A catalog of stellar magnetic rotational phase curves[★]

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Abstract. Magnetized stars usually exhibit periodic variations of the effective (longitudinal) magnetic field B_e caused by their rotation. We present a catalog of magnetic rotational phase curves, B_e vs. the rotational phase ϕ , and tables of their parameters for 136 stars on the main sequence and above it. Phase curves were obtained by the least squares fitting of sine wave or double wave functions to the available B_e measurements, which were compiled from the existing literature. Most of the catalogued objects are chemically peculiar A and B type stars (127 stars). For some stars we also improved or determined periods of their rotation. We discuss the distribution of parameters describing magnetic rotational phase curves in our sample.

Key words. catalogs – stars: fundamental parameters – stars: magnetic fields – stars: rotation

1. Introduction

Strong global magnetic fields can be found in most chemically peculiar (CP) stars on the upper main sequence of the Hertzsprung-Russell diagram. These stars are usually referred to as Ap or Bp stars, depending on the given effective temperature, and hence the principal spectral class. Magnetic fields in CP stars were discovered and have been measured for a long time. However, global magnetic fields also can be found in stars of other spectral types.

There exist claims on the existence of global-scale magnetic fields in some pulsating stars (Weiss & Wood 1975; Borra et al. 1981; Romanov et al. 1985; Weiss 1986; Neiner et al. 2003, for instance), in some close binary systems (Skulskij et al. 1992a,b), and in a few supergiants (Rakos et al. 1977; Scholz & Gerth 1980; Weiss 1986; Gerth 1988; Plachinda 1990; Gerth et al. 1991) and exceptionally in solar-like stars (Plachinda & Tarasova 1999, 2000b; Tarasova et al. 2001; Plachinda et al. 2001). Global magnetic fields are also observed in Be stars (Henrichs et al. 2000; Donati et al. 2001).

The above discoveries have been followed by recent high accuracy research programs (Wade et al. 2002; Chadid et al. 2003), but still require more B_e measurements and observational verification.

Most late type stars on the main sequence have local magnetic fields, which are restricted to relatively small active regions on the surface (Robinson et al. 1980; Saar 1988). Despite a few exceptions, global magnetic fields generally do not exist

in that group of stars (Borra et al. 1981; Brown & Landstreet 1987). Also, highly evolved stars on the horizontal branch of giants do not have global-scale magnetic fields (El'kin 1992).

Recently, Smirnov et al. (2003a,b) have found magnetic fields in a few T Tau stars. This discovery, however, requires independent confirmation.

The most useful observable global quantity is the effective (longitudinal) magnetic field B_e , which is observed through Zeeman splitting of some spectral lines into pairs of circularly polarised components. The effective magnetic field B_e , or rather its quadratic average $\langle B_e \rangle$ over many individual observations, can yield the averaged global-scale surface magnetic field strength of an individual star.

A definition of the quadratic effective magnetic field $\langle B_e \rangle$ was given by Borra et al. (1983). Extensive tables of $\langle B_e \rangle$ were recently compiled by Bychkov et al. (2003). They discussed also the distribution and other properties of $\langle B_e \rangle$ in various subclasses of magnetic Ap stars, with 352 Ap and Bp stars.

1.1. Magnetism of CP stars

A substantial number of magnetic CP stars exhibit periodic variations of their effective magnetic fields B_e with their rotational period. Periods of B_e variations of CP stars most often are in the range of 2–5 days (Lebedev 1986; Renson & Catalano 2001). In most cases the dependence of B_e on the rotational phase ϕ exhibits a simple sine wave form. Such a variability is very well described in frame by the Stibbs-Preston oblique rotator model (Stibbs 1950; Preston 1967a). In that model, the dipole magnetic field is stationary, i.e. the dipole

[★] All tables and Appendix A are only available in electronic form at <http://www.edpsciences.org>

does not change its parameters with time. Both the star and the dipole rotate about the rotational axis with the same angular velocity. Periodic variability of B_e is directly caused by the rotation which modulates the projection of B_e in the direction towards the Earth, see Eq. (1).

