)	13	.47
2570	50700	ADS 5557AB	A5 V	145	.62
2572	50747		A3 V	51	.50
2578	50853		A1 IV	180	.48
2584	50931		A0 V	55	.37
2585	50973	16 Lyn	A0 Vn	215:	.44
2588	51055	17 CMa	A2 IV	35	.48
		ADS 5585A			
2597	51330		F2 V	28	.50
2606	51693		A2 V	140	.54
2607	51733	ADS 5629AB	F2 V	110	.60
2620	52100	ADS 5680A	A8 V	115	.62
2629	52479		A2 V	25	.42
2644A	52859	ADS 5746A	A2 IV-V	35	.50
2644B	...	ADS 5746B	A2 V	135	.59
2647	52913		A2.5 V	85	.58
2700	54801	47 Gem	A4 IV	90	.57
2705	54958	A	F4 V	10	.28
2707	55057	21 Mon	F1 IV	125	.68
2710	55111		B9.5 V + A0 (SB2)	95	.40
2714	55185	22δ Mon	A0 V	140	.47
		ADS 5864A			
2716	55344		B9.5 III	135	.58
2724	55595		A6: V	155	.48
2751	56169		A3 Vn	225:	.51
2753	56221	64 Aur	A4 Vn	195	.54
2755	56341		A0 V	35	.37
2757	56386		B9.5 Vn	...	...
2758	56405		A2 V	145	.56
2763	56537	54λ Gem	A3 V (standard)	140	.59
		ADS 5961AB			
2768	56731	A	.....	15	.44
2772	56820	47 Cam	Am (A7/F1/F2)	28	0.58
		ADS 5995A			

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
2776	56963		Am (A9/F2/F3)	83	0.61
2777	56986	55δ Gem	A9 V	130	.54
		ADS 5983AB			
2780	57049		A0 V	210:	.59
2783	57102	ADS 6012B	B9 Vn	255:	.42
2784	57103	19 Lyn	B4 V (SB2)	60	.27
		ADS 6012A			
2785	57118		F0 Iab	15	.57
2810	57744	58 Gem	A0 V	155	.50
2816	57927	59 Gem	F3 V	93	.65
2818	58142	21 Lyn	A0.5 Vs	15	.38
2820	58187	1 CMi	A3 Vn	145	.56
2831	58439	A	A2 Ib	20	.58
2832	58461		.....	15	.26
2836	58552		A1 IIIs	10	.42
2837	58579	61 Gem	F0 Vp(4481 wk)	130	.54
2839	58585	A	F0 V	13	.47
2850	58907		A0 V	70	.41
2851	58923	5η CMi	F0 IV	45	.59
2852	58946	62ρ Gem	F0 V	63	.43
		ADS 6109A			
2853	58954	ADS 6093A	A9 Vn	165	.60
2857	59037	64 Gem	A2.5 V	160	.54
2863	59256		B9 IV	75	.43
2872	59507		A1.5 V	115	.51
2874	59412	A	A5 II	21	.54
2880	59881	7δ^1 CMi	F0 IV	61	.61
2886	60107	68 Gem AB	A1 Vp(4481 wk)	140	.33
2887	60111	8δ^2 CMi	F2 V	101	.83
2890	60178	66α Gem	A2 IV	25	.52
		ADS 6175B			
2891	60179	66α Gem	Am (A0/A2:/A1IV)s	10	.40
		ADS 6175A			
2898	60335	ADS 6191AB	F2 V	10	.44
2900	60345		A6 V	85	.60
2901	60357	9δ^3 CMi	A0 Vp(4481 wk)nn	240:	.24
2904	60489		Am (A8/F1/F0)	15	.36
2912	60629		A0.5 III	40	.44
2914	60652		Am (A7/A8/F2)	63	.69
2926	61035		F1 V	133	.51
2931	61219		A2 V	125	.49
2933	61227		.....	10	0.46

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s⁻¹	4481 W(A)
2936	61295		F2 IV	33	0.49
2946	61497	24 Lyn	A2 IVn	215:	.35
		ADS 6285A			
2950A	61563	ADS 6263A	A0 IV	50	.35
2950B	....	ADS 6263B	A0 IV	...	...
2958	61749		A6 V	100	.52
2962	61859		F5 V	10p	.33p
				28s	.17s
2966	61887		B9.5 V	155	.40
2969	61931		B9 Vn	200:	.41
2977	62140	49 Cam	A7 Vp(Sr v. st, CrEu 4200 st, CaMg wk, K sn)	18	.29
2989	62437		F0 V	35	.53
2991	62510	79 Gem	A0.5 V	110	.48
2992	62555	A	A4 III	35	.48
2996	62633	3 Pup	A2 Iab	35	.57
3007	62781		.....	270:	.43
3009	62863	2 Pup B	F0 V + F0 V˙(SB2)	60p	.29p
		ADS 6348B		35s	.21s
3010	62864	2 Pup A	A2 V	55	.49
		ADS 6348A			
3015	62952	4 Pup	F0 IV	95	.59
3021	63208	82 Gem	A0 V + G0 III	...	...
		ADS 6378AB			
3039	63586		B9.5 IV	205:	.45
3040	63589	A	Am (A2.5/A5/A7)	31	.53
3060	64042	ADS 6414A	.....	155	.46
3067	64145	83ϕ Gem	A3 V	150	.64
3077	64347		A1 V	40	.43
3082	64486		B9.5 IVs	...	...
3083	64491		A9 Vp(λ Boo)	15	.14
3108	65299		A2 IV	...	...
3109	65339	53 Cam	A3 Vp(Sr v. st, SiCrEu st, CaMg wk)	15	.26
3131	65810		.....	215:	.56
3132	65856	4ω^2 Cnc A	A1 V	145	.43
3136	65900	A	A1 IV	20	.40
3163	66664	8 Cnc	A1 V	175	.47
3164A	66684	ADS 6569A	B9.5 Vp(λ Boo)	65	.26
3164B	....	ADS 6569B	A0 Vp(4481 wk)n	...	...
3167	66824	28 Lyn	B9.5 Vp(CaMg wk)	15	.25
3173	67006	27 Lyn	A0 V	175	0.51
		ADS 6600A			
3174	67159	ADS 6588A	.....	110	0.34
3183	67456	A	A5 IIIs	15	.44
3189	67725		A0 Vp(4481 wk)n	...	...
3190	67751	A	A7 V	100	.61
3197	67934		A0 Vp(4481 wk)n	...	...
3198	67959		A1 III	10	.41
3214	68332		A7 III	78	.61
3215	68351	15 Cnc	A0: V:p(SiSr st, CaMg wk)s	25	.25
3221	68457	ADS 6680A	A8 V	45	.51
3224	68543		A2 Vn	235:	.57
3228	68703	ADS 6673A	F1 IV	75	.67
3230	68758		A2 Vn	250:	.49
3235	68930	29 Lyn	A5 III	75	.54
3255	69589		A1 IV	110	.52
3257	69665	21 Pup	A2 IV	70	.44
3258	69682		F0 IV	25	.41
3265	69997		Am (F2/F1/F4)	25	.40
3277	70313		A2.5 V	100	.53
3278	70340	ADS 6762AB	A2 Vp(SrCr st, CaMg wk)	25	.26
3279	70442		G2 III + A?	41p	.41p
				21s	.21s
3284	70569	20 Cnc	F0 V	41	.52
3285	70574		F0 V	115	.64
3308	71141		A2 IV	50	.47
3310	71150	23ϕ^2 Cnc	A5 IV	120	.34
		ADS 6815B			
3311	71151	23ϕ^2 Cnc	A2 Vp(4481 wk)	135	.41
		ADS 6815A			
3314	71155		A0 V	115	.41
3320	71267		A7 V	15	.44
3321	71297	2 Hya A	F0 Vwl(met: A6)	13	.43
3329	71496	28 Cnc	F0 V	120	.67
3333	71555	29 Cnc	A7 V	105	.54
3335	71581		A2 V + A2 V	20	.36
3337	71663	ADS 6828AB	F0 V	25p	.28p
				18s	.21s
3339	71688		A2.5 V	100	.52
3344	71815		A2 Vs	25	.45
3352	71973	ADS 6872A	Am (A4/F0/F2)	...	...
3354	72037	2 UMa	Am (A3/A5/A7)s	18	.43
		ADS 6872A			
3355	72041	30υ^1 Cnc	F0 V	103	0.54

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
3361	72208		B9.5 Vp(HgMnEu st, CaMg wk)	15	0.20
3367	72310	ADS 6862AB	B9 Vp(4481 wk)	40	.26
3372	72359	34 Cnc	A0 IIIp(Sr st)	10	.34
3374	72462	AB	A6 Vn	180	.55
3377	72524	33 Lyn	A0 Vn	275:	.40
3380	72617	A	F2 V	78	.51
3381	72626	ADS 6871AB	F0 V	88	.60
3383	72660		A1 II	10	.45
3394	72943		F0 Vp?(Sr st)	71	.58
3398	72968	3 Hya	A1 Vp(SrCr v. st, CaMg v. wk)	10	.36
3401	73029		A1 Vn	230:	.47
3402	73072		A2 V + F8 III	30p 13s	... ...
3406	73143	36 Cnc	A3 V	35	.47
3410	73262	4δ Hya	A0 Vnn	265:	.50
3412	73316	37 Cnc	A0.5 Vs	20	.41
3416	73451		A1 V + F5 II	68p 15s	.52p .16s
3420	73495	η Pyx	B9.5 Vn	220:	.44
3429	73731	41ε Cnc	A5 III	51	.59
3437	73997		A0 V	185	.43
3446	74190		A7 V	58	.51
3449	74198	43γ Cnc	A1 IV	65	.48
3450	74228	45 Cnc	A0 V F8 III	65p 60s	.34p .27s
3465	74521	49 Cnc	A1 Vp(HgMnSiEu st, CaMg wk)	10	.32
3469	74591	10 Hya	A6 V	115	.55
3473	74706		A5 V	115	.54
3474	74738	48ι Cnc ADS 6988B	A1 V	155	.56
3481	74873	50 Cnc	A1 Vp(4481 wk)	10	.32
3483	74879		A3: V	55	.52
3486	74988		A2 V	135	.50
3492	75137	13ρ Hya ADS 7006A	B9.5 IV	115	.45
3500	75333	14 Hya	B8 IIIp(HgMn)	20	.24
3504	75469		A1 III	10	.39
3505	75486	5 UMa	F0 IV	103	0.60
3507	75495		A5 V	...	...
3519	75698	51σ^1 Cnc ADS 7057A	A5 V	73	0.55
3523	75737	15 Hya ADS 7050AB	Am (A4/A9/F2)	21p 15s	.38p .17s
3526	75811	ADS 7061A	Am (A4/A6/A7)	10	.36
3528	75896		A2 IV	70	.49
3552	76369	17 Hya ADS 7093B	Am (A4/F1/F2)	55	.54
3553	76370	17 Hya ADS 7093A	Am (A1/F2/F3)	13	.44
3555	76398	59σ^2 Cnc	A5 V	120	.61
3556	76483	Pyx ADS 7095A	Am (A2/A9/F0)	60	.56
3559	76512		A5 V	120	.63
3561	76543	62o^1 Cnc	A6 V	90	.67
3565	76582	63o^2 Cnc	A7 V	95	.71
3566	76595		A1 V	85	.44
3569	76644	9ι UMa ADS 7114A	A7 IV (standard)	140	.65
3572	76756	65α Cnc ADS 7115AB	Am (A5/A9/F0)	65	.54
3573	76757	A	A2 IV	105	.56
3586	77093		A6 Vn	170	.50
3587	77104	66 Cnc ADS 7137A	A2 V	...	...
3589	77190	67 Cnc	A6 V	...	...
3592	77309		A1 V	...	...
3594	77327	12κ UMa ADS 7158AB	A0 Vp(4481 wk)n	185	.37
3595	77350	69ν Cnc	B9 Vp(SrHgMn)	<10	.33
3601	77537		A0 Vn	...	...
3606	77660		F0 V	...	...
3608	77692		A1 III	...	...
3619	78209	15 UMa	Am (A2/A7/F3)	33	.46
3623	78316	76κ Cnc	B8 IIIp(HgMnEu st, Mg wk)	10	.22
3624	78362	14ι UMa ADS 7211A	Am (A4/F1/F3)s	13	.47
3635	78661		F2 Vwl(met. A8)	71	.44
3637	78676		Am (A6/A9/F0)	45	.51
3638	78702		A0 V	205:	.57
3644	78922	ε Pyx	A6 III-IV	100	.59
3645	78935		A8 V	115	.68
3646	78955		A0 V	75	0.43

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
3649	79066		F0 IV	21	0.37
3651	79108		A0 Vp(λ Boo)	160	.38
3652	79158	36 Lyn	B9 IVp(HgMn st, CaMg wk)	40	.32
3655	79193	21 Hya	.....	15	.40
3657	79248		A2 V	30	.45
3662	79439	18 UMa	A6 V	145	.54
3675	79752		.....	245:	.48
3676	79763		A0 V (SB2)	35	.41
3686A	80024	ADS 7286A	A8 Vn	100	.57
3686B	....	ADS 7286B	A5 Vn	135	.65
3689	80064	ADS 7285A	A3 V	45	.49
3690	80081	38 Lyn ADS 7292A	A1 V	195	.56
3702	80447		A2 Vs	10	.34
3711	80613		B9.5 Vn	200:	.49
3719	80930		A3 IV	...	...
3724	81009	ADS 7334AB	F1 p(SiSrCrEu)	10	.36
3727	81039		A6 V	150	.58
3744	81728	29 Hya ADS 7382AB	A0 IIIp(4481 wk)	45	.25
3757	81937	23 UMa ADS 7402A	F0 V	140	.59
3758	81980	ADS 7396A	A6 Vn	190	.50
3760	82043		F0 IV	51	.55
3778	82380		A3 V	155	.50
3785	82428		A6 Vn	210:	.48
3787	82446	32 τ^2 Hya	A2 IV	65	.50
3792	82523	ADS 7426A	A3 Vp(4481 wk)nn	220:	.37
3796	82573		A7 V	65	.53
3797	82582		A9 V	150	.54
3798	82610	S Ant	Am: (A5/F0/A7)	155	.59
3799	82621	26 UMa	A0 Vn	165	.47
3806A	82685	ADS 7446A	F0 V	105	.58
3806B	....	ADS 7446B	F2 V	93	.64
3810	82747		A0 Vp(4481 wk)	160	.22
3818	83023	7 Leo ADS 7448A	A0 V	100	.44
3822	83104		A1 V	45	.35
3829	83287	42 Lyn	A9 V	101	.79
3832	83373	34 Hya	A0 II-IIIs	20	0.39
3846	83650	37 Hya	A0 V (SB2)	...	...
3847	83727		A9 V	...	...
3848	83731		A2 V	70	0.50
3852	83808	14 Leo	Am (A3/A5/A5)	...	...
3854	83869		A0 V	135	.53
3855	83886		A3 V	83	.58
3861	84107	15 Leo	A2 IV	31	.44
3865	84179	28 UMa A	F2 V	98	.60
3879	84607		F2 V	98	.74
3880	84722	19 Leo AB	A7 V	135	.55
3885	84812		A9 Vn	210:	.51
3889	85040	20 Leo AB	Am (A9/F1/F1)	18p 25s	.21p .15s
3894	85235	30φ UMa ADS 7545AB	A2 IV	20	.31
3899	85364	6 Sex	A7 V	130	.68
3900	85376	22 Leo	Am (A5/F0/A8)	105	.54
3906	85504	7 Sex	B9.5 III	15	.43
3909	85558	8γ Sex ADS 7555AB	A2 V	110	.52
3917	85795	31 UMa	A2 V	140	.51
3921	85905		A1 Vn(K sn)	245:	.37
3931	86266	ADS 7591A	A6 V	175	.62
3933	86301		A5 V	180	.53
3936	86358		F2 V	25	.33
3945	86611	12 Sex	A9 Vn	215:	.60
3958	87243		A2 V	185	.58
3962	87318	ADS 7625A	A0 Vn	220:	.48
3963	87344	ADS 7627A	B9 IV	15	.34
3965	87427		A9 V	180	.62
3969	87500		.....	170	.74
3974	87696	21 LMi	A9 Vp(λ Boo; met: A5)	150	.62
3975	87737	30η Leo	.....	15	.52
3981	87887	15α Sex	B9.5 III	10	.36
3985	88024		A1 V	85	.48
3986	88025		B9.5 V	95	.41
3988	88182		Am (A4/F0/F0)	88	.78
3989	88195	17 Sex	A0 IIIp(Fe II st, 4481 wk) + shell	180	.39
4000	88372		A0 Vn	215:	.41
4003	88522	ADS 7681AB	A0 V	15	.31
4011	88699		Am (F0/F2/F2)	58	.72
4016	88815		F2 IVwl(met: A9)	41	.44
4021A	88849	ADS 7705A	Am (A7/F1/F3)	21	0.42

