Magnetic Field and Radial Velocity Observations of the CP Star 52 Her from SAO – Russia and BNO Rozhen – Bulgaria

E. Gerth

Central Institute of Astrophysics
Telegrafenberg
D–01561 Potsdam

V.D. Bychkov, Yu.V. Glagolevskij, I.I. Romanyuk

Special Astrophysical Observatory
Zelenchuk, Nizhnij Arkhyz, Stavropolskij Kraj
357147, USSR

The peculiar A Star 52 Her (HD 152107) has been observed at the 6 m telescope of the *Special Astrophysical Observatory* (SAG), *Nizhnij Arkhyz* since 1980. The observation of this star was included into the cooperative investigation programme among the astrophysical institutes of the Academies of Sciences of the East-European countries concerning the evolution of stars and stellar magnetism. [1])

From the beginning of the observation of this star in 1971 in *Tautenburg* (GDR), nearly 50 ZEEMAN-spectrograms have been secured and evaluated up to 1980, showing a peculiar long time variation of the magnetic field with a reversal of the polarity crossing over in 1978 from positive to negative (GERTH, 1981). Besides this, the radial velocities, which were also measured in every case, showed a significant variation with period of $3\overset{d}{.}8575$, being the same period as found by WOLFF and PRESTON (1978) on the basis of their magnetic field measurements. Being not sure that some kind of a technical artifact (as suspected already by PRESTON and WOLFF, 1978) could have produced the secular variation of the magnetic field strength, and in particular the reversal of the polarity, we reported on the Conference in SAG 1980 only about 36 plates obtained up to 1978. Our uncertainty of trust was related to the difficulties following from instrumental polarization by four inclined mirrors in the light path to the spectrograph.

The observation of 52 Her with the 6 m telescope should serve to solve several problems: 1) inclusion of the star in the SAO observation programme, 2) measurement with minimal instrumental polarization, 3) comparison of SAO and *Tautenburg techniques*, 4) compilation of data of the star itself, 5) standardization of measurement and evaluation. The measurement of the plates and the computerized evaluation were performed by CIAP in *Potsdam*. The same problems should be tackled also at other observatories in order to get a broader base for comparison and compilation.

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[1]) STELLAR MAGNETISM, Proc. Internat. Meeting on Physics and evolution of stars, Niznij Arkhyz 30 Sep – 5 Oct 1991, eds. Yu.V. Glagolevskij, I.I. Romanyuk, p. 60-64. Scanned in 2018 from the original print of the conference booklet by E. Gerth.

We add in this contribution the measurement results obtained from *Rozhen* by the help of the Bulgarian colleagues D. KOLEV, I. ILIJEV, T. TOMOV. The cooperation between the observatories in *Potsdam, Rozhen, Tautenburg,* and *Nizhnij Arkhyz* has its manifestation in the exchange of technical equipment. The ZEEMAN-analyzer at the 2 m telescope in *Rozhen* has been built in the workshop of SAO, but the compensator has been done in Potsdam.

The measurements of the magnetic field strength and the radial velocities derived from the *Tautenburg* plates have been published by GERTH (1990). An evaluation of the results in favor of a kinematic model for the star using the *Tautenburg*, *SAO* and *Rozhen* results has been outlined in the *Conference report on Magnetic stars* by GERTH (1990), leaving the commitment of the latter results open, what to complete will be the main purpose of this paper.

In the tables below we notify the values of the effective magnetic field strength B and the radial velocity RV derived from photographic spectrograms by means of the *Modified Abbe-comparator* [2]) and computerized evaluation at the *Astrophysical Observatory Potsdam.* The evaluation [3]) procedure corresponds in full to that one used for the *Tautenburg* plates [4]) as described by GERTH (1990). The magnetic field results are of such standard quality as to be expected using photographic spectrograms. Concerning the radial velocity results obtained likewise in any possible case from the plates in the course of the evaluation procedure, we decided to publish them too, despite of some uncertainties of the dispersion curve connected with the comparison spectrum in the spectrograph of the 6 m telescope, which causes a non-systematical deviation compared with the data from *Tautenburg* in the order of 2 km/s. Within this error limits of reliability the results are put together in the following tables.

References

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[2]) Measuring device:
`www.ewald-gerth.de/49abbe-engl.pdf`

[3]) Programs:
`http://articles.adsabs.harvard.edu/full/seri/ASPC./0044//0000291.html`

[4]) Observations:
`http://onlinelibrary.wiley.com/doi/10.1002/asna.2113110108/abstract`

Tables.