Some of the magnetic CP stars exhibit more complicated rotational phase variations of B_e , which are interpreted as evidence that surface field configurations are more complex than a simple dipole. Stellar rotation can also cause apparent periodic variations of the longitudinal component of the global scale (integrated) magnetic field in the few late-type stars where it has been detected.

On the contrary, there exists evidence that the magnetic variability of long-period Ap stars is caused by the intrinsic variability of their magnetic fields, and not by stellar rotation. Such a mechanism could be similar to the solar cycle (Krause & Scholz 1981) in agreement with the dynamo model proposed by Steenbeck & Krause (1968). Therefore, one cannot claim with confidence that the B_e variability of e.g. γ Equ (F0 SrCrEu) or similar stars is necessarily due to stellar rotation and the related changes of aspect. Also some of the colder CP stars exhibit “secular” changes of their magnetic field B_e (Bonsack et al. 1974; Scholz 1979; Bychkov & Shtol’ 1997).

1.2. Observational data

Variability of the effective magnetic fields B_e in CP stars was discovered over 50 years ago (Babcock & Burd 1952). A large amount of observational data has been collected in the literature. However, research programs investigating magnetic variability of stars with the rotational phase ϕ usually presented observations of a few magnetic stars per paper at most. This is obviously due to the fact that acquiring of even a single magnetic phase curve $B_e(\phi)$ of a star requires much effort and observing time. Therefore, available B_e rotational phase curves are either scattered in the literature, or are presented in an inhomogeneous form, or are incomplete.

We performed an extensive search of the literature and have compiled a catalogue of all the available series of B_e measurements and their magnetic rotational phase curves $B_e(\phi)$. In this paper the catalogue of magnetic rotational phase curves is expressed in a uniform way. Curves $B_e(\phi)$ are fitted either by a simple sine function, or by a double wave (for 18 stars). In some cases we determined new values of the magnetic periods, assuming that $P_{\text{mag}} = P_{\text{rot}}$. Our catalogue also lists parameters of the magnetic rotational phase curves.

Our catalog of stellar magnetic rotational phase curves is very strongly dominated by Ap stars, which make up over 93% of the sample. Such a bias was caused by a relatively low accuracy of B_e measurements in the past. Consequently, the observer’s interest was directed towards stars with strong magnetic fields. The recent development of high accuracy observational techniques allowed several teams to discover and measure global magnetic fields also in a few solar-type stars and in high luminosity stars. The nature of the magnetic activity in both types of stars differs strongly from the magnetism of Ap stars. However, disregarding their different origin we could

produce magnetic rotational phase curves for all the above classes of stars with the available B_e measurements. We can also anticipate that the number of stars other than CP stars with measured global-scale longitudinal magnetic fields will rise soon. Thus, we do not restrict our paper to CP stars, and present here also several magnetic rotational phase curves for stars of other types.

Analysis of the catalogue enabled us to select stars for which additional B_e observations are most urgently needed, or those stars in which apparent B_e variations are particularly complex or suggest secular changes not necessarily correlated with the rotation.

1.3. Completeness of the catalog

This paper presents the first catalog of magnetic rotational phase curves. We attempted to compile magnetic phase curves from B_e observations retrieved from different sources, determine the new or consistent magnetic (rotational) period, where appropriate, and present the resulting magnetic phase curves and parameters of magnetic variability in a uniform manner.

The catalog contains magnetic phase curves for all stars for which the number of published B_e points is sufficiently high to construct a phase curve. In such a way the catalog is complete. On the other hand, it reflects the extreme incompleteness of the available observational data, in which magnetic observations of CP stars strongly dominate the whole set of the available data. In this aspect our catalog is missing many stars of other spectral types, e.g. late-type stars, which on average exhibit much weaker and sparsely investigated global magnetic fields.

