proportional to the logarithm of the number of impulses.

The detector of channel 1 was located inside the block PG-1-C and it only recorded high energy electrons and protons (see Table 1). The photograph of the uncovered blocks PG-1-C and PG-1-B is shown in Fig. 2 (Plate 1).

Measurements

During the flight of the satellite Intercosmos 3 the telemetric system transmitted to Earth more than one thousand hours of information from the PG-1 apparatus. The results of the measurements will be published elsewhere. The present paper only gives as an example of typical results obtained during more than one orbit of the satellite (on 25. 8. 1970). These results are shown in Figure 3. The corresponding geographical coordinates and the height of the satellite are also shown in Figure 3. The rapid intensity variations of the recorded particles are caused by the rotation of the unstabilized satellite in space in which the anisotropy of the recorded particles is in evidence.

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ON MAGNETIC STARS

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A statistical study of magnetic stars reveals that their mean rotational velocities do not depend on their magnetic field strengths. Also that stars with low magnetic field strengths are mostly Mn stars and those with high field strengths are mostly Cr–Sr stars.

Магнитные звезды. Статистическое исследование магнитных звезд показывает, что их средняя вращательная скорость не зависит от напряженности их магнитного поля. Показывается также, что звезды с небольшой напряженностью магнитного поля принадлежат чаще всего к Mn типу, тогда-как звезды с большой напряженностью в большинстве случаев Cr—Sr типа.

Introduction

Two processes viz., the dynamo-effect and the battery-effect are generally invoked to explain the magnetic fields in stars. If the former, a direct relation should then exist between the rotational velocity and the strength of the magnetic field. Until recently, sufficient data about rotational velocities was not available to support one or the other of these alternatives. Assuming a random distribution for i ($0° \leqq i \leqq 90°$), an analysis of the data now available on $v \sin i$ and H_e of the magnetic stars does not indicate any relationship between these two prameters. With the help of the same data, we have tried to study if the abundance peculiarity of a magnetic star depends on its field strength in any way and find that manganese stars generally have low field strengths.

Table I

A list of magnetic stars for which the rotational velocities are known. Abundance peculiarities are given where available. (The references are in paranthese.)

Sr. No.	Name	HD	Max $\|H_e\|$ (in gauss)	$v \sin i$ (in km/sec)	Abundance peculiarity
1.	α Lyr	172167	30(14)	0(2)	
2.	α Tau	29139	30(14)	20(2)	
3.	α CMa	48915	38(14)	0(2)	
4.	α And	358	80(14)	50(2)	Hg–Mn (10)
5.	β Gem	62509	110(14)	15(2)	
6.	β Ori	34085	130(14)	37(2)	
7.		22374	140(3)	7(11)	Cr–Sr (10)
8.	15 Vul	189849	143(4)	20(2)	Am (4)
9.	π′ Boo	129174	190(3)	0(2)	Mn–Hg (10)
10.	γ Cyg	194093	200(14)	4(2)	
11.	112 Her	174933	200(6)	23(2)	Mn–Hg (10, 13)
12.	51 Sgr	184552	230(3)	0(2)	Am(10)
13.	HR 4816	110066	300(4)	6(11)	Sr–Cr–Eu (10)
14.	ι Ori B	37043	300(5)	119(2)	
15.	μ Lep	33904	325(3)	0(2)	Hg–Mn (10)
16.	ι CrB	143807	340(3)	10(2)	Hg–Mn (10, 1)
17.	HR 4072	89822	340(3)	18(2)	Hg–Mn (10, 1)
18.		25354	380(3)	18(11)	Sr–Cr–Eu (10)
19.	γ Vir N	110379	390(3)	23(2)	Non-peculiar (8)
20.	45 Leo	90569	400(3)	13(11)	Cr–Sr (10)
21.	68 Tau	27962	400(3)	18(2)	Intermediate (1, 3)
22.	16 Ori	33254	420(3)	25(2)	Am (1)
23.	10 Aql	176232	440(3)	6(11)	Sr–Cr (10)
24.	ν Cnc	77350	470(3)	33(2)	4012 (10)
25.	46 Dra	173524	500(6)	20(2)	Hg–Mn (10)
26.		37807	500(5)	35(2)	
27.	41 Eri	27376	500(6)	40(2)	Mn–Hg (13)
28.		191742	510(3)	6(11)	Cr–Sr–Eu (10)
29.		110073	580(3)	25(2)	Mn (1)
30.	21 Aql	179761	950(3)	0(2)	Non-peculiar (8)
31.	22 Ori	35039	600(5)	21(2)	
32.	ϰ CnC	78316	640(3)	11(2)	Hg–Mn (10, 1)
33.		216533	650(3)	7(11)	Sr–Cr (10)
34.	θ′ Mic	203006	650(3)	51(2)	Cr–Sr–Eu (10, 1)
35.	β Scl	221507	660(3)	25(2)	Hg–Mn (10)
36.		196502	700(3)	8(11)	Cr–Sr–Eu (10)
37.		192913	670(3)	14(11)	Si 4012 (10)
38.	HR 7058	173650	700(3)	16(11)	Sr–Cr–Si (10)
39.	41 Tau	24823	700(3)	21(11)	Si 4012 4077 (10)
40.	HR 1886	36959	700(5)	50(2)	
41.		2453	710(3)	6(11)	Sr–Cr–Eu (10)
42.		115708	740(3)	13(11)	Sr–Cr–Eu (10)
43.	3 Hya	72968	740(3)	16(11)	Sr–Cr (10)
44.		8441	750(3)	6(11)	Sr–Cr–Eu (10)
45.		42616	840(3)	23(11)	Cr–Sr–Eu (10)
46.	γ Equ	201601	880(3)	13(2)	Intermediate (7, 10)
47.		165474	900(3)	6(11)	Sr–Cr–Eu (10)
48.	HR 465	9996	990(3)	6(11)	Cr–Eu (10)
49.	HR 4854	111133	990(3)	10(11)	Sr–Cr–Eu (10)
50.	HR 1217	24712	1000(3)	6(11)	Sr–Cr–Eu (10)