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s⁻¹	4481 W(A)
4021B	88850	ADS 7705B	Am (A9/F1/F3)	...	...
4024	88960	23 LMi	A0 Vp(4481 wk)n	235:	0.35
4026	88983	32 UMa	A5 V	120	.51
4031	89025	36ζ Leo	.....	81	.61
4033	89021	33λ UMa	A2 IV (standard)	40	.48
4041	89239		A2 Vp(λ Boo; met:B9.5)	135	.44
4047	89343		A7 III	160	.64
4055	89455		A9 V	155	.63
4062	89571		A9 V	...	...
4070	89774	42 Leo	A1 IV	50	.43
4071	89816		A5 Vn	180	.57
4072	89822		A1: Vp(SiSrHg st, CaMg wk)	<10	.31
4073	89828	ADS 7739	A: A1 Vnn AB:	255:	.54
4075	89904	27 LMi	A5 V	180	.50
4076	89911		Am (A0/A1/A2)s (SB2)	10p 10s	.29p .11s
4082	90044	25 Sex	A2: IVp(SiCrSrHgMn st, CaMg wk)	15	.34
4083	90071		F2 Vp(λ Boo; met: F0, 4481 wk)	15	.30
4090	90277	30 LMi	Am (F0/F2/F2)	33	.54
4096	90470		A3 V	105	.57
4101	90569	45 Leo	A2: Vp(SiSr st, CaMg wk)	<10	.30
4108	90745		A6 V	120	.63
4109	90763		Am (A0/A2/A2)	30	.46
4113	90840	32 LMi	A3 IV	70	.50
4124	91130	33 LMi ADS 7813A	A0 Vp(λ Boo)	190	.21
4131	91311		A0 V	160	.36
4132	91312	ADS 7826A	A6 V	115	.54
4137	91365	34 LMi	A0 V	165	.46
4148	91636	49 Leo ADS 7837AB	A2 IV	15	.40
4152	91790		A5 V	105	.46
4155	91858		A7 III-IV	145	.59
4160	91992		A7 Vn	200:	.48
4172	92245		A0 IVp(4481 wk)nn	235:	.30
4189	92769	40 LMi ADS 7899A	A3 Vn	195	.54
4191	92787	A	F0 V	65	.51
4192	92825	41 LMi	A1 V	185	.45
4197	92941		A4 V	195	0.44

HR	HD	Other	MK Classification	V sin i km s⁻¹	4481 W(A)
4214	93397		Am (A4/A6 V/A6)	85	0.54
4218	93526	ADS 7930A	B9.5 IIp(4481 wk)	10	.29
4227	93702	53 Leo	A0 V	205:	.46
4229	93742	40 Sex ADS 7936AB	A2 III-IV	51	.54
4230	93765	44 LMi	F2 Vp(4481 wk)	15p 10s	.21p .19s
4237	93903	41 Sex ADS 7942A	Am (A3/A7 V/A9)	18	.39
4244	94180	A	A3 V	55	.49
4248	94334	45ω UMa	A0 III	35	.39
4254	94480	48 LMi	F2 IV	135	.76
4259	94601	54 Leo A ADS 7979A	A0 V	150	.34
4260	94602	54 Leo B ADS 7979B	A0 Vn	200:	.42
4286	95256		Am (A3/A5/A7)	53	.60
4288	95310	49 UMa	F0 V	75	.71
4294	95382	59 Leo ADS 8019A	A6 IV	71	.59
4295	95418	48β UMa	A1 IV	35	.43
4300	95608	60 Leo	Am (A1/A2/A3)	13	.42
4302	95698	ADS 8028AB	F0 V	33	.45
4303	95771		.....	135	.59
4309	95934	51 UMa ADS 8046A	A3 Vp(4481 wk)	75	.40
4315	96220		F0 Vn	200:	.55
4320	96441		A1 V	125	.59
4322	96528	64 Leo	Am (A3/A6/A6)	85	.56
4330	96707		A7 IVp(Sr)	33	.46
4331	96723		A1 IVs	15	.43
4332	96738	67 Leo ADS 8071A	A2.5 V	60	.49
4334	96819		A2 Vn	230:	.52
4340	97138		A3 V	115	.56
4341	97244		A6 V	75	.56
4343	97277	11β Crt	A2 IV	40	.55
4344	97302		A2 IV-V	145	.54
4347	97411	ADS 8086AB	A0 IVp(4481 wk)	25	.28
4356	97585	69 Leo	B9.5 Vn	175	.54
4357	97603	68δ Leo	A4 Vn	165	.54
4359	97633	70θ Leo	A1 IV (standard)	15	.40
4366	97937		A9 Vp(4481 wk)	120	0.54

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
4368	98058	74φ Leo A	A6 Vn	235:	0.61
4369	98088	ADS 8115A	F1 p(SrCrSi v. st, CaMg wk)	31p	.12
				16s	...
4378	98280		A2 Vs	10	.49
4380	98253	55 UMa	A1 Vp:(4481 wk)	65p	.29p
				25s	.12s
4388	98673		A3 Vn	240:	.46
4391	98772		A1 IVn	230:	.53
4405	99211	14γ Crt	A7 V	130	.60
		ADS 8153A			
4410	99329	80 Leo	F1 V	155	.71
4422	99787	57 UMa	A1 V	150	.45
		ADS 8175A			
4424	99859		A3 IV	73	.52
4429	99945		Am (A2/F1/F0)	...	...
4454	100518		Am (A2/A5III/A6)	10	.43
4464	100740		A3 Vn	240:	.37
4465	100808	ADS 8231AB	F0 Vn	155	.60
4477	101107	59 UMa	F1 IV	98	.60
4481	101150	ADS 8249AB	A3 IV	205:	.45
4490	101369	ADS 8259A	A1 IV	55	.42
4493	101391		B9 Vp(HgMn)	45	.30
4515	102124	2ξ Vir	A4 V	130	.48
4527	102509	93 Leo	A6 III + F8 III	...	...
4528	102510	4 Vir	A3 IV	70	.52
4531	102590	ADS 8311AB	A9 V	78	.62
4534	102647	94β Leo	A3 V	115	.57
		ADS 8314A			
4535	102660		Am (A2.5/F1/F3)	18	.38
4543	102910	ADS 8330A	Am (A5/F0/F2)	68	.65
4545	102942	A	Am (A4/A6/A7)	41	.57
4547	102990	A	F3 V	18	.31
4554	103287	64γ UMa	A0 V (standard)	165	.46
4555	103313		Am (A9/F1/F1)	61	.62
4560	103483	65 UMa	A2 Vn	75p	.27p
		ADS 8347A		95s	.30s
4561	103498	65 UMa	F0 IVp(CrSrEu)s	...	...
		ADS 8347D			
4564	103578	95 Leo	A3 IVp(4481 wk)s	10	.30
4567	103632	30η Crt	A1 III	55	.45
4574	103928	ADS 8368A	F0 V	83	.59
4579	104039	ADS 8371AB	A1 IIIs	<10	.43
4584	104179		F0 V	105	0.64
4585	104181	7 Vir	A1 V	35	0.34
4589	104321	8π Vir AB	Am (A5/A5/A7)	61	.47
4594	104513	67 Vir A	Am (A4/A6/A7)	78	.64
4602A	104827	2 Com	F0 V	38	.50
		ADS 8406A			
4602B	....	ADS 8406B	Am (A9/F2/F2)	...	...
4629	105702	11 Vir	F3 III	33	.69
4632	105778	3 Com	A1 V	175	.50
4633	105805		A2 Vp(4481 wk)n	190	.45
4635	105850	3 Crv	A2 IV	122	.57
4646	106112		Am (A4/F2/F3)	78	.69
4650	106251	12 Vir	Am (A3/F2/F2)	51	.65
4660	106591	69δ UMa A	A2 Vn	215:	.48
4663	106661	6 Com	A2 Vn	175	.53
4670	106819		A3 V	65	.58
4673	106887	ADS 8501A	Am (A3/A6/F1)	85	.69
4680	107054		F0 Vp(4481 wk)	145	.50
4681	107070	13 Vir	A5 V	145	.51
4684	107131		A5 Vn	180	.62
4685	107168	8 Com	Am (A7/F2/F3)	15	.63
4687	107193		A0 Vn	225:	.36
4689	107259	15η Vir AB	A2 IV	10	.34
4694	107326		F0 V	130	.72
4705	107655		A1 III	35	.34
4707	107700	12 Com	.....	13p?	.16p
		ADS 8530A		41s?	.29s
4715	107904	4 CVn	F3 IV	115	.73
4717	107966	13 Com	A3 V	40	.52
4719	108007	ADS 8539AB	F0 V	125	.76
4722	108107		A2 Vn	195	.48
4733	108283	14 Com	A9 Vp(λ Boo)	185	.52
4738	108382	16 Com	A4 V	65	.53
4746	108506		F4 Vn	180	.77
4750	108642		Am (A2/A7/A7)	13	.42
4751	108651	ADS 8568BC	Am (A2/F1/F2)	18	.44
4752	108662	17 Com	A9: Vp(CrSrEu)	10	.39
		ADS 8568A			
4756	108765	20 Com	A2.5 V	120	.47
4760	108844	74 UMa	A8 V	78	.68
4766	108945	21 Com	A3 IIIp(SrCr)	65	.53
4775	109085	8η Crv	F0 III	81	.66
4776	109141		F2: III-IV	135	0.68

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
4778	109238		F0 V	85	0.65
4780	109307	22 Com	Am (A5/A7/A7)	13	.48
4781	109309	21 Vir	B9.5 V	115	.41
4789	109485	23 Com	A0 Vs	50	.35
4797	109585		F0 V	91	.54
4799	109704	25 Vir	A2 V	140	.56
4805	109860		A1 IVs	60	.40
4809	109931		F0 Vn	200:	.52
4811	109980	9 CVn	A6 Vp(λ Boo)	255:	.39
4816	110066		A0 III:p(SrCrEu v. st)	21	.54
4824	110377	27 Vir A	A6 Vp(λ Boo)	160	.48
4825	110379	29γ Vir ADS 8630A	F0 IV	28	.36
4826	110380	ADS 8630B	F0 IV	15	.30
4828	110411	30ρ Vir	A0 Vp(4481 wk)	140	.21
4833	110462	76 Vir	A2 IV	40	.47
4847	110951	32 Vir	Am (A5/F0/F2)	28	.42
4852	111112		A7 V	...	...
4854	111133	EP Vir	A0 Vp(SrCrEu v. st, Ca, met wk)s	10	.38
4855	111164	34 Vir	A3 Vp(λ Boo)	175	.53
4859	111270		A7 V	93	.57
4861	111308	28 Com	A0 Vp(4481 wk)	175	.30
4865	111397	29 Com	A1 V	150	.52
4866	111421	11 CVn	A7 V	48	.58
4869	111469	30 Com ADS 8674A	A1 V	195	.53
4875	111604		A5 Vp(λ Boo)	180	.36
4881	111786		F0 Vp(λ Boo, met: A1)	135	.14
4886	111893		A4 Vn	215:	.44
4892	112014	ADS 8682B	A0 V + A0 V (SB2)	...	...
4893	112028	ADS 8682A	A0 IIp(MgSi wk)s	...	...
4900	112097	41 Vir	F0 Vp(λ Boo, met:A7)	61	.54
4901	112131		A2 V	115	.48
4904	112171		A7 V	120	.58
4905	112185	77 UMa	A0 Vp(SiSr, met: st, CaMg wk)	25	.30
4911	112304		B9.5 Vn	180	.44
4914	112412	12α^1 CVn ADS 8706B	Am (A9/F4/F3)	10	.34
4915	112413	12α^2 CVn ADS 8706A	A0 Vp(SiEu, met st, CaMg wk)	...	...
4916	112429	8 Dra	F2 Vwl(met: A7)	130	0.60
4917	112486	ADS 8710AB	Am (A2/A8/A7) (SB2)	10p 10s	0.27p .20s
4921	112846	44 Vir ADS 8727A	A4 V	95	.42
4936	113436		A1 Vp(4481 wk)n	215:	.44
4937	113459	48 Vir ADS 8759AB	F0 V	140	.62
4948	113865	ADS 8777A	A3 V	75	.64
4950	113889	ADS 8772AB	Am (A5/A9/F0)	115	.67
4963	114330	51θ Vir ADS 8801AB	A2 IVs	<10	.35
4971	114447	17 CVn ADS 8805A	F0 V	71	.51
4974	114504	A	A0 IV	80	.47
4978	114576	AB	A3 V	185	.56
4990A	114846	54 Vir ADS 8824A	B9 V	90	.43
4990B	....	ADS 8824B	A2 Vp(Sr st, CaMg wk)	...	...
5003	115227		A2 V	110	.39
5004	115271	19 CVn	Am (A6/A6/A8)	98	.67
5005	115308		F2 Vp(CaMg wk)	75	.49
5010	115365	A	A6 V	165	.52
5014	115488	AB	A6 V	120	.48
5017	115604	20 CVn	F3 IV	15	.46
5021	115709		A2 IV	55	.49
5023	115735	21 CVn	B9.5 V	90	.41
5025	115810	ADS 8861D	A7 IV	101	.56
5031	115995	ADS 8864AB	A1 III	58	.45
5033	116061		A2 V	165	.56
5037	116160		A1 V	205:	.49
5040	116235	64 Vir	Am (A3/A6/A7)	18	.46
5045	116303		Am (A4/F0III-IV/A9)	28	.27
5054	116656	79ζ UMa ADS 8891A	A1 IVs	25p 25s	.26p .24s
5055	116657	ADS 8891B	Am (A2/A6/A6)	51	.56
5057	116706		A3 Vs	45	.48
5059	116831		A8 V	135	.66
5062	116842	80 UMa	A5 Vn	210:	.58
5074	117200	A	F5 Vwl(met: F0 V)	21	.33
5075	117201	B	F2 Vs	10	.31
5076	117242		A9 V	95	.56
5079	117281		A8 V	71	0.58