2. Effective (longitudinal) magnetic fields

The effective field B_e is the observable magnetic quantity, determined by the Zeeman splitting of selected lines in stellar spectra. In the case of a spherical star, it is the average of the projected surface field B_{loc} over the visible stellar disc, weighted by the local monochromatic intensity I_ν of outgoing radiation

$$B_e = \frac{\int_0^{2\pi} \int_0^{\pi/2} B_{\text{loc}} \cos \gamma I_\nu(\theta) \sin \theta \cos \theta d\theta d\varphi}{\int_0^{2\pi} \int_0^{\pi/2} I_\nu(\theta) \sin \theta \cos \theta d\theta d\varphi}, \quad (1)$$

where γ denotes the angle between the local vector B_{loc} and the direction towards the observer. The variable θ denotes the colatitude angle, and φ is the azimuthal angle of the angular integration. The above definition implicitly assumes that B_e is determined at a single discrete frequency only (Madej 1983; Bychkov et al. 2003).

The scalar variable B_e is directly observable, and can be measured by the amount of splitting of selected spectral lines into circularly polarised components. Zeeman splitting is caused by the shift of energy levels of atomic spin states. The effect is best observed in atoms with single unpaired electron,

$s = 1/2$, which occurs in hydrogen H I, singly ionized iron Fe II, and also in highly excited He I.

Equation (1) implies that B_e is determined both by the intrinsic configuration and strength of the stellar magnetic field $\mathbf{B}$, and by its momentary projection in the direction towards the Earth. Therefore, if the intrinsically static surface magnetic field is not aligned with the rotation axis, then the star has to exhibit periodic B_e variations with the period P_{mag} equal to the period of rotation, P_{rot} . In particular, this is true for the oblique dipole model of a stellar magnetic field. The effective magnetic field B_e can also change sign during rotation of a star.

3. Averaged magnetic rotational phase curves

We have studied periodic variations of the effective magnetic field B_e with the rotational phase ϕ in the following manner.

1. For all stars with an adequate number of B_e determinations, and for which the period of magnetic variability P_{mag} was known, we have determined the best fit for the relation of B_e vs. phase

$$B_{ei}(\phi) = B_0 + B_1 \cos \phi, \quad (2)$$

where

$$\phi = 2\pi \left(\frac{T_i - T_0}{P} \right), \quad (3)$$

by the least squares method. Here B_0 is the average field, B_1 stands for half of the amplitude, T_i is time of measurement, P denotes the period, and T_0 is the zero epoch, i.e. time corresponding to the zero phase ϕ . We have chosen the zero epoch T_0 in such a way that the phase $\phi = 0$ corresponds to the minimum of the best fit magnetic curve.

In the following Tables 1–3 we present listing of parameters of the magnetic curves, and also the parameter r , which was defined by Stibbs (1950). Parameter r relates both the angle β between the magnetic dipole axis and the rotational axis, and the angle i between rotational axis and the line of sight

$$r = \frac{\cos \beta \cos i - \sin \beta \sin i}{\cos \beta \cos i + \sin \beta \sin i}. \quad (4)$$

Alternatively, one can write

$$r = \frac{B_e(\min)}{B_e(\max)}. \quad (5)$$

2. There are stars with unknown periods of magnetic variations. In some cases if we were able to compile a sufficient number of momentary B_e measurements from the available papers, then we have attempted also to search for the magnetic period P with standard methods. We are aware that periods determined in those cases require additional B_e measurements, or new spectral, photometric, and polarimetric observations in order to confirm our magnetic periods and to decrease their errors.

3. In the case when the shape of the magnetic phases curve is more complex than a simple cosine, we include the second harmonic wave

$$B_{ei}(\phi) = B_0 + B_1 \cos(\phi + z_1) + B_2 \cos(2\phi + z_2). \quad (6)$$

4. There are also exceptional stars, which exhibit still more complex magnetic phase curves, and in such cases Eq. (6) does not provide an adequate fit. A very good example of that is the star HD 37776, which exhibits a magnetic rotational phase curve of exceptional complexity. For this star we present the fitting curve of other forms, and regard that star as a completely individual case.

4. Error analysis

For each star in the sample we performed a χ^2 test for evaluation of the goodness of the assumed fit, given either by Eq. (2) or Eq. (6), and the estimated scatter of the available B_e measurements.

A statistical χ^2 test can indicate a large discrepancy between observed points and the assumed fitting curve if either the fitting curve is intrinsically inconsistent with observations, or errors of observations (i.e. values of B_e) are overestimated.