Table I (continued)

Sr. No.	Name	HD	Max $\|H_e\|$ (in gauss)	$v \sin i$ (in km/sec)	Abundance peculiarity
51.	HR 4369	98088	1000(3)	25(11)	Sr–Cr (10)
52.	HR 1820	35912	1000(5)	58(2)	
53.	β Cr B	137909	1020(3)	28(2)	Intermediate (7, 10)
54.	HR 710	15144	1080(3)	13(11)	Sr–Cr (10)
55.		135297	1110(3)	20(11)	Sr–Cr (10)
56.		137949	1120(3)	10(11)	Sr–Cr–Eu (10)
57.	17 Com A	108662	1150(3)	34(2)	Cr–Sr–Eu (10)
58.	43 Cas	10221	1200(3)	30(2)	Si–Cr (10)
59.		11187	1250(3)	15(11)	Si–Cr (10)
60.		36629	1300(5)	30(2)	
61.		37058	1300(5)	30(2)	
62.		126515	1310(3)	6(11)	Cr–Sr (10)
63.	μ Lib	130559	1310(3)	38(2)	Sr–Cr (10)
64.	21 Per	18296	1350(3)	0(2)	Si–Eu–Sr–Cr (10)
65.	52 Her	152107	1430(3)	49(2)	Sr–Cr (10)
66.	HR 6326	153882	1440(3)	26(11)	Cr–Sr (10, 1)
67.	49 Cnc	74521	1450(3)	19(11)	Si–Cr (10)
68.	HR 7575	188041	1470(3)	4(11)	Sr–Cr–Eu (10)
69.	α^2 CVn	112413	1600(3)	24(11)	Si–Hg–Cr–Eu (10)
70.	78 Vir	118022	1680(3)	10(11)	Sr–Cr (10)
71.	HR 7552	187474	1870(3)	0(2)	Cr–Eu (10)
72.		192678	2000(3)	6(11)	Cr (10)
73.		71866	2000(3)	17(11)	Sr–Cr–Eu (10)
74.	CS Vir	125248	2100(3)	57(2)	Eu–Cr (10)
75.		50169	2120(3)	10(11)	Sr–Cr (10)
76.		10783	2200(3)	15(12)	Cr–Sr (10)
77.	53 Cam	65339	5390(3)	20(11)	
78.	HR 5597	133029	3270(3)	20(11)	Si–Cr (10)
79.		32633	5870(3)	23(11)	Si–Cr (10)
80.		215441	34400(3)	6(11)	Si (10)

Analysis of the data

Out of a hundred stars for which information on their magnetic field strengths is known (Cameron, 1967; Conti, 1969, 1970a, b; Severny, 1970), for eighty of them the values of $v \sin i$ are now available (Boyarchuk and Kopylov, 1964; Preston and Stepien, 1968; Preston, 1971). These are listed in Table I, along with their abundance peculiarities (Babcock, 1958; Jaschek and Jaschek, 1958, 1967; Osawa, 1965; Searle and Sargent, 1967).

