Hα and OI PHOTOMETRY OF UPPER MAIN SEQUENCE STARS WITH ANOMALOUS ABUNDANCES

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ABSTRACT. Additional α(16)Λ(9)-photometry of upper main sequence stars with anomalous abundances confirm our previous results, namely, Ap stars are neatly separated from normal main sequence stars. Furthermore, Ap stars are located on three different zones of the α(16)Λ(9)-plane, according to their abundance anomalies to form three photometric groups, (i) Si stars, (ii) Hg,Mn stars, and (iii) Cr,Eu,Sr stars.

1. INTRODUCTION

A preliminary report on the α(16)Λ(9)-photometric system of upper main sequence stars with anomalous abundances was given earlier (Mendoza 1977). The main result was that Ap stars are neatly separated from normal main sequence stars.

We have observed over 500 stars in the α(16)Λ(9)-photometric system mostly from the Bright Star Catalogue (Mendoza 1985a,b,c,). The observations include stars with spectral types from O to K, luminosity classes from I to V, and normal and abnormal stars. Figure 1 shows the α(16) Λ(9)-plane for the Bright Stars (Mendoza 1985a). The scatter in this figure is mainly due to luminosity effects and spectral peculiarities (Be, shell, Am, Ap, etc.). It is interesting to mention that stars with the Hα-line contaminated by emission have an α(16)-index <0.94, approximately; stars with the OI line (λ7774A) also contaminated by emission have an Λ(9)-index <0.26, approximately.

The photometric data indicate that there are probably two close sequences in the α(16)Λ(9)-diagram for normal main sequence stars, one for the O4-B9 V, and other for the A0-G2 V stars with a perceptible cosmic scatter around A0 V (Mendoza 1985c).

2. OBSERVATIONS

The new observations have been carried out with the 33-inch telescope of Observatorio Astronómico Nacional at San Pedro Mártir, in 1981-3. Table 1 contains the α(16)Λ(9)-photometry (in magnitudes) of 30 classical Ap stars. Jaschek and Egret (1982) classify them in four classes, for orien-

C. R. Cowley et al (eds.), Upper Main Sequence Stars with Anomalous Abundances, 195–198.

TABLE 1

Hα and OI-PHOTOMETRY of UPPER MAIN SEQUENCE STARS with ANOMALOUS ABUNDANCES

HD	Name	α(16)	Λ(9)	Sp	G
358	α And	1.233	0.325	B9	Hg,Mn
9996	GY And	1.368	0.294	B9	Cr,Eu,Sr
18296	21 Per	1.278	0.287	B9	Si:
19832	56 Ari	1.218	0.299	B9	Si
25823	41 Tau	1.192	0.289	B9	Si
28929		1.238	0.317	B9	Hg,Mn
33904	μ Lep	1.216	0.324	B9	Hg,Mn
40312	θ Aur	1.270	0.318	A0	Si
75333	14 Hya	1.221	0.319	B9	Hg,Mn
78316	κ Cnc	1.216	0.313	B8	Hg,Mn
106625	γ Crv	1.214	0.321	B8	Hg,Mn
108662	17 Com	1.338	0.285	B9	(Cr,Eu,Sr):
110066	AX CVn	1.398	0.291	A0	Cr,Eu,Sr
110073		1.209	0.323	B8	Hg,Mn
111133	EP Vir	1.352	0.296	A0	Cr,Eu,Sr
112185	ε UMa	1.359	0.287	A0	Cr,Eu,Sr
112413	α^2 CVn	1.285	0.289	A0	Si:
118022	78 Vir	1.390	0.271	A1	Cr,Eu,Sr
120198	84 UMa	1.328	0.284	B9	Cr,Eu,Sr
124224	CU Vir	1.242	0.286	B9	Si
130158	55 Hya	1.274	0.276	A0	Si
137909	β CrB	1.344	0.286	F0	Cr,Eu,Sr
148898	ω Oph	1.378	0.286	A7	Cr,Eu,Sr
151525	45 Her	1.314	0.294	B9	Cr,Eu,Sr
152107	52 Her	1.376	0.281	A2	Cr,Eu,Sr
174933	112 Her	1.245	0.318	B9	Hg,Mn
176232	10 Aql	1.322	0.275	F0	Cr,Eu,Sr
201601	γ Equ	1.330	0.288	F0	Cr,Eu,Sr
220825	κ Psc	1.372	0.277	A0	(Cr,Eu,Sr):
223640	108 Aqr	1.239	0.292	B9	Si