Error estimates of all parameters T_0 , B_0 , B_1 , B_2 , and r were performed in the following way. For each B_{ei} measurement with known standard error σ_i we generated a series of 1000 or even more secondary B_{ei}^{sec} values with a random number generator. Values of B_{ei}^{sec} had an assumed normal distribution around the observed B_{ei} with the width σ_i . In the case where the authors did not provide a σ_i estimate, we used an arbitrary error typical for the given method of observation.

Each observed B_{ei} value was then replaced by a single B_{ei}^{sec} chosen randomly from the precomputed artificial series. Then the set of secondary parameters T_0^{sec} , B_0^{sec} , B_1^{sec} , B_2^{sec} , and r^{sec} was determined.

The above computations were repeated many times (usually 1000 times or more). In such a way we obtained numerous sets of secondary fitting parameters, and were able to estimate errors of real T_0 , B_0 , B_1 , B_2 , and r separately.

5. Methods for the measurement of stellar effective magnetic fields

In this section we describe the principal methods of B_e measurements.

1. The photographic method is the earliest technique of the magnetic field measurements, which allowed Babcock (1952) to discover magnetic fields of Ap stars. An analyser of circular polarisation is placed in front of the spectrograph slit. Then, the radiation beam from a star is split into two beams, which are circularly polarised in either the clockwise or counterclockwise direction of rotation, and recorded on a photographic plate. Such a method allows one to observe simultaneously two spectra of a star in two opposite states of circular polarisation, and to observe σ_+ and σ_- components of lines split by the Zeeman effect.

Strictly speaking, the method is to measure the Zeeman splitting of resolved sigma components, and photographic plates are used to record the spectra.

Measuring the displacement between both components of a spectral line allows one to estimate the longitudinal component of the magnetic field integrated over the line forming region (or the whole stellar disc). Such an estimate is possible if the

necessary parameters of a given line, including Landè factors, are known.

The accuracy of the above method of B_e observations is low. The accuracy is strongly limited by the width of a line and altered most by the projected velocity of rotation $v \sin i$. For example, if $v \sin i > 35 \text{ km s}^{-1}$, the number of measured lines $N < 30$, and spectral resolution $R < 20\,000$ (dispersion $\geq 10 \text{ Å/mm}$), then the standard error of B_e is larger than the value of B_e itself. In such a case the measurement of B_e is indefinite.

Magnetic field measurements are commonly performed in metal lines. As is well known, metals are distributed nonuniformly over the surface of an Ap star, and such an inhomogeneity causes additional distortion in estimates of B_e integrated over the stellar surface. In spite of that, the above method allowed astrophysicists to obtain the first measurements of stellar longitudinal magnetic fields. The method was described in detail in Babcock (1958) and Glagolevskij et al. (1977).

2. HI: effective magnetic fields are measured from the degree of circular polarisation in the wings of hydrogen Balmer lines (Angel & Landstreet 1970; Landstreet 1982; Shtol' et al. 1985). This method has a few important advantages. First, the accuracy of measurement does not depend on the projected rotational rate $v \sin i$. Second, measurements of B_e are not affected by the details of inhomogeneous distribution of chemical elements on the stellar surface. Therefore, B_e measurements obtained in this way are considered as the most correct magnetic data and best suited for calibration purposes.

3. Scanning of a spectral line was the first photoelectric method used to measure stellar magnetic fields (Severny 1970; Borra & Landstreet 1973; Borra & Vaughan 1977). A one-channel phototube is located in the focal point of the camera of a high resolution spectrograph. The device measures the opposite circularly polarised radiation in a very narrow spectral bin of $0.1\text{--}0.2 \text{ Å}$. After that the same measurements are performed in neighbouring bins, until one gets the scan of flux and degree of circular polarisation across the whole profile of a given metal line. The estimate of B_e results from a comparison between the circular polarisation integrated over the short wavelength and long wavelength wings of that line.

The advantage of this method is that it yields a reliable estimate of the longitudinal magnetic field B_e , particularly for lines with a complex profile. The disadvantage is that the method requires a large number of measurements in the line profile, which decreases the effectiveness of observations.