For these stars a plot between max $|H_e|$, the maximum modulus of the effective magnetic field strength, and $v \sin i$ is given in Fig. 1. In the range of 0 to 1500G (gauss) for the parameter max $|H_e|$, the sample size is large enough to enable subdivision into six smaller groups, each corresponding to a range of 250G in max $|H_e|$. Beyond 1500G and upto 2200G, there are only eight stars — relatively a meagre data for an interval of this size — and only four more stars between 2200G and 34400G. Consequently, no grouping has been done beyond 1500G. In each range the mean $v \sin i$ and the number of stars with various abundance peculiarities are given in Table II.

We have also plotted in Fig. 1, the mean $v \sin i$ for each of the groups against the corresponding mean max $|H_e|$ (cf. Table II). An inspection of this figure does not reveal any significant relationship between the two parameters. The most one can say is that possibly $\overline{v \sin i}$ increases from about 15 km/sec to approximately 21 km/sec as $\overline{\max |H_e|}$ increases from 0 to 1000G. Beyond this limit, even this small apparent relationship is not maintained. Overall, we are inclined to infer that there is no significant relationship between the rotational velocities and the surface magnetic fields of the rotating magnetic stars and that the mean value of $v \sin i$ for all magnetic stars is around

20 km/sec corresponding to a mean value of v of approximately 31 km/sec. This seems to indicate that the magnetic fields in stars are not the result of a dynamo-effect.

Again Table II shows that apparently the Mn stars do not have magnetic field strengths in excess of 700G, whereas the Cr–Sr stars have a significant start from a value of around 400G and extend right upto the end.

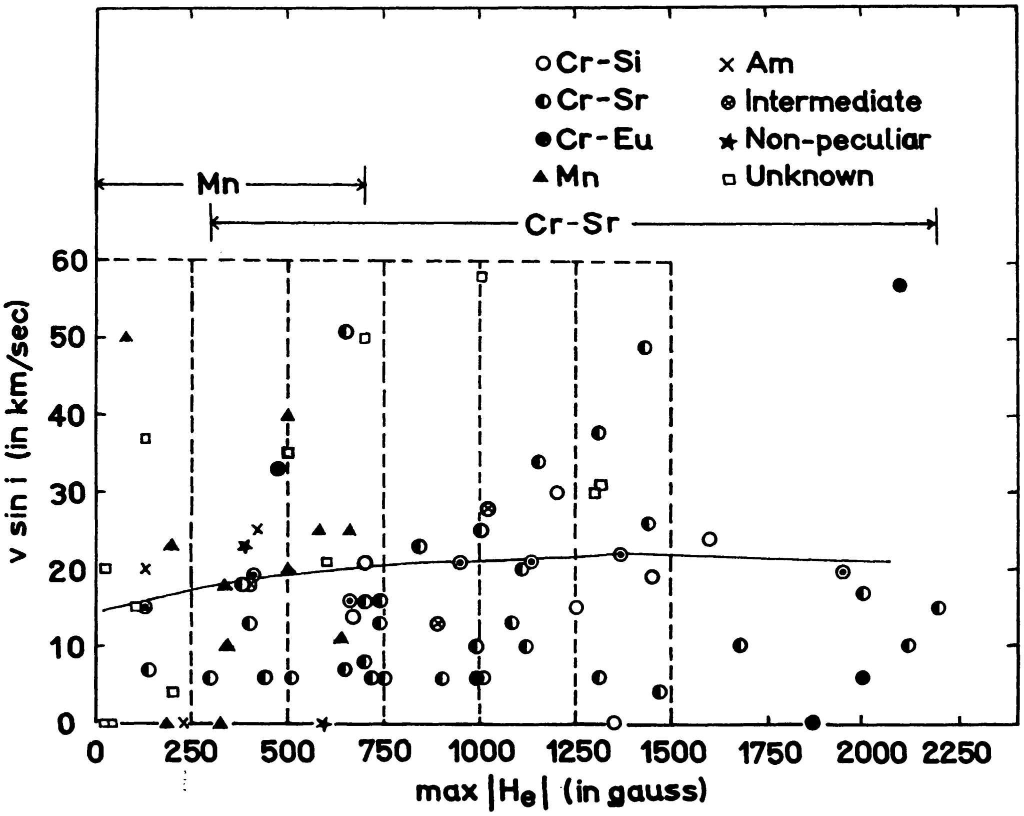

Fig. 1. A plot between max $|H_e|$ and $v \sin i$ of magnetic stars. The curve joining the circles with filled dots indicates the run of $\overline{\max |H_e|}$ against $\overline{v \sin i}$.