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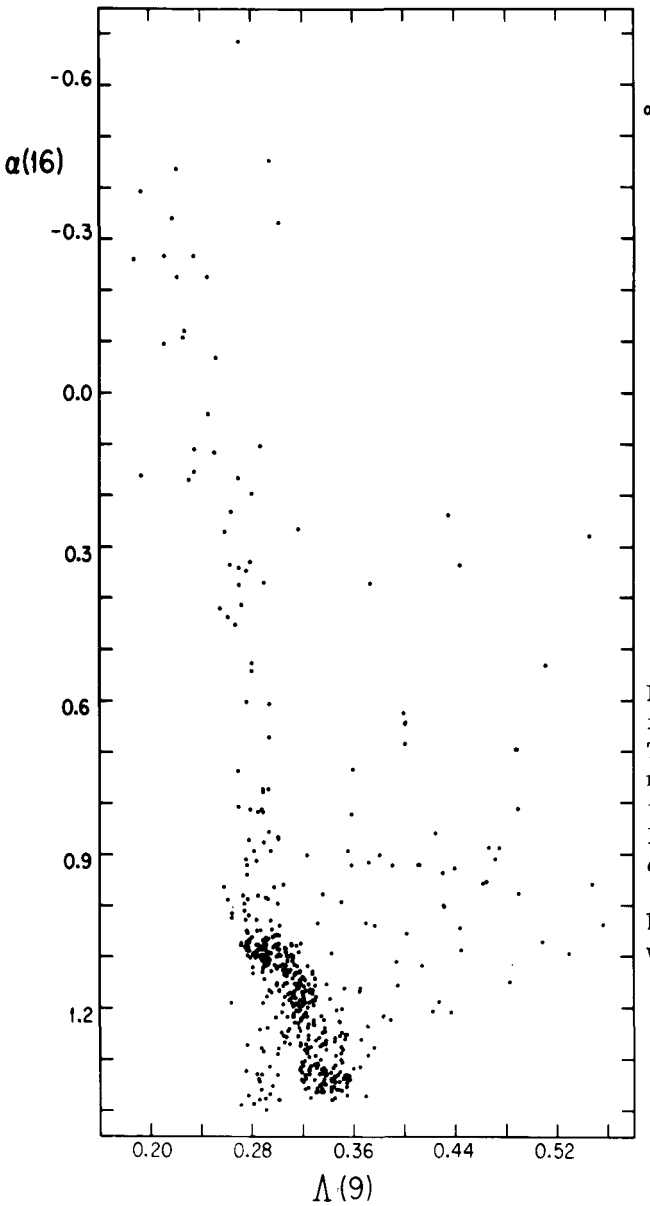

Fig. 1. The α(16)Λ(9)-plane for the Bright Stars (in magnitudes). CP-stars are located at the bottom and to the left side of this figure.

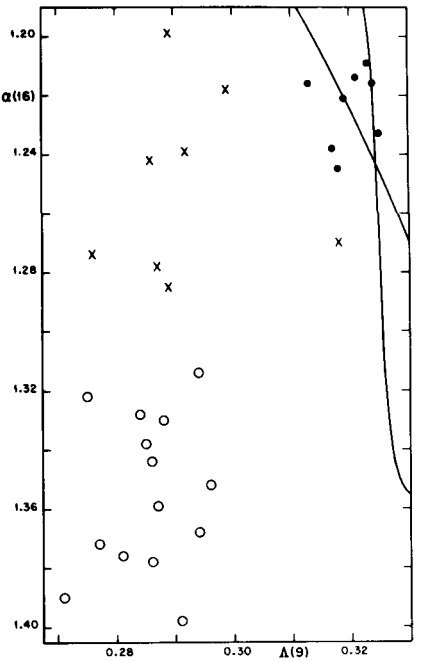

Fig. 2. The α(16)Λ(9)-array for the Ap stars listed in Table 1. Coding: solid line, normal main sequence, from O4 to G2; crosses, Si-stars; filled circles, Hg,Mn-stars; and open circles, Cr,Eu,Sr-stars (Am stars are not plotted; however, they do not mix-up with the Ap stars -loc. cit.).

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tation purposes:

A: Si λ4200 and Si stars
B: Hg, Mn, and Hg-Mn stars
C: Si combined with Cr, Eu, Sr, etc.
D: Cr, Eu, Sr, and combinations

Last column of Table 1 lists these classes as:

A: Si
B: Hg, Mn
C: Si: or (Cr,Eu,Sr):
D: Cr,Eu, Sr

3. CONCLUSION

Figure 2 shows the α(16)Λ(9)-array for upper main sequence stars with anomalous abundances. Three groups are clearly seen, (i) the Si-stars; (ii) the Hg,Mn-stars, and (iii) the Cr,Eu,Sr-stars. Figure 2 also shows:

a) Si-stars and Hg,Mn-stars have approximately equal α(16)-index, but different Λ(9)-index, on the average.
b) Si-stars and Cr,Eu,Sr-stars have different α(16)-index and approximately equal Λ(9)-index, on the average.
c) Hg,Mn-stars and Cr,Eu,Sr-stars have both indices quite different.

The above can be interpreted as each class having slightly different physical parameters.

It is interesting to mention that other stars hotter than the Sun are also well separated in this photometric system (see Fig. 1 and Mendoza 1985c), such as the Am stars, which are part of this colloquium (we do not give herein more details because of lack of space -see Mendoza 1976 and 1985c). Thus, we conclude that the α(16)Λ(9)-photometric system is suitable to classify stars very accurately, especially the A-type stars.

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