The “differential” version of the above method makes use of selected points in line wings to estimate B_e . Such a method is a faster and more effective way of B_e determination, which requires fewer points in the line profile. On the other hand, the estimated value of B_e strongly depends of the value of $v \sin i$ (Piskunov & Khohlova 1983).

Thus, the scanning line methods outlined above allow for B_e observations of high accuracy. However, in both methods all measurements are usually performed on a single line of the particular element. One can expect negative effects of line blending and the inhomogeneous distribution of that element over the stellar surface.

The method was extended by Borra et al. (1981). They used a special mask to scan ≈ 230 lines simultaneously to obtain the

averaged line profile and the distribution of circular polarisation in the profile.

4. The multiline Zeeman polarimetric technique (Brown & Landstreet 1981). The observer uses the same masks used for the usual measurements of radial velocity, and measures radial velocities in spectra circularly polarised in opposite directions. The difference between the radial velocities, averaged over all the measured lines, is the measure of B_e .

This approach requires use of at least one hundred lines, which should be narrow and sharp. Moreover, the determination of B_e is done by averaging of the Zeeman splitting amplitude over many lines ignoring their individual intensities and magnetic sensitivity etc. This method was used for B_e measurements in cool stars with narrow spectral lines.

A similar method was used for the measurement of photographic spectra with roughly the same advantages and disadvantages (Weiss et al. 1978).

5. CCD method. This is the method of acquiring of Zeeman spectra by CCD detectors. This technique is very similar to the classical photographic method. The essential difference is that the splitting of sigma components of metal lines or in the wing of Balmer line is recorded digitally with very high positional and photometric accuracy. As a result one can apply a variety of image processing methods which eventually increase the accuracy of the B_e determinations. For example, CCD detectors register echelle type high dispersion spectra, with bent shape orders. Such distorted spectra can be easily processed with the standard data reduction software (MIDAS, IRAF etc.).

Today CCD are used in place of photographic plates or single- or multi-channel phototubes.

6. Least-Squares Deconvolution (LSD), cf. Donati et al. (1997) and its extension, the WLS method (this is the LSD method improved by Wade et al. 2000c) are the most reliable methods of CCD Zeeman spectra reduction. A spectral line plus surrounding continuum observed by the CCD are represented by a 2-dimensional rectangular (n, m) matrix and each pixel in the matrix is assigned a value equal to the number of photons accumulated in that CCD pixel. Then the observed matrix is best fitted by the “model” line profile converted to the same form. In such a way the effective determination of the best fit of theoretical to the observational line profile reduces to standard tasks of linear algebra. Both methods of data reduction make use of all the information contained in a given spectral line.

There are a number of other methods for the measurement of stellar magnetic fields. such as

- scanning of a spectral line with a Fabry-Perot interferometer (Met) and measuring of the (V, I) Stokes parameters in polarised light (Borra & Vaughan 1977, 1978; Glagolevskij et al. 1979);
- the Robinson method for measuring of the surface magnetic field in late type stars (Robinson 1980; Robinson et al. 1980; Saar 1988);
- curve of growth method, which makes use of the magnetic intensification of lines (Hensberge & De Loore 1974; Kolev 1977);

- measuring of the surface magnetic fields in split lines (Preston 1969a, 1970, 1971; Wolff & Wolff 1970; Huchra 1972; Borra & Landstreet 1977; Landstreet 1988; Mathys & Lanz 1992);
- measuring of the so-called λ^2 effect (Lebedev 1990).

Methods that make use of metal lines will be referred to as (Met), and methods that make use of hydrogen lines will be referred to as (H). We have presented here only the most important and widely used methods of measuring the longitudinal magnetic field, B_e .

6. Tabular data

A full catalog of investigated stars and the corresponding parameters of the best fit sine wave magnetic curves, Eq. (2), is presented in Table 1. Columns of Table 1 list: HD number, spectral type, B_0 , σ_{B_0} , B_1 , σ_{B_1} (in G), period P , T_0 , and σ_{T_0} (in days).