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
5085	117376	A	A0 V	140	0.41
5088	117436	72 Vir	F1 V	155	.58
		ADS 8924A			
5090	117558		A2 V	140	.54
5094	117661	73 Vir AB	A7 III	51	.65
5097	117716		A2 V	180	.53
5105	118022	78 Vir	A7 Vp(CrEuSr st, CaMg wk)	13	.41
5106	118054	ADS 8954AB	A1 Vp(SrSi)	50	.37
5107	118098	79ζ Vir	A2 IVn	205:	.45
5108	118156	ADS 8956A	A8 V	101	.75
5109	118214	81 UMa	B9.5 V	135	.45
5112	118232	24 CVn	A5 V	145	.61
5116	118295		A9 V	135	.71
5120	118349	ADS 8966A	A8 V	103	.62
5127	118623	25 CVn	F0 Vp(λ Boo)n	190	.45
		ADS 8974AB			
5129	118660		A8 V	83	.60
5138	118889	ADS 8987AB	F2 V	130	.63
5142	119024	82 UMa	A2 Vp(4481 wk)n	240:	.48
5144	119055	1 Boo	A1.5 V	45	.42
		ADS 8991A			
5146	119086	ADS 8994AB	A1.5 V	95	.45
5153	119213		A2 IVp(Sr v. st, Cr st)	25	.38
5162	119476		A1.5 V	140	.48
5163	119537		A1 IVs	10	.38
5167	119752		A0 V	165	.51
5169	119765		A0 V	120	.43
5170	119786	85 Vir AB	A0 V	205:	.43
5179	120047		A5 Vn	220:	.56
5187	120198	84 UMa	A0 Vp(SrCrEu st, Ca wk)	45	.41
5197	120455		A0 IIIs	...	...
5204	120600		A8 V	113	.58
5214	120818		A4 V	115	.53
5216	120874		A2 V	70	.52
5220	120934		A1.5 V	70	.51
5229	121164		A8 IV	65	.63
5238	121409	86 UMa	B9.5 Vp(4481 wk)n	...	...
5244	121607	92 Vir	A7 V	130	.60
5255	121996	10 Boo	A0 V	65	.46
5262	122365		A3 V	115	.56
5263	122405	11 Boo	A7 V	110	.58
5264	122408	93ρ Vir	A3 V	170	0.38
		ADS 9085A			
5280	122866		A1 V	80	0.51
5284	122958		A1.5 V	160	.47
5290	123255	95 Vir	F0 IV	165	.71
5291	123299	11α Dra	A0 III (standard:)	15	.32
5303	123998	η Aps	Am (A1/A8V/F0) (SB2)	...	...
5305	124063	3 UMi	A8 V	58	.65
5313	124224	ADS 9152A	B8.5 Vp(Si)	115	.29
5324	124576		A0 V	100	.46
5329	124675	17κ^2 Boo	A7 V	115	.57
		ADS 9173A			
5332	124683		B9.5 V	95	.44
5333	124713		A7 V	73	.55
5341	124915		Am (A8/F1/F1)	68	.48
5342	124931		B9.5 V	55	.47
5343	124953		Am (A8/F1/F1)	85	.62
5345	125019		A2 V	150	.61
5349	125158		Am (A5/F1/F2)	...	...
5350	125161	21ι Boo	A6 V	130	.65
		ADS 9198A			
5351	125162	19λ Boo	A0 Vp(λ Boo, met: v. wk)	110	.11
5355	125248		A2 Vp(SrCrEu st, CaMg wk)s	10	.32
5357	125283		A2 Vn	...	...
5359	125337	100λ Vir	Am (A1/A3 V/A4)	31p	.34p
				13s	.17s
5360	125349		A1 IV	75	.56
5364	125442		F0 V	...	...
5367	125473	ψ Cen	B9.5 V	...	...
5368	125489		F0 Vp(λ Boo, met: A5)	145	.54
5372	125632		A4 V	150	.61
5373	125642		A2 V	145	.51
5374	125658		A5 IVs	18	.47
5379	125835		A1 Ib	...	...
5386	126129	ADS 9247A	A0 V	120	.44
5388	126200		A2 III	130	.63
5392	126248		A3 V	185	.53
5397	126367	ADS 9258A	A2 IV	45	.46
5401	126504		Am (A1/F1/F2)s	...	...
5405	126661	22 Boo	Am (A7/F1/F1)	33	.52
5406	126722	104 Vir	A2 IV	90	.55
5411	126943		F2 V	78	0.45
5413	126983		A2 Vs + A2 Vs	...	...
5414	127043	ADS 9277B	A0 V	...	...

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
5415	127067	ADS 9277A	A0 Vp(4481 wk)	55	0.24
5418	127167		A4 IV	115	.56
5422	127304	ADS 9288A	A0 III	...	...
5433	127726	ADS 9301AB	A6: Vn	205:	.51
5435	127762	27γ Boo A	A7 III-IV	115	.58
5437	127929	A	F0 IV	63	.56
5438	127964		A4 V	105	.53
5447	128167	28σ Boo A	.....	13	.24
5463	128898	α Cir	A9 p(SrEu st, Ca wk, K sn)	...	...
5466	128974		B9.5 III	...	...
5467	128998		A1 V	100	.43
5468	129002	33 Boo	A0 V	85	.44
5473	129153		A8 V	105	.57
5475	129174	29π^1 Boo	.....	30p	.29p
		ADS 9338A		25s	.05s
5476	129175	29π^2 Boo	.....	130	.63
		ADS 9338B			
5477/8	129246/7	ζ Boo	A1 V	...	...
		ADS 9343AB			
5482	129422		F0 Vn	...	...
5489	129685		A0 Vn	...	...
5492	129798	ADS 9357A	F3 V	...	...
5494	129858		A1 V	...	...
5505	129988	36ε Boo	A0 V	110	.61
		ADS 9372B			
5506	129989	ε Boo	G9 II-III	...	...
		ADS 9372A			
5511	130109	109 Vir	A0 IIInn	265:	.33
5514	130158	55 Hya	A0 IIIp(λ Boo)	55	.20
5517	130274	57 Hya	.....	145	.40
5522	130557		A0 IV	55	.35
5523A	130559	7μ Lib	A0 III:p(SrCr)s	45	.45
		ADS 9396A			
5523B	....	ADS 9396B	Am (A2/A6/A8)s	...	...
5531	130841	9α^2 Lib AB	A3 V	90	.41
5532	130917	A	A1 Vn	205:	.50
5556	131562		A3 IV	...	...
5557	131596	ω Oct	B9.5 Vs	...	...
5558	131625		A0 V	...	...
5567	131951		A0 IIIn	...	...
5569	132029	ADS 9442A	A2 IV	75	.54
5570	132052	16 Lib	F0 IV	105	0.59

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
5574	132145		A1 IVs	30	0.42
5577	132219	59 Hya	A9 IV	95	.74
		ADS 9453AB			
5578	132230	17 Lib	A0 V	110	.40
5586	132742	19δ Lib	B9.5 IV	75	.43
5591	132851	60 Hya	A5 IV	100	.64
5597	133029	BX Boo	A0 Vp(Si v. st, Ca wk)	30	.41
		ADS 9477A			
5599	133112		A5 III	101	.63
5608	133388		A3 V	110	.53
5610A	133408	ADS 9493A	Am (F0/F1/F2:)	...	...
5610B	....	ADS 9493B	Am (A9/F2/F1)	...	...
5621	133683		F5 Ia	...	...
5624	133880		B9 p(Si v. st)	...	...
5627	133962	47 Boo	A0 IIIs	40	.41
		ADS 9500A			
5628	133981		B8 IV	...	...
5629	133994		A2.5 V	55	.48
5633	134064	ADS 9505AB	A1 V	175	.51
5652	134759	24ι^1 Lib	B9.5 Vp(Si st, CaMg wk)	45	.30
		ADS 9532AB			
5656	134967	25ι^2 Lib	A2 Vn	210:	.54
5660	135153	1 Lup	A9 Ib	10	.49
5665	135263		A1 V	65	.46
5667	135345		F8 II + A	...	...
5670	135379	β Cir	A3 V	...	...
5671	135382	γ Tra	A2 Vn	...	...
5672	135384		A4 Vn	175	.53
5676	135502	48χ Boo	A1 V	75	.46
5679	135559	4 Ser	A5 IV	125	.53
5693	136174		B9.5 Vn	220:	.45
5702	136403		A3 IV	15	.32
5703	136407	29ο Lib	F2 V	98	.71
5715	136729		A2.5 IVp(4481 wk)	145	.45
5716	136751		F2 IV	85	.63
5717	136831	7 Ser	A0 V	...	...
5718	136849	50 Boo	B9 Vn	...	...
5719	136933	υ Lup	A0 p(Si st, Ca wk)	...	...
5721	137006	8 Ser	A9 V	123	0.62
5724	137058		A1 IIIn	...	...
5729	137333	ρ Oct	A2 IV	...	...

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
5733	137391	51μ^{1} Boo	Am (F0/F2/F2)	85	0.59
		ADS 9626A			
5735	137422	13γ UMi	A2 III	165	.48
5746	137898	10 Ser	A6 III	98	.59
5747	137909	3β CrB	F2 Vp(SrCrEuSi st, Ca wk)	18	.43
5748	137928		A2 IV	20	.44
5749	138105		Am (A6/F0/F0)	21	.41
5752	138213		A2 IV	45	.51
5754	138245		A3 V	90	.56
5756	138268	ADS 9681Aa	A7 Vn	190	.64
5759	138338		A3 V	55	.68
5760	138341		A3 V	55	.50
5762	138413		Am (A3/A8/F0)	41	.60
5765S	138488	ADS 9689A	A7 V	...	...
5765N	....	ADS 9689B	Am (A7/F1/F2)	...	...
5770	138527	τ^{2} Ser	B9.5 Vp(λ Boo: Ca, 4481 wk)	...	...
5774	138629	53ν^{2} Boo	A2 V	200:	.51
		ADS 9688AB			
5783	138803		F1 V	111	.68
5786	138867		B9.5 V	...	...
5788	138917	13δ Ser	F0 IV	73	.65
		ADS 9701B			
5789	138918	13δ Ser	A9 IV	88	.63
		ADS 9701A			
5791	138936		A9 V	81	.57
5793	139006	5α CrB	A0 V	125	.47
5804	139225	18τ^{5} Ser	F2 V	88	.53
5817	139478		F0 V	61	.54
5818	139493		A0 Vn	200:	.48
5819	139518		A0 V	165	.46
5842	140159	21ι Ser	A1 Vp(4481 wk)	95	.38
		ADS 9744AB			
5843	140160	29χ Ser	A5 Vp(Sr v. st, Ca wk)	65	.42
5845	140232	22 τ^{7} Ser	Am (A2/F0/F2)	68	.61
5848	140417	44η Lib	A9 IV	105	.61
5849	140436	8γ CrB	A0 V	100	.42
		ADS 9757AB			
5856	140722	ADS 9775AB	Am (A7/F2/F2)	58	.61
5857	140728	BP Boo	A0 Vp(SiCr st, Ca wk)	65	.44
5858	140729	26τ^{8} Ser	A0 V	105	.39
5859	140775		A1 Vs	65	.37
5867	141003	28τ Ser	A1 V	190	0.58
		ADS 9778A			
5870	141187	31υ Ser	A2 V	120	0.49
5875	141378		A3 IV	95	.59
5881	141513	32μ Ser	B9.5 III	85	.42
5883	141556	χ Lup	B9 III	...	...
5886	141653		A1 V	95	.42
5887	141675	ADS 9793A	Am (A3/F1/F3)	61	.16
5892	141795	37ε Ser	Am (A3/A7V/A7)	38	.46
5895	141851	36 Ser	A3 Vp(4481 wk)n	185	.46
5903	142105	ζ UMi	A1 Vn	...	...
5917	142445	4 Sco	A3 V	115	.54
5919	142500	40 Ser	A5 Vn	210:	.45
5930	142703		A9 Vp(λ Boo)	95	.18
5959	143459	50 Lib	B9.5 Vp(4481 wk)	25	.29
5960	143466		F0 V	150	.68
5964	143584		F0 V	73	.54
5971	143807	14ι CrB	A0 IIIp(HgMnEu)s	10	.34
5972	143894	44π Ser	A2 V	115	.54
5982	144206	6υ Her	B9 IVp(HgMn st, CaMg wk)	<10	.24
5983	144208		A2 V + F5 II	...	...
5992	144426		A3 V	10	.50
6002	144708	11 Sco	B9 Vp(λ Boo)nn	255:	.27
		ADS 9924A			
6003	144844		B9 IVn + Ap(Si)s	25p	.12p
				70s	.14s
6004	144874	45 Ser	A6 V	160	.56
6013	145122	8 Her	B9 Vp(4481 wk)nn	240:	.34
6023	145389	11φ Her	B9 Vp(HgMn sl. st)s	10	.29
6025	145454		B9.5 Vp(4481 wk)nn	255:	.33
6026	145501	14ν Sco	B8 IIIp(SiSr)	...	...
6031	145570	15ψ Sco	A3 V	25	.40
6032	145589	AB	A7 V	110	.56
6033	145607	16 Sco	A3 Vn	160	.52
6034	145622		A2 V	115	.53
6035	145647		A1 III	35	.43
6036	145674	ADS 9944A	A0 Vn	195	.52
6041	145788		A1 IIIs	10	.42
6051	145964		B9.5 Vp(4481 wk)nn	285:	.32
6061	146254		B9.5 IV	140	.43
6066	146416		B9.5 Vp(4481 wk)nn	...	...
6067	146514		F0 Vn	145	.52
6070	146624		A1 IV	30	0.46