52 Her magnetic field (observed with the 6 m telescope)

N	Number	Jul. Date	B_e	± σ
1	274	44329.608	447	199
2	300	44332.955	817	223
3	301	44358.577	50	138
4	302	44358.584	1460	326
5	303	44358.589	1440	291
6	312	44417.685	2249	184
7	313	44418.224	858	254
8	324	44422.378	2108	242
9	334	44455.499	342	215
10	345	44477.354	1728	279
11	346	44477.369	1266	243
12	376	44527.342	464	153
13	387	44532.300	706	182
14	388	44532.305	1759	178
15	491	44632.523	2194	183
16	492	44632.536	1510	339
17	647	44863.376	483	283
18	648	44863.385	1177	221
19	649	44863.391	1279	320
20	650	44863.397	814	203
21	870	45512.235	1403	191
22	902	45573.365	1468	191
23	903	45573.370	1878	303
24	904	45573.380	567	266
25	905	45573.384	306	376
26	1100	45924.398	1676	192
27	1101	45924.406	1743	177
28	1102	45924.415	1917	224
29	1103	45924.428	1328	168
30	1104	45924.433	1901	165
31	1218	46329.165	633	298
32	1219	46329.169	550	324
33	1220	46329.176	880	285
34	1221	46329.181	1222	287
35	1225	46330.222	459	322
36	1226	46330.229	1191	356
37	1227	46330.234	654	367
38	1228	46330.240	970	225
39	1229	46331.181	827	286
40	1240	46331.186	84	272
41	1241	46331.191	311	272
42	1242	46331.194	817	287

52 Her radial velocity (observed with the 6 m telescope)

N	Number	Jul. Date	RV	± σ
1	274	44329.608	0.28	0.39
2	300	44332.955	-1.13	0.33
3	301	44358.577	-1.81	0.67
4	302	44358.584	2.39	0.54
5	303	44358.589	1.12	0.54
6	312	44417.685	0.25	0.44
7	313	44418.224	-0.39	0.39
8	324	44422.378	0.41	0.49
9	334	44455.489	-2.13	0.59
10	335	44455.499	-1.61	0.42
11	345	44477.354	1.58	0.35
12	346	44477.369	0.43	0.52
13	376	44527.342	-1.26	0.35
14	387	44532.300	-1.07	0.63
15	388	44532.305	0.34	0.48
16	491	44632.523	1.21	0.71
17	492	44632.536	2.84	0.68
18	647	44863.376	-1.01	0.54
19	648	44863.385	-5.57	0.53
20	649	44863.391	-1.88	0.74
21	650	44863.397	0.55	0.65
22	870	45512.235	5.87	0.35
23	902	45573.365	1.12	0.57
24	903	45573.370	0.61	0.35
25	904	45573.380	-1.14	0.50
26	905	45573.385	0.66	0.48
27	1218	46329.165	-2.36	0.71
28	1219	46329.169	-2.02	0.38
29	1220	46329.176	-4.74	0.36
30	1221	46329.181	-2.75	0.31
31	1225	46330.222	-2.08	0.45
32	1226	46330.229	-2.61	0.37
33	1227	46330.234	-2.66	0.46
34	1228	46330.240	-2.54	0.40
35	1229	46330.247	-2.16	0.41
36	1240	46331.186	-2.55	0.45
37	1241	46331.191	-2.35	0.35
38	1242	46331.194	-3.99	0.35

52 Her magnetic field (observed with the 2 m telescope, Bulgaria)

N	Number	Jul. Date	B_e	± σ
1	1213	45220.269	1093	215
2	1214	45220.293	1304	233
3	1215	45220.322	972	192
4	2507	46302.320	309	172
5	2510	46303.331	813	191
6	2512	46304.282	706	183
7	2640	46370.239	1283	377

52 Her radial velocity (observed with the 2 m telescope, Bulgaria)

N	Number	Jul.Date	RV	± σ
1	1213	45220.269	0.48	0.30
2	1214	45220.293	0.05	0.39
3	1215	45220.322	0.44	0.28
4	2506	46302.272	-3.53	0.33
5	2507	46302.320	-1.19	0.37
6	585	46302.423	0.66	0.43
7	2509	46303.293	-1.56	0.33
8	2510	46303.331	0.19	0.40
9	586	46303.434	2.25	0.37
10	2511	46304.244	-4.05	0.36
11	2512	46304.282	0.28	0.34
12	587	46304.371	0.54	0.35
13	2640	46370.239	0.90	0.71