Here B_0 is the average field, B_1 stands for half of the amplitude, and T_0 is the zero epoch, i.e. the date corresponding to the zero phase ϕ . We have chosen the zero epoch T_0 in such a way that the phase $\phi = 0$ corresponds to the minimum of the best fit magnetic curve for all listed stars. Julian Day of the zero phase is $\text{JD} = 2\,400\,000. + T_0$.

Table 2 of our catalog presents for each star: HD number, N – number of individual points, σ – average scatter of B_{ei} observation around the fitting curve, parameter r and its standard error σ_r , $N_V = N - 3$ (for sine wave fits), χ^2 for one degree of freedom, method of measurement, reference numbers and (in some cases) the running number of brief comments.

There are 18 magnetic stars that display more complex phase curves $B_e(\phi)$. For these stars phase curves were fitted by the expansion in a harmonic series with the second cosine term, see Eq. (6) (double wave).

Table 3 presents additional parameters necessary to define the double wave. These are coefficients B_2 , phase shifts z_1 and z_2 , and their errors σ_{B_2} , σ_{z_1} , σ_{z_2} , $N_V = N - 5$, values of χ^2 , number of references and comments.

Table 4 lists cross-reference numbers for papers with observational data.

Table 5 presents a compilation of the periods used in this paper. Most of them are rotational periods of the catalogued stars. Entries are: HD number, period (in days) and the exact reference. Table 5 clearly indicates stars for which the rotational period was determined in this paper.

7. Comments on individual stars

7.1. Ap and Bp stars

HD 8441. No precise value of the period was available in the literature. Estimates of the period ranged from 2 to 100 days (Catalano & Renson 1998).

HD 9996. Preston & Wolf (1970) and Scholz (1983) suggested the existence of a magnetic period in the range 8000–8400 days. The best period P_{mag} for B_e measurement that we collected here equals 7692^d. It is necessary to continue

monitoring of this star to determine a more accurate period and magnetic phase behaviour.

HD 35456. Borra (1981) presents 4 different possible values of the period of the projected magnetic field in the range 1.7^d–8.2^d. Obviously, his results are not conclusive. We have determined the period $P_{\text{mag}} = 0.28313^{\text{d}}$, which reproduces best the magnetic B_e variations of this star.

HD 36313. North (1984) presented the photometric period, $P_{\text{phot}} = 0.58931^{\text{d}}$. Borra (1981) found two probable magnetic periods, $P_{\text{mag}} = 3.5^{\text{d}}$ and 6.2^{d} . The above photometric period poorly reproduces variations of the collected B_e points.

HD 37776. The magnetic rotational phase curve has a very complicated form for $P_{\text{mag}} = 1.538675^{\text{d}}$. The principal contribution to the phase curve comes from the second harmonic term, i.e. $\text{abs}(B_2) \gg \text{abs}(B_1)$, see Eq. (6). Moreover, note that B_e measurements published in Ref. 24 appear also in Ref. 174. Therefore, we took into account only the latter paper for the construction of the magnetic rotational phase curve.

We arbitrarily adopted the rotational period two times larger but did not obtain a phase curve of acceptable quality. The origin of the actual complex phase curve remains unclear.

HD 40312. Behavior of the B_e field of this star was studied in several research papers. We have constructed the average $B_e(\phi)$ curve without observations both from Ref. 25 (H_α line) and Ref. 226 (photographic data), due to their low accuracy. Also measurements from Ref. 60 frequently duplicate those from Ref. 2, therefore we used Ref. 2 only (H_β line). We found a new improved magnetic period $P_{\text{mag}} = 3.61866^{\text{d}}$ on the basis of data from Refs. 2 and 310.

High accuracy B_e measurements obtained from metal lines (Ref. 310) suggest that the phase curve deviates from a sine wave near phase $\phi = 0.5$. We attempted to fit those data by a double wave.

HD 49606. The magnetic behavior of this star was investigated in Refs. 38 and 241 (phot. method), but with rather nonconclusive results. Meaningful B_e observations were published in Refs. 230 and 267 (hydrogen lines) and in Ref. 330 (metal lines).