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
6074	146738	18υ CrB ADS 9990A	A3 IV	100	0.60
6081	147084	19ο Sco	A5 II (standard)	15	.44
6088	147321		A2.5 V	115	.56
6091	147365	A	F3 V	93	.61
6093	147449	50σ Ser	F1 IV	83	.61
6095	147547	20γ Her ADS 10022A	F0 IV	145	.73
6110	147835	ADS 10031A	A2 Vn	190	.49
6111	147869	21 Her	A1 III	55	.46
6116	148048	η UMi	F2 V	...	...
6117	148112	24ω Her ADS 10054A	A2 Vp(CrSr st, CaMg wk)	35	.34
6123	148283	25 Her	A3 Vn	260:	.40
6127	148330		A2 III	10	.44
6129	148367	3υ Oph A	Am (A2/A5V/A5)	18	.48
6144	148743		A9 Ib-II	43	.60
6149	148857	10λ Oph ADS 10087AB	A1 V	125	.41
6153	148898	9ω Oph	A2 Vp(SrCrEu st, K sn)	51	.49
6156	149081	34 Her	A1 IV	65	.50
6161	149212	15 Dra	B9.5 IV	140	.50
6168	149630	σ Her	A0 IVn	...	...
6169	149632		A1 IV	40p 50s	.27p .13s
6170	149650		A2 V	90	.48
6173	149681		A9 V	...	...
6176	149822		A2 Vp(SiSrCr st, CaMg wk)	55	.33
6179	149911		A2 Vp(SrCr v. st)	45	.58
6184	150100	16 Dra ADS 10129C	B9.5 V	60	.35
6185	150117	17 Dra A ADS 10129A	AB: B9.5 V	215:	.44
6186	150118	17 Dra B ADS 10129B		195	.44
6193	150366		Am (A5/A9/A7)	38	.44
6194	150379	36 Her ADS 10149B	Am (A1/A6/A6)	81	.59
6195	150378	37 Her ADS 10149A	B9.5 V	145	.48
6201	150451		Am (A5/F1/F1)	65	.56
6203	150483		A1 Vn	235:	.47
6216	150768	ADS 10173A	A2 Vn	165	0.61
6218	150894	A	A3 V	115	0.48
6222	151087		F2 V	88	.66
6226	151199		A2: IIIp(Sr v. st, Ca wk)	48	.40
6232	151431	19 Oph ADS 10207A	A3 V	145	.50
6234	151525	45 Her A	A1 Vp(Si st, CaMg wk)	35	.29
6235	151527		B9.5 Vp(4481 wk)n	225:	.40
6240	151676		A5 Vn	155	.59
6246	151862	ADS 10225A	A1 IV	70	.47
6250	151956	47 Her	Am (A3/A5/A7)s	38	.49
6254	152107	52 Her ADS 10227A	A5 p(SrCrEu st, Ca wk)	35	.43
6255	152187	21 Oph ADS 10230AB	A2 Vp(Si st, Ca wk)	55	.49
6268	152308	49 Her	A0: IVp(Sr st, CaMg wk)	95	.37
6277	152569	A	F0 Vn	185	.69
6278	152585		Am (A2/A7/A5)	81	.60
6279	152598	53 Her A	F0 V	73	.54
6291	152849	24 Oph ADS 10265AB	A0 Vn	190	.42
6317	153653		A5 V	155	.56
6319	153697	ADS 10279AB	F0 V	88	.62
6324	153808	58ε Her	A0 IVp(λ Boo)	50	.39
6326	153882	ADS 10310A	A0 Vp(SiSrCrEu st, Ca wk)	15	.46
6329	153914	ADS 10312AB	A1 V	120	.50
6332	154029	59 Her	A2 III	21	.52
6335	154099		A7 Vn	165	.63
6341	154228	A	A1 IV	30	.43
6350	154418		Am (A2/A7/A6)	78	.58
6351	154431		A6 V	110	.53
6352	154441	ADS 10326A	B9 V	...	...
6354	154481		B9 Vnn + shell (HI, Ca K)	260:	.25
6355	154494	60 Her ADS 10334A	A3 V	105	.56
6361	154660	ADS 10347A	A4 Vn	250:	.48
6362	154713		A2 IVs	30	.42
6347	154895	ADS 10355AB	A2 V	65p 75s	.37p .35s
6376	155102		A2 IV	30	.48
6377	155103	ADS 10360AB	Am (A3/F0/F0)	71	.55
6378	155125	35η Oph ADS 10374AB	A2 IV	15	.36
6379	155154		A9 V	145	0.53

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
6380	155203	η Sco	F3 IVn	...	...
6381	155259		A1 V	...	...
6383	155328	ADS 10369A	A0 V	...	...
6385	155375		A2 IIIs	25	0.49
6386	155379		B9.5 Vp(HgMnSrSi)	15	.36
6391	155514	63 Her	A9 V	160	.58
6399	155860	ADS 10397A	A3 V	90	.53
6410	156164	65δ Her ADS 10424A	A2 Vn	230:	.49
6412	156208		A1 IV	35	.37
6421	156295		A7 V	95	.74
6432	156653		A1 IV	30	.41
6434	156697		F0 Vn	185	.57
6435	156717	ADS 10465AB	A0 Vp(4481 wk)n	210	.28
6436	156729	69 Her	A1 IV	145	.54
6445	156897	ξ Oph	F1 IV	...	...
6446	156928	53ν Her ADS 10481A	A2 V	110	.51
6449	156971	A	F3 Vwl:(met.: F1)	18	.39
6455	157087		A3 IVs	10	.42
6457	157198	70 Her A	A1 IV	95	.43
6473	157546		B9 Vp(4481 wk)n	215:	.34
6480	157728	73 Her	A7 V	81	.65
6481	157740		A3 III	25	.43
6482	157741	ADS 10528A	B9 Vp(4481 wk)nn	...	...
6484	157778	75ρ Her B ADS 10526B	B9.5 IVn	270:	.47
6485	157779	75ρ Her A ADS 10526A	A0 IIIp(HgMn)	65	.35
6486	157792	44 Oph	Am (A3/F0/F3)	68	.74
6490	157864		B9 IV	115	.48
6494	157955		B9.5 III	60	.47
6497	157978		G0 III + A1 IVs + A2 Vs	...	...
6499	158067	A	A7: V	35	.48
6506	158261		A1 III	10	.38
6507	158352		A8 V	165	.60
6509	158414	77 Her	A2 V	135	.49
6511	158460		A0 Vnn	275:	.41
6514	158485		A3 V	175	.56
6519	158643	51 Oph	B9.5 Vn	210:	.41
6521	158716		A2 IV	35	.47
6532	159082		A0 IVp(λ Boo)	30	0.26
6533	159139	78 Her	A0 Vn	...	...
6534	159170		A3: Vn	225:	0.54
6545	159376	52 Oph	B9 V: p(Si st, Mg wk)	35	.30
6548	159480	53 Oph ADS 10635A	A2 IVs	40	.44
6551	159503		A5: Vn	205:	.60
6554	159541	24ν^1 Dra ADS 10628B	Am (A3/F0/F0)	75	.49
6555	159560	25ν^2 Dra ADS 10628A	Am (A3/F1/F0)	58	.65
6556	159561	55α Oph AB	A3 Vn	210:	.53
6559	159834	ADS 10655A	A5: V	28	.43
6561	159876	55ξ Ser	Am (A7/A9/F3)	45	.55
6562	159877		Am (A9/F1/F2)	35	.43
6570	160054		A6 IV	100	.58
6571	160181	79 Her	A1: Vp(4481 wk)n	150	.32
6581	160613	56o Ser	A3 IV	95	.40
6589	160765		A1 V	110	.43
6593	160839		Am (A3:/F1/F2)	51	.51
6609	161270	61 Oph ADS 10750A	A0 III	100	.41
6610	161289	ADS 10750B	A0 V	125	.47
6611	161321	ADS 10749A	Am (A2/A6/A6)	38	.36
6618	161693		A0 V	155	.47
6619	161695		A0 Ib	25	.46
6627	161833	ADS 10795AB	A0 Vp(4481 wk)	90	.33
6629	161868	62γ Oph	A0 Vp(4481 wk)n	185	.31
6633	161941		B9 V	35	.37
6641	162132		A2 IIIs	40	.44
6642	162161		B9.5 Vp(4481 wk)	60	.31
6655	162570		A6 Vn	190	.56
6656	162579	30 Dra	A2 V	110	.61
6664	162732	88 Her	B6 IIIp(4481 wk)n + shell	145	.24
6679	163245		A1 Vn	175	.50
6680	163318		A8 V	145	.52
6681	163336	ADS 10891A	A2 IV	45	.50
6689	163624	ADS 10912AB	A5 III-IV	38	.51
6690	163641		B9 Vp(4481 wk)	45	.31
6696	163772		A0 V	155	.49
6700	163955	4 Sgr	B9.5 II-III	135	.42
6709	164258		A6 Vp(SrCr st, Ca wk)	50	.50
6718	164429		A2: Vp(SiSrCr st, Ca wk)	85	0.48

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
6723	164577	68 Oph	A0 Vn	185	0.48
		ADS 10990AB			
6730	164669	95 Her	A2 Vn	215:	.52
		ADS 10993A			
6732	164716		B8.5 V	145	.40
6744	165029		A0 Vn	230:	.43
6753	165358	ADS 11028A	A2 V	95	.50
6754	165373		F0 IV	81	.48
6758	165475	ADS 11056A	A3 Vp(4481 wk)	200:	.26
....	165474	ADS 11056B	A6 Vp(SrCrEuSi st, CaMg wk)	18	.39
6767	165645	ADS 11054A	A9 V	135	.54
6771	165777	72 Oph	Am (A3/A7:/A7)	55	.53
		ADS 11076A			
6776	165910	ADS 11086A	A0 Vn	235:	.40
6781	166045	100 Her	A3 V	170	.60
		ADS 11089A			
6782	166046	ADS 11089B	A3 V	165	.54
6784	166095		Am (A6/A9/A9)	25	.61
6786	166114		A8 IV	...	...
6789	166205	δ UMi	A0 V	...	...
6792	166228	ADS 11090A	A0 Vp(4481 wk)n (SB2)	215:	.34
6794	166230	101 Her	A7 V	33	.53
6798	166393	ADS 11127AB	A4 Vn	185	.46
6802	166469		A0 IIIp(SrCr st, CaMg wk)	15	.27
6803	166479	ADS 11123AB	A0 V + G1 II	...	...
6811	166926	24 UMi	Am (A2/A9/F0)	...	...
6813	166960		Am (A3/F0/F2)	23	.44
6814	166988	ADS 11149AB	A2 III	140	.43
6825	167356	ADS 11196A	B9 Ia	25	.58
6827	167387		B9.5 Vp(4481 wk)n	195	.35
6829	167468	φ Oct	A0 V	...	...
6830	167564		A5 IV	145	.58
6835	167666		A7: V	95	.53
6843	167833		A7 IV	120	.62
6844	167858		F1 V	13	.36
6864	168646		A2 V	250:	.64
6870	168733		B8.5 II	...	...
6876	168913	108 Her	Am (A3/F0/F0)	23	.43
6877	168914	107 Her	A5 IV	180	.58
6878	169009		A1 Vp(λ Boo)	35	.28
6883	169111		A2 V	90	0.52
6903	169702	2μ Lyr	A2 V	150	0.49
6904	169718	ADS 11334AB	A0 V	165	.47
6906	169820		B9 IV	125	.40
6909	169851	ADS 11354AB	A9 V	135	.60
6910	169853		A3 III	...	...
6911	169885		A3 III	43	.59
6914	169938		A4 V	135	.61
6917	169981		A2 III	10	.40
6918	169986	59d Ser A	GIII + A0 Vs(SB2)	...	...
6920	170000	43φ Dra	A0 IIIp(λ Boo)	65	.27
		ADS 11311AB			
6923	170073	39 Dra	A2 V	170	.56
		ADS 11336A			
6926	170141	A	A2 Vnn	250:	.51
6930	170296	γ Sct	A2: V	205:	.57
6932	170397		A2 Vp(SiSrCrEu st, Ca wk)	30	.42
6936	170479		A6 III-IV	...	...
6942	170642		A2 V	...	...
6944	170680	ADS 11411A	A0 Vp(λ Boo)	200:	.32
6953	170867	κ^2 Cra	B9 Vnn	...	...
6955	170878		A1: Vp(4481 wk)	260:	.38
6956	170902		A4 V	185	.60
6957	170920	61 Ser	.....	13	.40
6958	170973		A0 Vp(SiSrEu st, CaMg wk)	10	.31
6962	171130		A1 V	120	.54
6963	171149		A0 Vnn	280:	.53
6967	171247	ADS 11448A	A0 Vp(Si st, CaMg wk)	65	.21
6969	171369		F1 V	81	.56
6975	171487		A2 Vn	240:	.40
6976	171505		A0 V	155	.47
6979	171653		Am (A3/F1/F2)	101	.82
6988	171856	AB	Am (A9/A7V/F2)	110	.61
6993	171978		.....	35	.40
6997	172044	ADS 11504A	B7 IIIp(HgMn)	35	.21
7001	172167	30α Lyr	A0 V (standard:)	15	.31
		ADS 11510A			
7003	172187		A6 V	97	.53
7011	172546	26 Sgr	Am (A4/F1/F0)	43	.58
7013	172569		F0 IV	81	.65
7017	172671	AB	B8: Vn + A0 III	101	.40
7018	172728		A0 III:p(HgSrMnSi)	30	.36
7019	172741		A6 V	63	0.53

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
7025	172864		A2 V	...	...
7028	172883		A0 IIIp(HgMn)	63	0.53
7048	173495	ADS 11640A	A1 V	140	.48
....	....	ADS 11640B	A2 V	125	.48
7049	173524	46 Dra A	A0 IIIp(HgMn)	35	.33
7051	173582	4ε^1 Lyr	A3 V	150	.61
		ADS 11635A			
7052	173583	4ε^1 Lyr	F0 V	145	.70
		ADS 11635B			
7053	173607	5ε^2 Lyr	A6 Vn	195	.70
		ADS 11635C			
7054	173608	5ε^2 Lyr	A7 Vn	215:	.62
		ADS 11635D			
7056	173648	6ζ^1 Lyr	Am (A5/F0/F2)	38	.51
		ADS 11639A			
7057	173649	7ζ^1 Lyr	F0 Vn	195	.53
		ADS 11639D			
7058	173650		A1 Vp(SiHgMn st, CaMg wk)	25	.21
7059	173654	5 Aql	Am (A3/A5V/A6)	61	.56
		ADS 11667A			
7060	173664		A3 IV	55	.48
7069	173880	111 Her	A3 IV	70	.59
7077	174115	AB	Am (A2/F1/F2)	35	.48
7080	174177		A2.5 IV-V	55	.43
7085	174240		A1 IV	90	.47
7086	174262		A1 V	115	.49
7088	174309	30 Sgr	F1 IVn	145	.62
		ADS 11731A			
7090	174366		A1 V	110	.54
7091	174369		A2 V	105	.47
7096	174481		A6 V	150	.63
7101	174589	8 Aql	F0 IV	93	.64
7102	174602	9ν^2 Lyr	A3 Vp(4481 wk)	115	.46
		ADS 11737A			
7110	174866		A6 V	150	.53
7124	175286	50 Dra	A2 Vp(Ca wk)	...	...
7141	175638	θ^1 Ser	A5 V	...	...
7142	175639	θ^2 Ser	A5 Vn	...	...
7143	175640		B9 IIIp(HgMnEu st, CaMg wk)	<10	.27
7145	175687	36ξ^1 Sgr	A0 II	<10	.39
7155	175852		B9 III	50	.38
7159	175892		A2 IV	35	0.46
7160	175938		F0 V	...	...
7167	176232	10 Aql	A7 Vp(Sr v. st, Eu st, CaMg wk, K sn)	10	0.42
7178	176437	14γ Lyr	B9 III	60	.35
		ADS 11908A			
7184	176560	ADS 11897AB	A2 V	140	.54
7194	176687	38ζ Ser	A3 V	65	.49
		ADS 11950AB			
7199	176795	ADS 11870A	A0 IV	...	...
7207	176971		A5 V	125	.61
7209	176984	14 Aql AB	A1 III	15	.42
7214	177178		A5 V	155	.53
7215	177196	16 Lyr	A6 IV	111	.58
		ADS 11964A			
7219	177332		A7 V	78	.58
7230	177517	A	B9.5 Vp(Si st, CaMg wk)	90	.17
7231	177552		F1 V	59	.54
7235	177724	17ζ Aql	A0 Vp(4481 wk)nn	295:	.31
		ADS 12026A			
7236	177756	16λ Aql	B9.5 Vp(λ Boo)n	...	...
7247	178089		F2 V	15	.34
7250	178187		A4 IV	35	.47
7251	178207	51 Dra	B9.5 IVn	215:	.57
7253	178233		A7 IV	115	.60
7254	178253	α CrA	A2 Vn	...	...
7261	178449	17 Lyr	Am (F1/F1/F1)	125	.52
		ADS 12061A			
7278	179366		A4 III-IV	...	...
7283	179527	19 Lyr	B8 IIIp(SiSr st, He I wk)	20	.26
7284	179583		A3 IV	65	.47
7286	179648		A2 V	190	.48
7288	179791		A3 V	180	.54
7290	179933	55 Dra	A0 V	75	.52
7301	180317	1 Sge	A3 V	170	.59
7303	180482	22 Aql	A3 V	60	.53
7313	180782		A0 V	195	.55
7315	180868	25ω^1 Aql	A7 V	78	.55
7324	181119		A2 V	165	.59
7327	181240		A8 III	78	.59
7329	181296	η Tel	A0 Vn	...	...
7331	181333	28 Aql	A9 III	48	.61
7332	181383	29ω^2 Aql	A2 V	140	.51
7338	181470		A0 V	10	0.32

