POLARIZATION IN PECULIAR EMISSION-LINE OBJECTS*

R. Barbier, European Southern Observatory;

J.P. Swings, European Southern Observatory, and
Institut d'Astrophysique, Université de Liège

ABSTRACT

We report on visual polarimetric measurements of B[e] and related stars, and on an unsuccessful search for correlating the observational data with characteristics of the objects or of their surrounding dust shells.

INTRODUCTION

Be stars in general are known to show intrinsic linear polarization (see e.g. Coyne, 1976, 1982) which arises from Thomson scattering in a flattened plasma disk around those stars ($P_{max} \simeq 1$ % at about 5000 A). One case of a B[e]star, HD 45677, was studied very carefully by Coyne and Vrba (1976) : its polarization, which varies on a time scale of months, and which is always larger at wavelengths longer than 5000 A, is attributed to scattering from patchy clouds of dust located in a ring around the star. In the present study we observe a series of B[e]stars in order to confirm the presence of the dust surrounding them that was detected via near infrared photometry (see e.g. Allen and Swings, 1976).

OBSERVATIONS

The observations were made with two different polarimeters of the European Southern Observatory :

1) a four channel photometer-polarimeter attached to the

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*Based on data collected at the European Southern Observatory (La Silla, Chile)

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TABLE 1 : "u, b, y" POLARIMETRY (ESO 3.6 M; DEC. 1979)*

Object	p(u) %	θ(u) °	p(b) %	θ(b) °	p(y) %	θ(y) °	No.of meas.
HD 44179	1.5± .4	148±2	1.45±.25	148±1	1.64±.4	152±1	2
HD 45677	.75 .15	169 1	1.1 .2	173 1	.85 .25	177 2	2
RX Puppis	1.65 .5	113 1	1.9 .5	118 1	1.8 .5	123 2	2
HD 87643	.8 .4	134 1	.9 .4	138 1	1.0 .4	139 1	2
GG Car	1.0 .3	93 1	2.0 .4	98 1	1.9 .3	98 1	2

*values from a quick look reduction program written by R.B. giving the values of p and θ with their absolute errors.

TABLE 2

UBV POLARIMETRY (ESO 1 M, MARCH 1980)*

Object	p(U) %	θ(U) °	p(B) %	θ(B) °	p(V) %	θ(V) °	No. of meas.
HD 37806	.7	116	1.0	120	.9	113	1
17 Lep	.5	37	.7	35	.7	29	1
HD 44179	3.1	?	1.8	36	1.7	26	1
HD 45677	1.2±.1	172±2	1.5 ±.1	173±1	1.2 ±.1	170±3	8
HD 50138	.9	162	1.2	164	1.0	159	1
Z CMa	1.2	147	1.7	?	.8	140	1
3 Pup	1.3	91	1.6	94	1.7	90	1
RX Pup	2.1±.1	120±2	2.3 ±.1	124±3	2.1 ±.1	121±2	6
HD 87643	.7±.1	132±6	.75±.1	133±7	.6 ±.1	134±5	6
HR Car	2.2±.2	127±1	2.6 ±.1	129	2.8 ±.5	124	2
GG Car	.8±.1	99±2	1.6 ±.1	99±1	1.65±.4	95±2	5
AG Car	.5	135	.8	132	.8	130	1
X Oph	.7	138	.9	136	.9	130	1
CPD −52°9243	5.2±.3	39±3	5.6 ±.1	38±1	5.8 ±.1	34	2
HD 326823	3.0	30	3.3	33	2.2	?	1
HD 163296	.7	143	.8	152	.5	156	1

* - using the calibration standards HD 80558 and HD 111613;
- after taking into account an interstellar contribution;
- errors indicated : rms on the average value when multiple measurements; individual measurements < .5 % on p; from < 1° to 20° on θ.

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3.6 m telescope (with only three channels in operation at the time of the observations, so that u, b and y were chosen);

2) a two channel polarimeter attached to the 1 m telescope, where the broad bands U, B, V were used.

Both instruments are described in the E.S.O. Users' Manual.

In the first case, five objects were measured, whose values are listed in Table 1; in five other objects, HK Ori LkHα208, MWC 137, MWC 819 and CD-24°5721 polarization was detected, but additional measurements are required.

In the second case, sixteen objects were measured, four on several occasions, as well as a series of nearby objects in order to be able to subtract the "environmental" polarization (sometimes quite large, but always with different angles). The reduction was performed as for CPD-52°9243 (Swings, 1981), and the results are listed in Table 2.

REMARKS

We searched for correlations between the polarization values and several quantities related to the extended atmosphere of the objects, i.e. the emission class (excitation, emission lines, see Allen and Swings, 1976) or the infrared excess, i.e. the H(1.6 μ) - K(2.2 μ) and V-K indices : only negative results were obtained.

We then searched for systematic differences between the polarizations in B[e] and in Be stars (of our sample or on a more general basis). From our data on 12 B[e]'s and 4 Be's, we find that the difference between the peculiar and the classical Be stars is essentially and(surprisingly) independent of wavelength : 1.0 % in U, .9 % in B and 1.1 % in V.

Data at longer wavelengths are required since the effect of dust would manifest itself more for λ > 5000 A.

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DISCUSSION

Metz: For a study of the difference between peculiar Be stars and "normal" Be stars, it is necessary to select stars with nearly equal angles of inclination. Did you pay attention to that ?

Swings: The problem is that for most of the B[e] stars one knows very little about how one sees the object. What I did, was to take the average polarization for 12 B[e]'s and compare it to an average of 4 B|e|'s chosen at random, so to speak.

Poeckert: Could the B[e] stars be a hot extension of the T Tau stars ?

Swings: My feeling is that B[e] are much older, and are evolving towards proto-planetary nebulae. They may bare similarities to T Tauries (IR excess, [SII] emissions, polarization, etc.), but they are not the same type of objects.

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