HD 55719. The magnetic variability of this star was studied with the photographic method in Refs. 32 and 93. Results of those B_e observations were not conclusive, certainly due to the high projected rotational velocity $v \sin i \approx 77 \text{ km s}^{-1}$. The number of new high accuracy B_e measurements in Ref. 256 is not sufficient to obtain credible conclusions regarding the magnetic variability of this star.

It is well known that the accuracy of Zeeman splitting measurements is related to the slope $dI_\lambda/d\lambda$ in spectral lines, and it decreases when lines are broadened e.g. by rotation. This is the case of HD 55719. Methods of B_e measurements and their disadvantages were presented in Sect. 5 of this paper. The accuracy of magnetic measurements was discussed in our previous paper, Bychkov et al. (2003).

HD 62140. The best period $P_{\text{mag}} = 4.28488^{\text{d}}$. Behavior of B_e in this star was studied in Refs. 91, 62 and 310. The latter paper presents B_e observations of high accuracy. Available observational data show that the phase curve $B_e(\phi)$ is best fitted by a double wave.

HD 65339 = 53 Cam. It is a very well investigated magnetic star. The longitudinal magnetic field B_e of this star was measured from its metal lines in Refs. 1, 9, 50, 105, 106, 110, 224, 310, 324 and 327. Observations of B_e in hydrogen line wings were published in Refs. 25, 33, 74, 96, 190 and 327. Early B_e photographic measurements are of poor accuracy; however, they still yield a picture of B_e in this star, consistent with that derived from metal lines.

HD 71866. The best magnetic period is $P_{\text{mag}} = 6.80024^{\text{d}}$. The magnetic field was measured in Refs. 3, 6 and 196 (phot. method), and in Ref. 310 (LSD method). On average, the accuracy of LSD B_e observations is 6–8 times higher than photographic observations.

HD 112185. The magnetic behavior of this star was studied by many authors in Refs. 2, 25, 56, 123, 165, 182, 271, 310 and 334. The amplitude of B_e variations is small, therefore, they can only be investigated with methods of high accuracy. We did not use B_e observations from Refs. 25, 56, 123 and 165, due to their low accuracy. Most precise B_e measurements from metal lines were presented in Ref. 310 (LSD method).

HD 112413. This is a well known and investigated magnetic star. The magnetic field B_e was investigated in Refs. 1, 25, 27, 33, 58, 77, 84, 99, 110, 123, 126, 211, 215, 217, 310, 318 and 327. The average phase curves were derived only from B_e data of high accuracy.

HD 118022. This is a well known and investigated magnetic star. Magnetic field measurements were presented in Refs. 1, 13, 22, 64, 76, 77, 81, 84, 310, 324 and 327. The average phase curves were derived only from B_e data of high accuracy.

HD 125248. Magnetic field determinations were published in Refs. 1, 2, 25, 88, 119, 184, 239, 256, 324 and 333. Measurements of B_e published in 1, 88 and 119 were not used in our paper due to low accuracy. Magnetic curves obtained from hydrogen or metal lines differ. The average phase curve for metal lines was obtained from B_e measurements published in Refs. 184, 239, 256, 324 and 333 (Fig. A.102). Note the very high accuracy of B_e values obtained by the LSD method in Ref. 333. The accuracy of their measurements is up to 10 times better than the accuracy of B_e obtained with other methods.

HD 125823. Magnetic field B_e of this star was measured both in hydrogen and metal lines. The phase curves obtained from both series of B_e points differ substantially. We present separately the hydrogen and metallic $B_e(\phi)$ phase curves, corresponding to measurements published in Refs. 37 and 176. There is a large scatter of B_e points clearly due to low accuracy of data. We need more high precision magnetic observations.

HD 128898. Magnetic field B_e was measured in Refs. 2, 81, 93, 184 and 256. Estimates in Ref. 93 were not used to construct $B_e(\phi)$ in this paper because they were obtained by photographic methods of low accuracy. New high accuracy B_e observations are necessary to improve the magnetic rotational phase curve parameters.

HD 133029. Determination of the magnetic period of this star is still the essential problem. Measurements of B_e obtained from hydrogen lines strongly differ from those observed in metal lines. We assume here that the most credible period is $P_{\text{mag}} = 2.105^{\text{d}}$.