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
7340	181577	44ρ[1] Sgr	A9 IV	83	0.59
7342	181615	46υ Sgr AB	B2-5p(HI v. wk) + shell	35	.74
			(A2 Ia, HI v. wk)		
7351	181960		A1 V	100	.45
7357	182239		A9 V	48	.56
7362	182369	47χ[1] Sgr AB	A8 V	45	.54
7366	182475		F2 V	135	.78
7369	182490	2 Sge A	A1 III	35	.45
7371	182564	58π Dra	A2 IV	15	.44
7377	182640	30δ Aql A	A9 III	85	.60
7379	182678		A0 V	75	.50
7384	182761		A0 III	170	.50
7390	182919	5 Vul	A0 III	140	.44
7392	183007		Am (A1/A4:/A3)	...	...
7395	183056	4 Cyg	B9.5 II	20	.15
7400	183324	35 Aql	A0 IVp(λ Boo)	105	.16
7408	183534	7ι[1] Cyg	.....	40	.36
7410	183545		A2 Vn	185	.54
7411	183552		Am (F0/F0/F2)	...	...
7415	183656		B7 IIIn + shell (HI, Ca K,	170	.27
			Fe II)		
7416	183806		A0 Vp(SrCr)	...	...
7420	184006	10ι[2] Cyg	A4 Vn	220:	.50
7422	184035		A2 IV	...	...
7423	184102		A2 Vn	165	.57
7425	184146		A2 V	...	...
7431	184552	51 Sgr	Am (A2/A7V/F0)	13	.46
7436	184603		A1 Vn	175	.46
7439	184705		F0 V	108	.69
7441	184759	9 Cyg AB	A0: V + G0 III	...	...
7444	184875		A1 V	75	.42
7445	184884	ADS 12660A	.....	130	.49
7453	184977		A9 V	73	.56
7470	185404	53 Sgr	A0 V	150	...
		ADS 12741AB			
7480	185762	45 Aql	A2.5 IV	65	.47
		ADS 12775A			
7481	185859		.....	55	.43
7483	185872	14 Cyg	B9.5 Vp(Si)	25	.38
7489	186005	55 Sgr	F0 IV	140	.66
7498	186219		A4 IV	...	...
7499	186307	AB	A6 V	90	0.52

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
7500	186340	ADS 12789A	A5 V	140	0.51
7501	186357		F1 III	98	.69
7502	186377		A6 III	15	.44
7505	186440		.....	125	.48
7510	186543	ν Tel	A7 IV	...	...
7519	186689	49υ Aql	A7 V	33	.45
7528	186882	18δ Cyg	B9.5 IV	140	.44
		ADS 12880A			
7529	186901	ADS 12893A	B9.5 III	...	...
....	186902	ADS 12893B	A0 Vp(4481 wk)n	...	...
7531	186957		Am (A0/A2/A2)	...	...
7532	186984		.....	91	.83
7533	186998		F0 V	...	...
7545	187340		A2 III	33	.46
7546	187372	ζ Sge	A2 Vn	190	.41
		ADS 12973AB			
7552	187474		A2 Vp(SiEuCr)	...	...
7553	187532	51 Aql	F1 IV	95	.57
		ADS 13017A			
7557	187642	53α Aql	A5 IVn	200:	.54
		ADS 13009A			
7562	187753		Am (A1/A5/A5)	51	.52
7563	187764		F0 V	85	.47
7573	187982		A1 Iab	45	.67
7575	188041		F0 Vp(SrCrEu v. st)	40	.48
7579	188097		Am (A3/A6/A7)	...	...
7580	188107		B9.5 Vn	210:	.30
7587	188162		A0 IV	...	...
7590	188228	ε Pav	A0 IV	...	...
7592	188260	13 Vul A	B9.5 III	55	.37
7596	188350	58 Aql	B9.5 V	105	.43
7598	188385	ADS 13093A	A1 V	105	.50
7601	188485		B9.5 IV	110	.40
7610	188728	61φ Aql	A1 IV	15	.44
7611	188793	A	A2 V	120	.43
7614	188899	61 Sgr	A2 V	55	.49
7616	188971		A3 V	...	...
7619	189037	24ψ Cyg	A2 Vn	190	0.40
		ADS 13148A			
7624	189118	θ[2] Sgr	A4 IV	...	...
7630	189198		A8 III	...	...
7632	189253		A0 V	...	...

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s⁻¹	4481 W(A)
7634	189296		A2 Vnn	...	...
7638	189377	ADS 13186AB	A1 V	...	...
7641	189410	14 Vul	F1 Vn	...	...
7646	189684		A8 V	...	...
7649	189741	63 Sgr	A2 V	...	...
7650	189763	62 Sgr	A1.5 V	...	...
7653	189849	15 Vul	Am (A8/A9/F3)	10	0.41
7654	189900		A2.5 V	...	...
7677	190590		A5 Vn	240:	.56
7684	190781		A1 IV	15p 15s	.26p .22s
7694	191110		B9.5 Vp(HgMn) + B9.5 Vp (HgMn)	<10p <10s	.17p .12s
7695	191174	ADS 13371A	A3 V	32	.55
7702	191329		A2 V	190	.54
7711	191747	18 Vul	A2 IV	30p 50s	.23p .19s
7717	191984	ADS 13506A	A0 Vn	150	.43
....	.....	ADS 13506B	A2 IV:p(SrCrEu st, Ca wk)	20	.38
7723	192342	ADS 13543A	Am (A2/F2/F2)	15	.41
7724	192425	67ρ Aql	A1 V	165	.50
7730	192514	30 Cyg ADS 13554D	A2 V	160	.56
7731	192518	21 Vul	A5 Vn	205:	.55
7734	192538		B9.5 Vp(4481 wk)	220:	.39
7736	192640	29 Cyg	A7 Vp(λ Boo, met.: A1, 4481 wk)	35	.07
7740	192696	33 Cyg	A2 IVn	225:	.51
7752	192934		A0 III	...	...
7755	192983		A1 Vn	190	.44
7764	193281	ADS 13702A	A2.5 V	75	.46
7769	193369	36 Cyg	.....	90	.51
7774	193472		Am (A4/F0/F2)	93	.63
7776	193495	β Cap	A0 V + G1 II	...	...
7781	193592	ADS 13692A	A2 IV	20	.46
....	....	ADS 13692B	F3 V	...	...
7782	193621		B9.5 Vp(4481 wk) + shell	270:	.44
7784	193702	ADS 13728AB	A1 V	175	.44
7787	193807	κ^2 Sgr	A6 V	...	...
7803	194244	ADS 13811A	B9 IVn	205:	.43
7818	194882	ADS 13850AB	A2 IV	30	.47
7826	195050	40 Cyg	A2 V	120	0.52
7827	195066	ADS 13870A	A0 V	145	0.48
7828	195068	43 Cyg	F2 V	43	.52
7829	195093	12o Cap B ADS 13902B	A6 V	125	.59
7830	195094	12o Cap A ADS 13902A	A2 Vn	250:	.57
7832	195206		A9 IV	85	.61
7833	195217		Am (A3/A7/A7)	63	.57
7835	195324	42 Cyg	A1 Ib	15	.53
7836	195325	1 Del ADS 13920AB	A1: III + shell	200:	.32
7839	195479	A	Am (A1/A9/F2)	18	.47
7840	195483	ADS 13946A	B8 V	140	.46
7842	195549		A0 V	140	.49
7848	195627	ϕ^1 Pav	F0 V	...	...
7849	195692	ADS 13964AB	Am (A2/F1/F0)	65	.53
7850	195725	2θ Cep	Am (A7/F1/F2)	51	.55
7857	195922		A0 Vp(4481 wk)n	185	.37
7858	195943	3η Del	A2 IV	55	.51
7865	196078		A7 V	83	.52
7871	196180	4ζ Del	A2 V	85	.39
7874	196362	26 Vul	A5 IIIs	10	.46
7876	196379	A	A9 II (standard)	21	.48
7877	196385		F3: V	10	.35
7879	196502	73 Dra	A9: Vp(CrSrEu st, Ca v. wk)	10	.46
7883	196544	5ι Del	A1 IV	30	.50
7887	196629	A	F0 V	150	.56
7891	196724	29 Vul	A0 IV	40	.37
7903	196821		A0 IIIp(λ Boo)s	10	.31
7906	196867	9α Del ADS 14121A	B9 IV (standard)	125	.41
7913	197051	β Pav	A8 V	...	...
7916	197101		F2 V	150	.70
7917	197120	ADS 14149A	A1 Vp(4481 wk)	125	.40
7920	197157	η Ind	A9 IV	...	...
7924	197345	50α Cyg ADS 14172A	A2 Ia (standard)	30	.65
7928	197461	11δ Del	Am (A7/F2/F0; 4481 wk)	28	.30
7930	197508		Am (A3/F1/F0)	...	...
7937	197725	17 Cap	A2 V	130	.49
7938	197734		A1 IV	25	.43
7945	197950	4 Cep	A7 Vn	160	0.61

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
7950	198001	2ε Aqr	A1.5 V	90	0.47
7953	198069	13 Del	A1 IV	155	.47
		ADS 14293A			
7954	198070		B9.5 IVn	235:	.50
7958	198151	AB	A2 V	125	.54
7974	198391	14 Del	A1.5 IV	15	.42
7981	198552		A1 V	40	.44
7984	198639	56 Cyg A	A6 V	63	.56
7990	198743	6μ Aqr	Am (A5/A9/F3)	63	.66
7998	198949		F2 V	73	.53
8002	199095	76 Dra	A0.5 V	...	...
8004	199099		B9.5 Vp(4481 wk)	95	.34
8006	199124		A9 V	145	.57
8012	199254	16 Del	A5 V	145	.55
		ADS 14429A			
8018	199443		A6 V	78	.67
8024	199603		Am (A4/F0/F0)	91	.66
8025	199611	ADS 14460A	F1 V	140	.62
8028	199629	58ν Cyg	A0 IIIn	200:	.41
8033	199728	20 Cap	F0: Vp(Si v. st, met.CaMg v. wk)	60	.16
8038	199942		A6 V	145	.53
8045	200052		A5 V:p(SiMg)	35	.74
8058	200496	12 Aqr	A3 IV	23p	.22p
		ADS 14592B		55s	.41s
8059	200497	ADS 14592A	G0 II-III	...	...
8060	200499	22η Cap AB	A3 IV	53	.52
8075	200761	23θ Cap	A1 V	80	.48
8083	201057		B9.5 V	85	.32
8087	201184	25χ Cap A	.....	195	.51
8094	201433	ADS 14682A	B9 Vp(Si)s	10	.37
....	....	ADS 14682B	Am (A2.5/A7V/A9)n	...	...
8098	201616	6 Equ	.....	55	.51
		ADS 14702D			
8101	201671	ADS 14710A	Am (A0/A2V/A2)	115	.57
....	....	ADS 14710B	A4 V		
8102	201707		A8 III	...	...
8106	201834		B8 IIIp(SiSr st, He wk)	15	.22
8114	202103	AB	A2.5 V	...	...
8116	202128	ADS 14761AB	A7 Vn	190	.66
8120	202240		A7 II	18	0.49
8130	202444	65τ Cyg	F2 IV	98	0.57
		ADS 14787A			
8134	202606		Am (A1/A2/A3)s	40	.45
8135	202627	ε Mic	A2 IV	...	...
8139	202723	31 Cap	F1 IV	125	.68
8140	202730	θ Ind	A6 V	...	...
8147	202923		A0 V	100	.37
8151	203006	θ1 Mic	A7 Vp(SrCrEu st, Ca wk)	...	...
8155	203096	ADS 14849A	Am (A5/A6/A7)s	10	.35
8162	203280	5α Cep	A7: Vn	180	.54
		ADS 14858A			
8169	203439		A1 IV	20	.34
8174	203501		A3 II	...	...
8178	203562	10β Equ	.....	40	.48
		ADS 14920A			
8180	203585	θ2 Mic AB	A0 Vp(Si st, CaMg wk)	...	...
8186	203696		.....	115	.46
8187	203705	18 Aqr A	F0 IV	125	.60
8190	203803	A	F1 IV	130	.72
8192	203843	20 Aqr	A9 III	81	.79
8194	203858	ADS 14943A	A1 IV	70	.56
8195	203875	19 Aqr	A7 IV	90	.66
8198	203925		F0 IV	65	.56
8202	204018		Am (A4/F0V/F6)	...	...
8203	204041		A3 Vp(λ Boo)	55	.21
8206	204131	ADS 14962A	A0 Vp(SrCrSiHg)	35	.34
8208	204153		F0 IV	105	.55
8210	204188		Am (A6/A9/F0)	31	.45
8216	204411		A4 Vp(SiCrHg)	15	.37
8217	204414	35 Vul	A2 IV	70	.61
8230	204854	6 PsA	A2 V	...	...
8235	204943		A7 V	98	.65
8237	204965		A2 Vp(4481 wk)	85	.40
8240	205087		A0 Vp(SiSr st, CaMg wk)	15	.19
8246	205314		B9.5 Vn	175	.37
8253	205471	8 PsA A	Am (A5/F0V/F2)	15	.41
8257	205539		F2 IVp(Ca I, Mg II wk)	10	.20
8258	205541		A3 Vn	205:	.47
8263	205765	ADS 15142A	A1 V	175	.53
8264	205767	23ξ Aqr AB	A6: V	155	.65
8265	205811	3 Peg	A2 V	90	0.57

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
8266	205835	74 Cyg	A3 Vn	185	0.57
8267	205852	5 Peg	F0 IV	155	.61
8270	205924	4 Peg	A8: Vn	230:	.60
		ADS 15157A			
8272	205939		A9 IV	10	.44
8276	206043		F0 IV-V	135	.61
8278	206088	40γ Cap	Am (F0/F1V/F2)	31	.44
8291	206538	76 Cyg A	A2 V	140	.50
8293	206546	AB	Am (A2/A6/A8) (SB2)	13p	.22p
				15s	.27s
8295	206561	44 Cap	A8 V	81	.55
8300	206644	77 Cyg AB	A0 V + A0 V (SB2)	55p	.14p
				75s	.18s
8302	206677	45 Cap	A8 V	115	.59
8305	206742	ι PsA A	A0 III-IV	...	...
8307	206774	79 Cyg	A0 V	...	...
8319	207052	48λ Cap	A0 V	175	.48
8322	207098	49δ Cap	Am (A4/F1V/F0)	93	.62
		ADS 15314AB			
8326	207155	θ PsA	A1 V	...	...
8328	207203	11 Peg	A0 IV	115	.42
8329	207218		A3: V	105	.59
8332	207235		A5 V	130	.56
8334	207260	10ν Cep	A1 Ia	40	.63
8337	207503		Am (A4/A7/F2)	73	.61
8342	207636		A0 Vn	170	.52
8343	207650	14 Peg	A1 IV	60	.44
8345	207673		A1 Ib	35	.57
8351	207958	51μ Cap	F1 IV	93	.60
8354	207978	15 Peg	F2 V	68	.42
8358	208108		Am (A1/A2V/A3)s	35	.44
8361	208132	ADS 15407A	Am (A1/A9V/F0)	51	.54
...	....	ADS 15407B	Am (A2/A6/F2)	...	...
8366	208321		A2 Vn	...	...
8368	208450	δ Ind AB	F0 IV	...	...
8373	208565	17 Peg	A1 Vn	270:	.36
8377	208727		B8 V	240:	.30
8381	208796		B9.5 V	...	...
8389	209124		.....	260:	.31
8396	209278	29 Aqr	A2 V	110	0.48
		ADS 15562A			
....	....	ADS 15562B	G0 II	...	...