Table II

The number of stars with various abundance peculiarities in each range of max $|H_e|$ together with the corresponding values of $\overline{\max |H_e|}$ and $\overline{v \sin i}$. (The stars HD 37043, HD 133029, HD 65339, HD 32633 and HD 215441 have been omitted from this table, as well as from Fig. 1 due to their abnormal values of one of the parameters considered).

Range of max $\|H_e\|$ (in gauss)	$\overline{\max \|H_e\|}$ (in gauss)	$\overline{v \sin i}$ (in km/sec)	Abundance peculiarity								
			Cr-Si	Cr-Sr	Cr-Eu	Mn	Am	Inter-mediate	Non-peculiar	Un-known	Total
0— 250	130	15	—	1	—	3	2	—	—	6†	12
250— 500	410	19	—	4	1	5	1	1*	1	1	14
500— 750	660	16	2	9	—	3	—	—	1	2	17
750—1000	950	21	—	5	1	—	—	1**	—	1	8
1000—1250	1130	21	2	4	—	—	—	1***	—	—	7
1250—1500	1370	22	2	5	—	—	—	—	—	2	9
1500—2200	1950	20	1	4	3	—	—	—	—	—	8
		Totals:	7	32	5	11	3	3	2	12	75

† HD 48915 tends to be an Am star (Kohl, 1964).
* HD 27962 is more Am-like (Cameron, 1967).
** HD 201601 is given as a Sr-Cr-Eu star (Osawa, 1965).
*** HD 137909 is given as a Eu-Sr-Cr star (Osawa, 1965).

The range upto 400*G* can be taken to consist mainly of Mn stars, the range 400 to 700*G* being a mixture of Mn and Cr–Sr stars, with the Mn stars showing a preference for lower values and the others for higher values. The range beyond 700*G* seems to be the domain of Cr–Sr stars.

With the help of these groupings, the abundance peculiarities of those magnetic stars about which these details are not known, can perhaps be estimated. Thus the six stars in the range below 250*G*, whose peculiarities are not known, could mostly be Mn stars, or perhaps Am stars. Likewise, the two stars of unknown peculiarity in the range 600 to 700*G* are more likely to be Cr–Sr stars than Mn stars. And the three stars with unknown peculiarities in the range beyond 1000*G* should in all probability be Cr–Sr stars. Some of these stars could well be non-peculiar with measurable fields, a point which a re-examination of their spectra alone can ascertain.

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MOLECULES IN ETA AQUILAE

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The total numbers I_Φ(AB) of a given molecule AB in a column extending between $\tau = 0$ to $\tau = 3{\cdot}00$ have been calculated for various phases Φ of light variations in η Aql for the molecules CO, CN, C_2, OH, NH and CH. At all phases, the log I_Φ(AB) values decrease in the order CO, OH, CH, NH, CN and C_2.
Consideration of log I_Φ(AB) — Φ curves shows that the amplitude of the curves, the extent of the hump at $\Phi = 0{\cdot}15$, the slopes of the ascending and descending branches and the phase interval [between the instants on two sides of the minimum phase, at which log I_Φ(AB) is less by 0·5 than the value of log I_Φ(AB) at the minimum phase] decrease in the order of decreasing dissociation energy of the molecule, i.e., CO, CN, C_2, OH, NH and CH.
It is found that higher dissociation energy molecules form in higher layers at all phases and that for all the molecules considered, the average geometrical depth of formation progressively shifts towards deeper layers as one proceeds from maximum phase to minimum phase of light variation in the star. Finally the dissociation equilibrium abundances of molecular species closely follow the shape of the light curve including its asymmetry and hump and that the abundances of higher dissociation energy molecules reflect this correspondence better.

Молекулы в η *Aql*. Вычислены полные числа I_Φ(AB) данной молекулы AB в столбце, заключенном между $\tau = 0$ и $\tau = 3{,}00$ для разных фаз изменения блеска η Aql для молекул CO, CN, C_2, OH, NH и CH. Для всех фаз значения log I_Φ(AB) уменьшаются в следующем порядке: CO, OH, CH, NH, CN и C_2.
Рассмотрение кривых log I_Φ(AB) — Φ показывает, что все величины в скобках (амплитуды кривых, величина горба при $\Phi = 0{,}15$, градиенты восходящих и нисходящих ветвей, а также интервал фазы между моментами, по обеих сторонах от минимума, при которых log I_Φ(AB) меньше на 0,5, чем значение в минимуме) уменьшаются с уменьшением энергии диссоциации молекулы, а именно в следующем порядке: CO, CN, C_2, OH, NH и CH.
Найдено, что молекулы с высокой энергией диссоциации при всех фазах образуются в высоких слоях