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SEARCH FOR MAGNETIC FIELD IN BIDELMAN'S F SR λ4077 STARS

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ABSTRACT. *No large-scale magnetic field could be found among 6 F Sr λ4077 stars. This does not suggest the possibilities that these stars may be related to the magnetic Fp Sr stars.*

1. INTRODUCTION

Bidelman (1981;1983;1985) has listed interesting stars (Ap, Am, Ba, subdwarf stars etc.) he found on the objective prism plates. Among these stars, he mentioned 21 F stars as having a strong Sr II λ4077 line. They look different from the classical Ap Sr stars, where the Sr II lines are even more enhanced, as well as from the Am (or Fm) stars, whose Ca is deplored.

Because of the possible connection these stars might have a priori with the Fp Sr stars it was judged interesting to look for a magnetic field in them, since a large-scale magnetic field (as the instrumentations used here can detect) is one of the main characteristics of Ap-Fp stars.

A systematic study of these stars began a few years ago by means of photometry (North, 1987) and using the Spectrovelocimeter CORAVEL (North and Duquennoy, 1991). It was found that their effective temperature is very often smaller than 7000 K. This raises of course the question of the physical mechanism responsible for their abundance anomalies, because Michaud's radiative diffusion works only when Te>=7000 K (Vauclair and Vauclair, 1982). If the Sr overabundance of the cooler stars is to be explained by radiative diffusion,' then their upper layers must be efficiently stabilized, and one can imagine that only a strong magnetic field might do it.

2. OBSERVATIONAL RESULTS

Observations have been made at SAO with the 6 m telescope, using both the MSS Zeeman analyzer and the MF Magnetometer. The results are summarized in Table 1: they are clearly negative.

Table 1. Results of the magnetic observations

HD	Date	exp. time	Instrument	Be ± σ
25475	30.1.91	1^h05^m	MF Magn.	-1690 947
177645	13.8.89	0^h45^m	MSS Zeeman	-127 92
	6.6.90	2^h00^m	MF Magn.	230 310
	1.6.91	3^h08^m	MF Magn.	-139 342
182274	12.8.89	0^h55^m	MSS Zeeman	333 120
198583	12.8.89	3^h20^m	MF Magn.	-310 220
206433	14.8.89	3^h35^m	MSS Zeeman	-226 164
213258	12.8.89	0^h47^m	MSS Zeeman	-198 133
	13.8.89	0^h53^m	MSS Zeeman	210 108

At this point, it is interesting to mention that photometry (as well as CORAVEL data) allowed to discover a dichotomy among the F Sr λ4077 stars: the hotter ones are metal-rich, while the cooler ones are slightly metal-poor or normal (as far as iron-peak elements are concerned). Interesting is the critical effective temperature that is precisely 7000 K. It is therefore likely that the F Sr λ4077 stars do not form a physically homogeneous sample; one of them, HD 182274, is a "CH subgiant" (Bond, 1974) and belongs to the family of barium stars, whose Sr overabundance is explained in terms of nucleosynthesis, not in terms of radiative diffusion.

The physical characteristics of the stars investigated in this paper are recalled in Table 2 (North and Duquennoy, 1991).

Table 2. Physical characteristics of the stars listed in Table 1

HD	T_e (phot.)	log g	[Fe/H] (phot.)	Vsini	Remark
25475	~6900	3.8	+0.13	≥70	Uncertain E(B2-V1)
					Uncertain T_e, log g
177645	7150	3.55	+0.40	23	" "
182274	6180	4.41	-0.40	9	CH "subject" (Ba dwarf)
198583	6480	3.52	-0.05	~51	
206433	~6500	~4.1	-0.15	17	Uncertain E(B2-V1)
213258	7200	4.2	+0.20	4	Composite spectrum?

Of the 3 metal-poor stars, only HD 182274 is a bona fide Ba dwarf: on the basis of high resolution spectra taken at Haute-Provence Observatory, the other two do not seem to share the characteristics of Ba stars, although this is less certain for HD198583, which rotates very fast.

3. CONCLUSION

Although the above results are still very fragmentary, they nevertheless suggest the following conclusion:

- A strong large-scale magnetic field is not required to produce the spectral peculiarities of the F Sr λ4077 stars, especially of the cooler ones which cannot be related to Am stars because of their metal-deficiency.
- The metal-rich F Sr λ4077 stars are probably closer to Am (Fm) than to Ap (Fp) stars, since they are not magnetic.
- The only confirmed Ba dwarf measured is not magnetic (at least not strongly), which is interesting for it is the first time that this kind of stars is investigated this way. However, this result is not surprising, for the physical mechanism producing the abundance anomalies here (s-process elements produced in an evolved companion and accreted by the star) does not involve any magnetic field.

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