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
8407	209515		A0 III	70	0.32
8410	209625	32 Aqr	Am (A5/A9V/F2)	28	.49
8417	209791	ξ Cep	Am (A3/F1/F2)	36p	.38p
		ADS 15600A		38s	.43s
8419	209833	23 Peg	B9.5 Vnn	220:	.38
8422	209932		B9.5 V	80	.41
8429	209993		A1 V	145	.46
8431	210049	μ PsA	A2 Vn	...	...
8434	210071		A0 Vp(SiSr st, CaMg wk)	75	.26
8441	210210		A9 III	88	.66
8443	210221		A3 Ib	20	.60
8444	210271		A7 Vn	...	...
8446	210300		A5 III	70	.52
8450	210418	26θ Peg	A2 V	130	.44
8451	210419		A0 Vn	300:	.51
8459	210516	28 Peg	A5 IV	40	.53
8460	210594		A7 IV	86	.56
8463	210715		A4 IV	130	.57
8464	210739		A2 Vp(Ca st)	160	.56
8471	210853	ψ Oct	F0 III-IV	...	...
8487	211096		A1 IV	65	.49
8489	211211		A0 Vn	215:	.52
8491	211287		B9.5 Vnn	210:	.36
8494	211336	ε Cep	F0 IV	80	.54
8495	211356		A3 IVn	185	.45
8524	212132	π Gru A	F1 IV	...	...
8525	212150		A0 Vp(λ Boo)	180	.31
8533	212404	51 Aqr	B9.5 V	80	.48
		ADS 15902AB			
8537	212495		A0 V	160	.42
8542	212643		A0 V	155	.43
8546	212710		B9.5 Vn	...	...
8547	212728		A5: Vn	...	...
8563	213135		F1 V	93	.53
8567	213236	56 Aqr	B9 II:	15	.25
8569	213272		A1 V	110	.48
8573	213320	57σ Aqr	A0 III	10	.35
8576	213398	β PsA	A1 III	...	...
8578	213403	28ρ^1 Cep	Am (A2/A7/F0)	70	.67
8583	213464	58 Aqr	Am (A9/F2/F2)	30	.43
8584	213534		Am (A6/A8/A8)	48	0.47

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
8585	213558	7α Lac	A1 V	115	0.46
		ADS 16021A			
8586	213617	39 Peg	F2 V	83	.58
8588	213660	ADS 16031A	A2.5 V	115	.55
8591	213798	29ρ^2 Cep	A2 V	120	.51
8598	214019	ADS 16062A	A0 V	225:	.42
8599	214035		A0 V	115	.44
8602	214150		A2 IV-V	...	...
8605	214203		A2 IV	25	.44
8607	214279		A1 V	170	.41
8613	214454	9 Lac	F0 Vp(λ Boo; met.: A6)	93	.48
8616	214484	AB	A2 IIIs	...	...
8624	214698	41 Peg	A1 IV	25	.46
8627	214734	30 Cep	A2 V	155	.52
8630	214846	β Oct	A7 IV	...	...
8641	214994	43ο Peg	A1 III (standard)	10	.40
8645	215114	ASDS 16208A	A3 Vn	145	.51
8647	215143	67 Aqr	B9.5 V	...	...
8666	215664		F0 Vn	170	.64
8675	215789	ε Gru	A2 Vn	...	...
8676	215874	70 Aqr	F1 V	98	.59
8677	215907		B9.5 V	120	.43
8681	216048		F0 V	155	.58
8695	216336	γ PsA	A0 Vp(SrCrEu)	...	...
8708	216608	ADS 16345A	Am (A2/F1/F2)	46	.64
8709	216627	76δ Aqr	A3 Vp(4481 wk)	70	.41
8715	216701	1 Psc	A6 III	80	.59
8717	216735	50ρ Peg	A0 IV	95	.48
8722	216823	τ^3 Gru	Am (A5/A7/F2)	...	...
8724	216900	ADS 16389A	A3 V	60	.56
8728	216956	24α PsA	A3 V (standard)	85	.67
8738	217186		A1 V	50	.42
8739	217232	52 Peg	F0 V	125	.56
		ADS 16428AB			
8740	217236		F2 IV-V	80	.63
8753	217477	ADS 16443A	B9.5 Vp(HgMn st, CaMg wk)	20	.28
8755	217491		A3 V	55	.48
8756	217498		A3 V	70	.54
8765	217754		F2 IV	18	.46
8766	217782	2 And	A1 V	195	0.48
		ADS 16467A			
8767	217792	π PsA	Am (F0/F1/F2)	...	...
8781	218045	54α Peg	A0 IV	130	0.44
8786	218108		A6 Vn	...	...
8790	218242	υ Gru	A0 Vnn	...	...
8798	218395	ADS 16519A	A3 V	180	.50
....	....	ADS 16519B	Am (A1/A3:/A7)s	...	...
8799	218396		F0 Vwl(met.: A5)	40	.33
8806	218525		A3 V	60	.49
8816	218639		A0 Vn	235:	.44
8817	218640	89 Aqr	G0 II-III + A3 V:	...	...
8822	218753	2 Cas	Am A5/A7/F0)	<10	.46
		ADS 16556A			
8826	218918	59 Peg	A3 IIIn	245:	.56
8830	219080	7 And	F0 IV	63	.52
8837	219290		A1 IV	45	.45
8840	219402		A2 V	145	.51
8844	219485		A1 IV	15	.38
8848	219571	γ Tuc	F2 III	...	...
8851	219586		A9 V	145	.60
8856	219659		A0 Vn	180	.49
8861	219749		A0 Vp(SiSr st, CaMg wk)	65	.18
8864	219815	9 And	Am (A9/F1/F3)	70	.59
8865	219832	95ψ^3 Aqr	B9.5 V	130	.53
		ADS 16671A			
8867	219841		A0 IV	65	.40
8870	219891		A4 III	175	.61
8880	220061	62τ Peg	A5 Vp(λ Boo)	135	.39
8884	220105	ADS 16685A	A3 Vn	240:	.51
8890	220278	97 Aqr	A3 Vp(Ca II st, Mg wk)	160	.40
		ADS 16708AB			
8902	220575		B8 IIIs	15	.26
8911	220825	8κ Psc	A2 Vp(SrCrSi st, Ca wk)	30	.46
8915	220933	69 Peg	A0 IIIp(Hg)	25	.35
8918	220974		A5 III	90	.50
8919	221006		A0 Vp(Si)	...	...
8932	221357	100 Aqr	A9 III-IV	110	.56
8933	221394		A0 Vp(SrCrSiHg)	35	.39
8936	221491		B9 Vn	180	.44
8937	221507	β Scl	B9.5 IIIp(HgMnSi)	...	...
8938	221525		A8 III	...	...
8939	221565	101 Aqr	A0 V	165	.42
8944	221675	14 Psc	Am (A3/A9V/F2)	70	.67
8947	221756	15 And	A1 Vp(4481 wk)	75	0.27

TABLE 2—*Continued*

HR	HD	Other	MK Classification	V sin i km s^{-1}	4481 W(A)
8949	221760	ι Phe	A0 Vp(SrCrEu)	...	...
8954	221950	16 Psc	F2 Vp(G-band st)	16	0.19
8959	222095		A2 V	...	...
8960	222098	74 Peg	A2 IV	15	.44
8963	222133	75 Peg	A0 Vn	215:	.49
8968	222345	ω^1 Aqr	A9 V	93	.62
8970	222377		Am (A1/A9/F0)	50	.66
8971	222386		A2 V	...	...
8973	222399	ADS 16913A	F0 III	46	.20
8931	222570		A4 III	85	.60
8983	222602		A2 Vn	195	.47
8984	222603	18λ Psc	A7 IV	60	.54
8988	222661	105ω^2 Aqr ADS 16944A	B9.5 IV	130	.44
9002	223024	107 Aqr A	A9 III	60	.68
9013	223274		A0 V	165	.50
9016	223352	δ Scl ADS 17021A	A0 Vp(λ Boo)n	280:	.26
9017	223358	ADS 17020AB	A0 Vp(SrSiCrHg)	68	.45
9018	223385	6 Cas ADS 17022A	A3 Ia+	30	.62
9019	223386		A0 III	25	.36
9022	223438	21 Psc	A5 III	78	.55
9025	223461	79 Peg	A5 II-III	48	.54
9026	223466	ADS 17029A	Am (A2/A5/A7)	60	.57
9028	223552	ADS 17032A	F2 IV-V	80	.55
9031	223640	108 Aqr	A0 Vp(SiSr st, CaMg wk)	20	.28
9039	223781	82 Peg	A3 V	165	.52
9042	223855	25 Psc	B9.5 V	50	.40
9043	223884		A3 Vn	210:	.46
9044	223991	ADS 17090AB	Am (A1/A7/A7)	23	.42
9048	224103	26 Psc	A0 IIIs	20	.37
9056	224309		A1 V	...	...
9060	224361		A2 V	...	...
9062	224392	η Tuc	A2 Vn	...	...
9080	224801		A0 IIp(SiSrHg st, CaMg wk)s	25	.16
9085	224903		A8 III	28	.50
9092	224995	31 Psc	A7: IV	90	...
9093	225003	32 Psc	A9 III	46	.50
9100	225180	9 Cas	A1 IVp(λ Boo)	25	.35
9102	225200		B9 IVs + A2 n	315:	.36
9105	225218		A3 IVp(λ Boo)s	20	0.34

NOTE.—Table 2 is published in computer-readable form in the AAS CD-ROM Series, Vol. 5, but with the "Other" column deleted.

stars; a plot for the early F stars in similar. These plots show a scatter of ±8.1 and ±9.7 km s^{-1}, respectively, which represent our estimated errors. The mean systematic errors are +0.2 and +1.1 km s^{-1}, respectively, which are insignificant. However, for $V\sin i > 225$ km s^{-1} Slettebak et al. have only one standard, which they marked as uncertain, and we do not know how to extend the calibration curve (Fig. 1, top); our values for velocities greater than 200 km s^{-1} may be uncertain and are marked with colons. However, we note that for the 26 stars with $V \sin i > 250$ km s^{-1} our values are larger on the average by 19±11 (s.e. in the mean) than those in the BSC; this difference is not significant, so that we agree on the average with previous measures. We rounded off our measures to the nearest 5 km s^{-1}.

The λ4476 Fe I line could be measured only among the late A stars, or about 31% of the stars. We found that those measures give rotational velocities that average 6 km s^{-1} lower than for λ4481 Mg II. Therefore we added 6 km s^{-1} to the measures from λ4476 before averaging them with those of λ4481. Thus measures derived from both lines have means that are usually not rounded multiples of 5 km s^{-1}.

The rotational velocities are listed in fifth column of Table 2.

2.3. λ*4481 Equivalent Widths*

The equivalent widths, W, of λ4481 were determined from the Gaussian profile fits for the sharper-lined stars; the values are listed in the last column of Table 2. For the broader-lined stars where Gaussian curves do not fit the wings of the lines, we made pixel-by-pixel integrations, sometimes after performing 2 pixel smoothing first. Our only direct comparison is for HR 7001 = Vega, for which we derived 0.31 Å, and Adelman & Gulliver (1990) give 0.291 Å, which is well within our estimated error of 0.062 Å per star.

The equivalent widths range from 0.11 to 0.83 Å and average 0.54 Å. The mean values as functions of spectral type and luminosity class are listed in Table 3. For each of four luminosities we list the mean equivalent widths, the rms scatter per star, and the number of stars (n) included. When there were less than 10 stars in a bin, we grouped together the data for two or more spectral types. The rms scatter per spectrum is ±0.062 Å for the main-sequence stars or 11% of the equivalent width. Of course this scatter is partly cosmic (real differences from star to star) and partly due to measuring errors, such as due to uncertainties in locating the continuum; we do not have the data to separate these sources.

Figure 2 shows these mean equivalent widths as functions of spectral type for four different luminosity classes. The error bars on the symbols are the errors in the means, namely, the rms times $(n - 1)^{-1/2}$. The curve drawn through the main-sequence (class V) stars is repeated in the lower three panels. Those show that within the errors, the relation fitting class V also fits classes IV–I for the late A stars. However, the early A stars of classes IV and III have lower equivalent widths, and those of classes II and I are higher. In fact, for classes II and I the equivalent widths can be fitted by a straight horizontal line within the error estimates. In all cases the equivalent width of λ4481 is relatively insensitive to spectral type, so when that line is seen or measured to be weak, that cannot be attributed to a small classification error and must represent an underabundance.

We do not list or use the equivalent widths of 4476 Fe I. They are generally less than 0.2 Å and vary rapidly with spectral type. And because we did not measure that line in all the late-type stars, the ones measured may be only the cases where the line is normal or unusually strong, so mean values might be misleading.

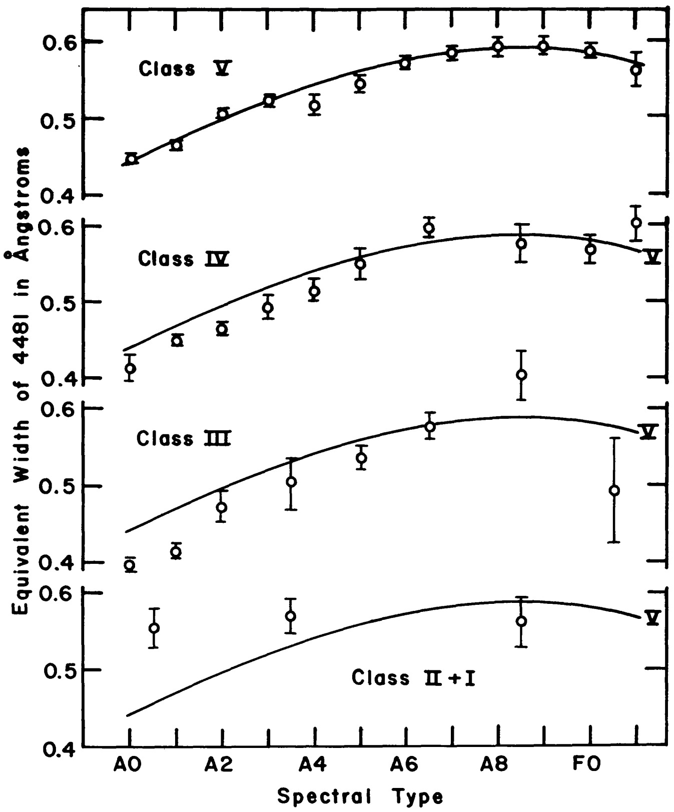

FIG. 2.—Equivalent widths, W, of the λ4481 Mg II lines in normal stars of various spectral types (abscissas) for various luminosity classes as marked. The error bars are standard errors in the mean values. Those errors, that average 11% of the equivalent width per star, are due partly to cosmic scatter and partly to measuring errors. The free-hand curve through the data for the class V stars is transferred to each of the lower three panels for a comparison of values.

TABLE 3

MEAN EQUIVALENT WIDTHS OF λ 4481 Mg II IN NORMAL STARS

Type	V[a] ⟨W⟩	V[a] rms	V[a] n	IV[a] ⟨W⟩	IV[a] rms	IV[a] n
A0	0.448	±0.062	102	0.415	±0.054	8
A1	0.465	0.059	84	0.450	0.051	53
A2	0.507	0.060	143	0.464	0.062	56
A3	0.522	0.063	84	0.495	0.072	21
A4	0.518	0.058	20	0.518	0.054	18
A5	0.546	0.057	36	0.551	0.081	16
A6	0.573	0.058	44	}0.598 (A6, A7)	0.050	19
A7	0.583	0.066	44			
A8	0.591	0.058	25	}0.577 (A8, A9)	0.098	18
A9	0.593	0.069	30			
F0	0.589	0.073	54	0.570	0.105	36
F1	0.561	0.096	21	0.602	0.082	13

Type	III[a] ⟨W⟩	III[a] rms	III[a] n	II, I[a] ⟨W⟩	II, I[a] rms	II, I[a] n
A0	0.397	0.040	23	}0.554 (A0, A1)	0.090	14
A1	0.415	0.039	24			
A2	0.473	0.062	11	}0.580 (A2–A5)	0.071	10
A3, A4	0.502	0.115	12			
A5	0.538	0.061	14			
A6, A7	0.579	0.063	13	}0.563 (A6–F1)	0.099	10
A8, A9	0.644	0.111	12			
F0, F1	0.494	0.177	8			

[a] Luminosity class.

3. DISCUSSION

3.1. *Mean Rotational Velocities*

The observed mean rotational velocities for normal stars are listed in Table 4 as a function of spectral type (horizontally) and luminosity class (in four vertical sections). In cases of less than 10 stars we grouped together the measures for several types. At each type and class we give the number of stars measured (n), the mean projected rotational velocity ($\langle V \sin i \rangle$), the estimated standard error in those means (s.e./mean), and the dispersions in the velocities (s.e.).

For class V stars the mean projected rotational velocities are shown in the top panel of Figure 3. We see the well-known decrease from large values in the Bs to small values in the Fs. But the scatter seems excessive in view of the numbers of stars included and the standard errors of the means. A least-squares linear regression shows a decrease from 149 km s^{-1} at A0 to 111 km s^{-1} at F0. Relative to that, the scatter is 12.0 km s^{-1}, whereas the mean expected error (Table 4, line 4) is ±7.9 km s^{-1}. Therefore the scatter is real at the 1.5 σ level. It shows up primarily as a unexpected rise for A4–A6. Without those three

TABLE 4

Mean Projected Rotational Velocities (km s^{-1}) for Normal Stars

A. Class V

Type	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	F0
n	104	86	143	83	21	36	44	43	25	31	46
$\langle v \sin i \rangle$	150	131	132	124	147	148	138	112	114	132	106
s.e./mean	±7	7	5	7	13	8	7	8	11	8	7
s.e.	±68	61	61	64	56	46	45	54	52	44	50

B. Class IV

Type	A0	A1	A2	A3	A4–A5	A6–A7	A8–A9	F0
n	10	49	57	20	21	21	17	36
$\langle v \sin i \rangle$	79	63	51	79	107	104	80	83
s.e./mean	±11	8	6	13	12	7	12	7
s.e.	±34	55	48	57	53	33	50	40

C. Class III

Type	A0	A1	A2–A3	A4–A5	A6–A7	A8–F0
n	24	23	21	20	13	18
$\langle v \sin i \rangle$	62	55	66	65	80	64
s.e./mean	±14	13	16	9	13	7
s.e.	67	59	69	40	46	28

D. Variation with Luminosity and Type

	Class II	Class Ib	Class Ia	Class II-Ia	
Type	A0–F0	A0–F0	A0–F0	A0–A4	A5–F0
n	10	14	9	20	13
$\langle v \sin i \rangle$	20	23	31	27	21
s.e./mean	±4	3	3	±2	3
s.e.	±12	11	7	+10	11

points that scatter is ±9.6 km s^{-1}, not much larger than the expected value of ±7.9 km s^{-1}. We will discuss below the reason for the high values between A4 and A6.

Skipping momentarily to class III, a least-squares linear regression of the mean velocities shows a small increase from 60 km s^{-1} at A0 to 73 km s^{-1} at F0 (see Fig. 3, third from the top). If we use the visual luminosity decrease by 1.3 mag between A0 and F0 (Blaauw 1963), the small change in bolometric corrections (assuming them to be the same as for dwarfs), and the temperature decreases by a factor of 0.74, we would expect the radii to be smaller by a factor of 0.85 and the rotational velocity to be larger by a factor of 1.17 at F0 relative to A0. This is almost exactly the same as the observed increase by a factor of 1.21. The scatter of ±6.4 km s^{-1} is smaller than the expected value of ±11.9 km s^{-1}. Therefore the small change in rotational velocities is entirely as expected, and the scatter is smaller than expected.

Turning now to class IV stars, we see the same peak at types A4–A6 as among the dwarfs and a small increase from A0 to F0 among the remaining stars as among the giants. A linear regression for the remaining stars shows an increase from 66 km s^{-1} at A0 to 82 km s^{-1} at F0 and a scatter of ±9.9 km s^{-1} compared with a mean value of ±9.7 km s^{-1}. Using the absolute visual magnitudes, bolometric corrections, and temperatures for A0 and F0 stars, we predict a rotational velocity at F0 of 1.24 that at A0, while the above slope gives a factor 1.29. Thus the agreement is good, and we are left only with explaining the hump at A4–A7.

The results for luminosity classes II–Ia are understandable. The left block in Table 4D shows the variation with luminosity (with all types combined), and the right block shows the variation with type (with all luminosities combined). The limited numbers of stars force these large groupings. The left block shows an increase in line width with luminosity. That had been found earlier by Abt (1957) and interpreted as an increasing contribution from macroturbulence in the stellar atmospheres. At luminosity class II there is a sizeable contribution of rotation to the line widths, which range from 10 to 43 km s^{-1} and have a dispersion of 12.2 km s^{-1}. At class Ia the range of line widths is only from 25 to 45 km s^{-1} with a dispersion of only 7.2, showing that much of the line width is due to turbulence that, unlike rotation, probably does not vary from star to star by aspect effect. The right block in Table 4 shows the decrease in rotation with decreasing temperature at a nearly constant luminosity. For the two mean types (A1.2 and A7.9) and with luminosities (of Ib stars) given by Blaauw (1963) and bolo-

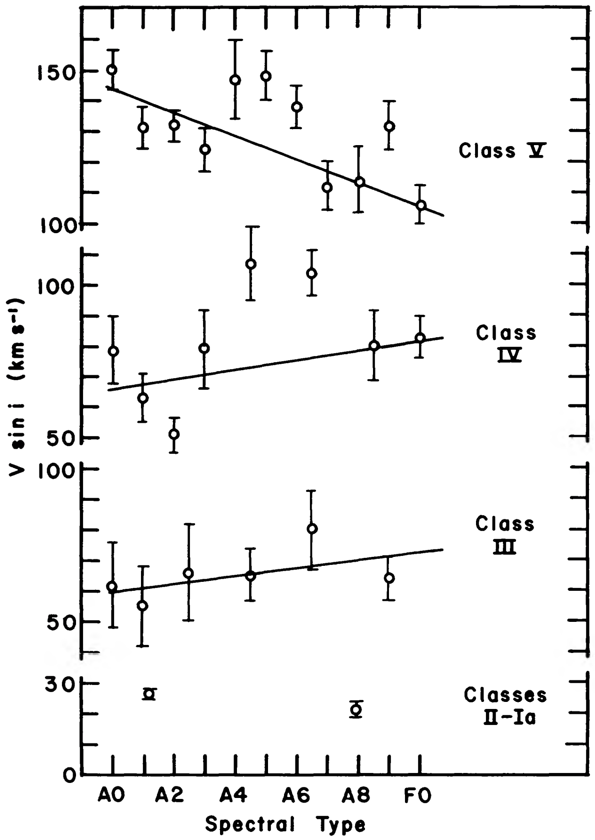

FIG. 3.—Mean projected rotational velocities for normal stars of various spectral types (abscissas) and for various luminosity classes as marked. The error bars are standard errors in the mean values; they average about ± 8 km s^{-1}.

metric corrections and temperatures given by Allen (1973), we would expect the rotational velocities at the latter type to be 0.71 times those at the earlier type. The discrepancy with the observed factor of 0.79 is probably due to the fact that the line widths are caused partly by turbulence.

We can estimate the atmospheric macroturbulent velocities among the luminous stars if we make three reasonable assumptions. One is that the mean rotational velocities along the upper main sequence do not vary substantially with type, which is true within a factor of 1.2 (Abt & Hunter 1962). A second is that during evolution off the main sequence, stars conserve their angular momentum in shells, rather than in solid-body rotation, which is true if mass loss does not carry away much of the angular momentum (Oke & Greenstein 1954; Abt 1958). Third, we will assume a macroturbulent velocity for A5 III stars of 5 km s^{-1}, but the results would be trivially different if we selected 2 or 10 km^{-1}.

For A5 stars of luminosity classes III, II, Ib, and Ia the mean line broadenings are 65, 20, 23, and 31 km s^{-1}. From their mean luminosities we can obtain relative radii, and we assume from the above that their rotational velocities are inversely proportional. This gives rotational velocities of 65, 19, 7, and 2 km s^{-1}. Differencing these as squares we derive macroturbulent velocities of 5, 7, 22, and 31 km s^{-1}, respectively.

3.2. *Deconvolution of the Rotational Velocities*

Our line widths yield values of the components of the equatorial rotational velocities, V, projected along the lines of sight, namely, $V \sin i$. The values of the inclinations, i, between the lines of sight and the rotational axes are generally not known except in the rare cases of (1) eclipsing binaries (where $i_{\rm orbital} = 90°$ and strong tidal effects will ensure that the rotational axes are roughly parallel to the orbital axes) and (2) variable Ap and spotted stars where independent determinations of the rotational periods are available. But for the bulk of our stars we will have to make an assumption about i to convert from measured values of $V \sin i$ to V.

We will assume that for a large sample of stars there is a random orientation of rotational axes with respect to the lines of sight. The justifications for this assumption are three. First, Huang & Wade (1966) explored the frequency of eclipsing binaries as a function of Galactic latitude, reasoning that if there is any preferred orientation of binaries in the Galaxy, it would be such that the orbits would tend to lie in the Galactic plane. They found no dependence upon Galactic latitude, implying a random orientation of axes. Second, as was mentioned above, variable Ap stars yield independent determinations of the rotational periods from the variation of the abundance or temperature spots in their photospheres. Then a comparison of the two period determinations, one of which is dependent upon the unknown inclinations, yields values of the inclinations. That test was made by Abt, Chaffee, & Suffolk (1972) for 22 stars. They found agreement between observed values of i and a random distribution of such values. Third, for visual binaries one can determine the orientations of the orbits in three dimensions. Batten (1967) found a random distribution of orbital axes plotted in Galactic coordinates. Dommenget (1988) confirmed that, at least on Galactic scales larger than 30 pc. The median distance of our stars is about 60 pc. Another test is to see whether in triple visual systems there is any tendency to have coplanar orbits. Worley (1967; see also Batten 1973) found no such tendency. Of course, the tidal effects in visual binaries are very small, but all these studies strongly imply that a random distribution of the rotational axes of field stars is a reasonable assumption.

Let us divide the stars into three groups with types of A0–A1, A2–A4, and A5–F0. The counts of the numbers of stars of various kinds are given in Table 5 for general interest. The group called "4481 weak" include both the λ Bootis stars and the less extreme cases where only λ4481 is noted to be weak. Please note that even if the BSC were complete to a given apparent magnitude, the frequencies given in Table 5 are limited by apparent magnitude, so that the more luminous stars are overrepresented relative to a sample limited to a given volume of space. In this sample of 1383 A0–F0 stars, 48.0% are of class V, 27.6% are of class IV–I, 6.4% are Ap, 9.3% are Am, 8.1% are λ Boo or λ4481 weak, and 0.6% are shell stars. Roughly half are dwarfs, one-quarter are normal stars above the main sequence, and one-quarter are peculiar. The remaining stars in Table 2 are earlier than A0 or later than F0.

Note in Table 5 that the mean rotational velocities of the λ4481-weak stars are similar to those of the other dwarfs, and their dispersions are only slightly larger. We conclude that the

TABLE 5

FREQUENCIES OF VARIOUS KINDS OF STARS IN A SAMPLE LIMITED BY APPARENT MAGNITUDE

	V	IV	III	II	I	Ap	Am	λ 4481 Weak	Shell
				A0–A1					
n	188	60	45	4	11	43	3	58	5
Percent	45	14	11	1	3	10	1	14	1
⟨*v* sin *i*⟩	142	62	52	20	29	32	30	145	212
s.e.	±65	48	55	15	10	22	30	85	24
				A2–A4					
n	242	84	25	0	6	29	9	31	3
Percent	56	20	6	0	1	7	2	7	1
⟨*v* sin *i*⟩	131	62	68	...	26	41	42	122	200
s.e.	62	51	68	...	7	38	33	76	23
				A5–F0					
n	234	79	54	6	8	17	116	23	0
Percent	44	15	10	1	1	3	22	4	0
⟨*v* sin *i*⟩	125	89	73	23	23	30	46	134	...
s.e.	50	44	36	13	14	21	29	64	...

λ4481-weak peculiarity is not dependent upon rotational velocity. Therefore we will group the λ4481-weak stars together with the normal stars of class V and compare them with the Ap+Am stars.

For each range in spectral type we will deconvolve the class V + λ4481-weak stars and the Ap+Am stars. The results are given in Figures 4–6.

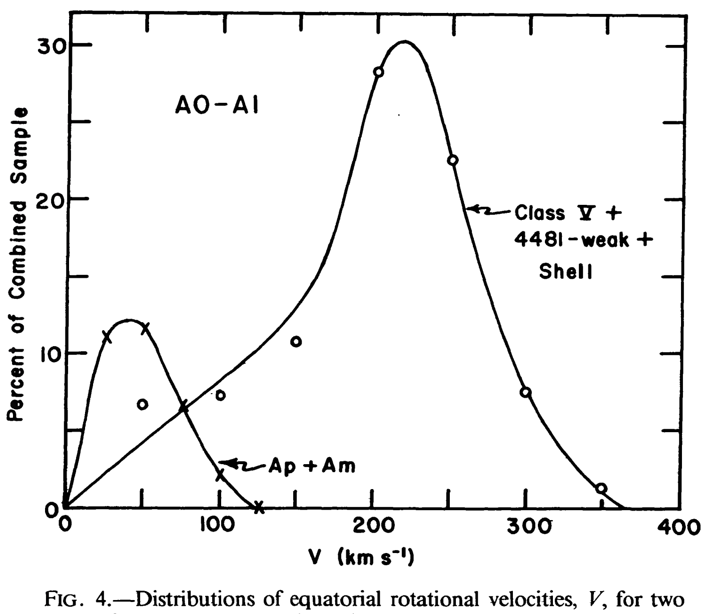

FIG. 4.—Distributions of equatorial rotational velocities, *V*, for two samples of A0–A1 stars. The right distribution is for 188 normal class V stars plus 58 stars with weak λ4481 lines plus five shell stars; the distribution on the left is for 46 Ap+Am stars whose peculiar abundances are thought to be due to diffusion. The areas under the curves are proportional to their relative frequencies in the BSC.

In Figure 4 we see the distributions for 46 Ap+Am stars (crosses) and for 188 normal A0+A1 V plus 58 λ4481-weak plus five shell stars (circles). The proportions are 15:85. Please note that all of the rapid rotators ($V > 120$ km s^{-1}) are normal stars or ones in which rotation-dependent diffusion effects are not acting while most of the stars that rotate more slowly are peculiar stars in which diffusion is occurring. But there is an overlap of 9%, namely, about 26 stars that are rotating slower than 120 km s^{-1} and that seem to have normal spectra. Let us discuss the other two spectral ranges before trying to explain this lack of a complete dichotomy.

In Figure 5 we show the distributions in *V* for 38 Ap+Am stars (crosses) and for 242 A2–A4 V plus 31 λ4481-weak plus three shell stars (circles). The proportions are 12:88. The only stars labeled Ap or Am and with $V \sin i > 120$ km s^{-1} are HR 8464 and HR 8890, each with $V \sin i = 160$ km s^{-1}; they are called peculiar because their Ca II K lines are too strong. Such stars are neither regular Ap nor Am stars that always have very weak Ca lines due to diffusion, but we do not know what they are. Otherwise all stars with $V > 120$ km s^{-1} are normal or λ4481-weak, and most of the stars rotating more slowly are Ap or Am. There is an 7% overlap, corresponding to 21 too many normal stars with sharp lines.

In Figure 6 we show the distributions in *V* for 133 Ap+Am stars (crosses) and for 234 A5–F0 V plus 23 λ4481-weak stars (circles). The proportions are 34:66. Here the only star labeled as Ap or Am and with $V \sin i > 120$ km s^{-1} is HR 3798 = S Ant, a SB1 with a period of 0.648345. Its rotational velocity of 155 km s^{-1} indicates likely synchronism of rotational and orbital motions. But it is a marginal Am star. Aside from that star, all the rapid rotators with $V \sin i > 120$ km s^{-1} have normal or λ4481-weak spectra, and most of the stars that rotate more slowly have Ap or Am spectra. There is an 10% overlap, corresponding to 39 too many normal stars with sharp lines.

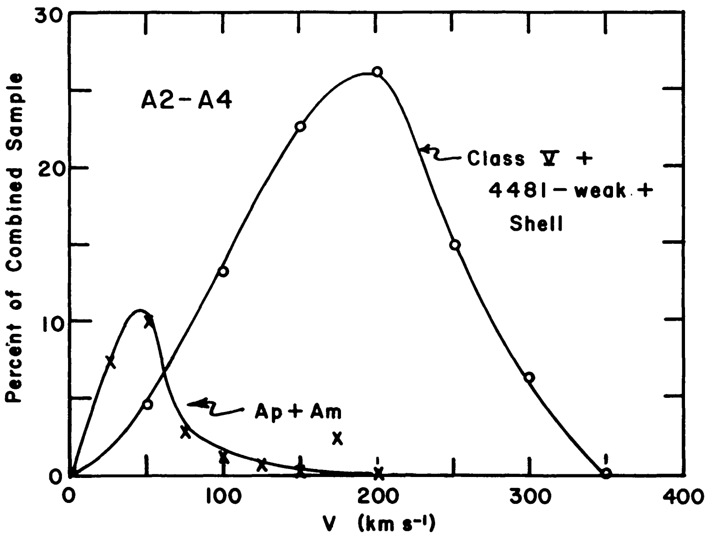

FIG. 5.—Distributions of equatorial rotational velocities, *V*, for two samples of A2–A4 stars. The right distribution is for 242 normal class V stars plus 31 stars with weak 4481 lines plus three shell stars; the distribution on the left is for 38 Ap+Am stars whose peculiar abundances are thought to be due to diffusion. The areas under the curves are proportional to their relative frequencies in the BSC.

These three figures show consistently that whereas all the rapid rotators (well-mixed stars) have normal spectra or the accreted metal-poor material called λ4481-weak, not all the slow rotators (relatively unmixed stars) have peculiar spectra. We are left with three possible explanations: (1) rotation is not the only criterion that determines whether a star has a normal or abnormal spectrum, (2) rotation is the sole criterion but there is a time lag, particularly in the case of tidally interacting binaries, between the first occurrence of a slow rotation and the appearance of the abundance peculiarities, or (3) we have not isolated all of the peculiar stars with our MK classification. If we find that explanations (2) and (3) are invalid, we will be forced to accept explanation (1).

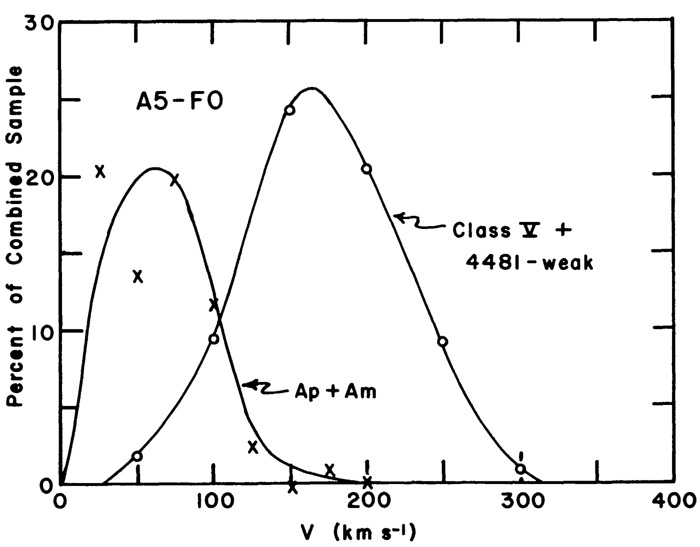

FIG. 6.—Distributions of equatorial rotational velocities, *V*, for two samples of A5–F0 stars. The right distribution is for 234 normal class V stars plus 23 stars with weak λ4481 lines; the left distribution is for 133 Ap+Am stars whose peculiar abundances are thought to be caused by diffusion. The areas under the curves are proportional to their relative frequencies in the BSC.

3.3. *Alternate Explanations for the Overlap in Rotational Velocity Distributions*

Let us consider the time-lag explanation first. In spectroscopic binaries of relatively short periods there is a tidal interaction that gradually slows the stellar rotational velocities until they are synchronized with the orbital periods. For A-type stars (Levato 1976) that are not young, synchronization has occurred in essentially all binaries with periods less than 2–3 days, while most of those with periods less than 20 days or more have rotational velocities less than 120 km s^{-1}. A related effect, namely, the time it takes to achieve orbital circularization in binaries, has received considerable attention recently (e.g., Goldman & Mazeh 1991). Although there remain large discrepancies between theoretical models and the observations, the latter imply times of the order of 5×10^9 yr for a 10 day binary.

Among the known data in the BSC for the A0–A1 V stars and λ4481-weak stars, there are 17 known spectroscopic binaries with periods less than 20 days and rotational velocities of $V \sin i < 100$ km s^{-1}. That already goes a long way toward accounting for the 29 excess sharp-lined normal stars that produce the overlap in the rotational-velocity distributions. That is a minimal number because most of the fainter BSC stars lack sufficient published radial-velocity measures to detect all the binaries, let alone to determine their orbital periods. Therefore Abt and Willmarth are currently conducting a study of the fraction of short-period binaries among the sharp-lined normal A-type stars.

However, this mechanism to reduce the rotational velocities will not explain the excess of sharp-lined normal stars for the simple reason that the timescale for the diffusion process to produce Ap and Am spectra is considerably faster than the timescale for the production of slow rotators. For instance, Michaud et al. (1976) found that the separation of He takes 10^5–10^6 yr, and observations show that the Orion OB1 Association with an age of 5×10^6 yr has Am stars (Smith 1972), as does the Orion Nebulae cluster (Levato & Abt 1976) with an age of 5×10^5 yr. These should be compared with a time of the order of 10^9 yr to reduce the rotational velocities below 120 km s^{-1} by tidal interactions for orbital periods of roughly 10 days. Thus as soon as the rotational velocity of a star in a binary has dropped below the 120 km s^{-1} limit, the star quickly develops the Am characteristic with the result that we should see very few normal spectra with rotational velocities below that limit.

Let us turn now to the third possible explanation for the overlap of the rotational velocity distributions of peculiar and normal stars, namely, that we have failed to discover all of the peculiar stars in our sample.

Among the standards (Morgan et al. 1978) at A0 are HR 7001 = α Lyr at A0 Va and HR 5291 = α Dra at A0 III. However the equivalent widths of their λ4481 lines are 0.31 and 0.32 Å, respectively, which are considerably lower values than for other normal stars of those types (see Fig. 2). Furthermore, Adelman & Gulliver (1990) have shown that those two stars are underabundant in Mg II relative to the Sun by factors of 4.9 and 2.5, respectively. Also many other metals and He I are underabundant in these two stars by factors up to 10 relative to the Sun, so they are abnormal stars, rather than normal ones. In Table 2 these two stars are now labeled "standard," implying that we used them as standards in our classifications but we no longer consider them to be normal.

The realization that two of our primary standards are not normal means that many of our program stars are also abnormal but have been misclassified as normal. If that were the end of it, we could reclassify the stars near A0 for which we used α Lyr and α Dra as standards. But how many others of our standards are really abnormal if they were studied spectrophotometrically? Some have broad lines, and for those it would be very difficult to obtain good abundance measures. However we did relook at the strengths of λ4481 by using as standards only HR 343, 403, 669, 4033, 4359, 7906, and 8641. Thus at least the identification of "λ4481-weak" stars has been revised using the better standards. The results for the A0–A1 stars are shown in Figure 7 where nearly all the stars with λ4481 equivalent widths larger than 0.4 Å are normal, essentially all the stars with λ4481 equivalent widths less than 0.3 Å are Ap or λ4481-weak, and the region between 0.3 and 0.4 Å contains normal and peculiar stars, perhaps because of the ±0.062 Å accuracy of our measures (see § 2.3). Because both the λ4481 equivalent width measurements and the visual classifications have errors in them, there will be marginal cases in which one criterion says that a star is normal and another says that it is abnormal.

The realization that many of the sharp-lined "normal" stars might really be abnormal stars tells us that visual MK classification may not be a complete way to discover all the abnormal stars, while full spectrophotometric studies for many stars are not practical; an intermediate technique that might work is to measure one or a few lines on CCD spectra as we have done for λ4481 or to make photoelectric measures as Henry & Hesser (1971) did for the Ca II K line.

A related effect is that discovered for many stars classified A2 IV (plus some at A1 IV and A3 IV). Whenever we classified a star as such, we usually noticed that it had sharp lines. Whereas A2 V stars have a mean rotational velocity of 132 km s^{-1} (Table 4), those of type A2 IV average only 51 km s^{-1}. That difference is too large to be explained by the small evolutionary expansion between those types. Furthermore the equivalent widths of λ4481 are substantially lower for A0–A3 IV than for the A0–A3 V stars (see Table 3 and Fig. 2). When we looked at the strengths of the Ca II K line in the photometry of Henry & Hesser for those stars in our list that also occurred in theirs, we found that the A2 IV stars had weaker K lines than the A2 V stars by an amount that corresponds to a difference of one spectral subclass. So perhaps roughly half of the stars classified as A2 IV seem to be like other peculiar stars in having low rotational velocities and weak Mg II and Ca II lines; the other half may be the normal evolutionary descendents of the normal class V stars. Here we have a possible class of peculiar stars that has not been recognized before but with Mg underabundances of the order of a factor of about 5.

We now return to the problem mentioned in § 3.1 on mean rotational velocities, namely, the effect shown in Figure 3 where the class V and IV stars of types A4–A6 have rather high mean rotational velocities. Or those curves can be viewed as having dips around A2, just where we found the admixture of stars with weak λ4481 and K lines. Most Ap stars occur among the early As and most of the Am stars occur among the late As; if there are similar peculiar stars that we missed and called them normal, their low rotational velocities would depress the means for the early As and late As, leaving a maximum between them.

A final question is that if members of relatively closely spaced binaries are partly or completely synchronized in rotational velocities, why are not their primaries invariably peculiar stars due to diffusion? We considered the 34 A0–F0 known double-lined spectroscopic binaries because for those we can estimate their orbital inclinations by assuming normal masses for their primaries. Of the 34, 16 have Am primaries, one is a λ Boo star, two are of luminosity class III (the Am effect disappears after a star leaves the main-sequence region), two have periods of 72 and 9890 days for which we would expect no tendency toward synchronization, two have derived rotational velocities of 189 and 199 km s^{-1} (much too large for diffusion to occur), three have rather weak λ4481 lines (0.19–0.32 Å) and are probably peculiar in abundance, and two have marginally long periods of 16–20 days for synchronization to occur; that leaves only six binaries to explain, and four of those are of types A1–A3 IV that we suspect to be marginally peculiar. Therefore the "normal" close binaries do not provide a strong objection to our conclusion that if the rotational velocities of A-type stars are less than about 120 km s^{-1}, the stars definitely or probably have peculiar abundances.

To summarize, we tentatively conclude that the overlap in rotational velocity distributions between peculiar and normal stars is due to our failure to detect all of the peculiar-abundance stars and that if we had detected them, the rotational velocity

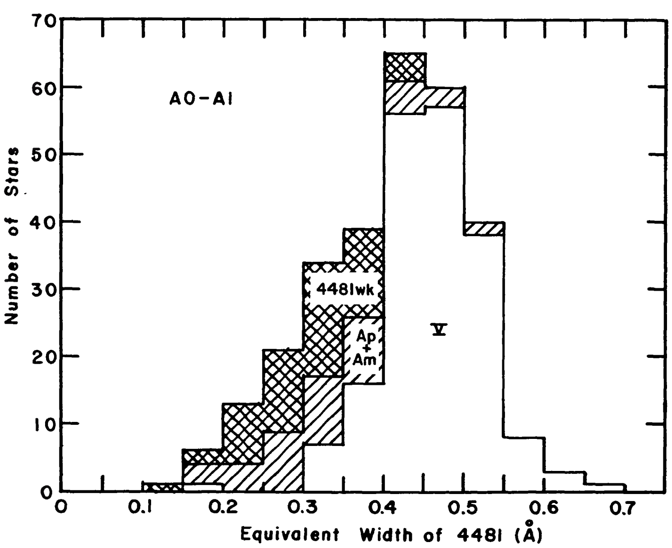

FIG. 7.—The numbers of A0–A1 stars with various equivalent widths of the λ4481 Mg II lines. The blank area marked "V" represent normal class V stars; the star Vega, thought to be a standard but recently found to be an Am star, has W = 0.31 Å. The values for the Ap+Am stars have single hatching while those representing the λ Boo plus λ4481-weak stars have cross-hatching. The prototype star λ Boo has W = 0.11 Å.

of a star would be adequate to determine whether its spectrum would be peculiar or normal. The evidence is the following (1) some of our primary standards, such as Vega and Thuban (α Dra), have now been found to be peculiar: therefore other stars labeled normal by us are also probably peculiar, (2) part, at least, of the stars classified A2 IV and of neighboring types are peculiar in having unusually low rotational velocities, weak Mg II λ4481 lines, and weak Ca II K lines, implying a previously unrecognized kind of peculiarity, and (3) the mean rotational velocities of class V and IV stars shows excessive scatter that could be explained by undetected peculiar stars that have a spectral distribution similar to the Ap+Am stars.

One final effect should be mentioned. van den Heuvel (1968) found that among many types in the B's and A's there are bimodal distributions in rotational velocities with a maximum near zero and a second maximum near 150 km s^{-1}. We do not find such bimodal distributions in the A's, perhaps because our new classifications, based on hydrogen types that more nearly represent the stellar effective temperatures, do not put the sharp-lined Ap and Am stars at the wrong types.

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