HD 137909. A magnetic star already extensively investigated. Its B_e field was measured by various techniques and the corresponding results were published in Refs. 1, 2, 17, 22, 25, 31, 39, 47, 51, 56, 57, 59, 63, 72, 76, 77, 84, 110, 125, 131, 184, 190, 211, 217, 232, 256, 310, 324 and 327. The average hydrogen phase curve $B_e(\phi)$ presented in Fig. A.114 uses B_e values observed in H_β line wings, Refs. 2 and 76. Values of B_e presented in Refs. 25, 77 and 190 are of low accuracy. Moreover, some of them were measured in other lines of the Balmer series. Therefore we did not use these references.

There are also many published B_e points which were measured in metal lines. These observations were made with the most accurate LSD method, and also measurements were obtained from the Fe II 4520 line in Ref. 63. We present the corresponding phase curves in Figs. A.115 to A.118. Note that phase curves exhibit some differences in the above figures.

HD 147010. The magnetic field B_e was measured in metal lines, see Refs. 41, 142, 184 and 256, and also in hydrogen lines – 168. We did not take into account photographic observations of low accuracy (Refs. 41 and 142) to construct the averaged magnetic rotational phase curve.

There is a systematic discrepancy between B_e measured in metal lines, and those observed in hydrogen lines. Therefore, we present here two distinctly differing $B_e(\phi)$ phase curves for this star.

HD 152107. A star with very interesting magnetic behavior. The magnetic field B_e has been studied by various methods. The principal magnetic period is $P_{\text{mag}} = 3.8^{\text{d}}$, and there are variations on longer time scales. In the time interval JD 2 442 400. – JD 2 444 200, this star exhibited slow changes of its longitudinal magnetic field. Such an observation was claimed in Ref. 178, where measurements of the magnetic field were done in metal lines with the photographic method. However, magnetic field measurements published in Ref. 2 partly overlap this JD range, but they neither confirm nor deny the hypothesis about B_e variations on long time scale. The latter B_e estimates were obtained from hydrogen lines with the photoelectric technique.

Therefore, the question of the magnetic behavior of this star remains open. Long time monitoring of HD 152107 with modern methods of high accuracy is necessary to solve this issue.

HD 153882. The magnetic field B_e was measured by many authors in metal lines, Refs. 1, 6, 31, 72, 90, 184, 256 and 310. The average magnetic curve was obtained without B_e points from Refs. 1, 6 and 90, which were obtained by photographic methods of relatively low accuracy. The best magnetic period is $P_{\text{mag}} = 6.00858^{\text{d}}$.

HD 170000. The magnetic field of this star was measured in hydrogen lines. The most accurate data are those in Ref. 60 (Fig. A.137, H_β line). Magnetic B_e measurements in Ref. 25 (Fig. A.138, H_α line) are less accurate. Both phase curves have similar parameters. It is interesting to note that both phase curves exhibit a relative time shift by $0.5 \times P_{\text{mag}}$, which is not obviously seen when comparing both figures. Moreover, if we try to construct a phase curve from both series of B_e points taken together, then any periodic variations of B_e vs. phase vanish.

HD 175362. Effective magnetic field B_e was measured by various methods. Estimates of B_e obtained from hydrogen lines and metal lines exhibit systematic differences. We have also rejected metal line B_e measurements of Ref. 52, due to their low accuracy (photographic method).

HD 188041. The period of magnetic variability is $P_{\text{mag}} = 223.826^{\text{d}}$, according to Mikulasek et al. (2003). Measurements of B_e were performed by various methods, but only in metal lines. As it was shown in Ref. 232 results of magnetic field measurements strongly depend on the choice of element responsible for the development of lines in which B_e was measured. As a result, for example, B_e points from Ref. 4 show strong variability with phase, whereas B_e observations from Refs. 1, 15, 16, 184 and 256, display variations with much smaller amplitude. Perhaps B_e measurements in hydrogen lines would yield a conclusive solution to the problem, because in the latter case results would not depend on the stratification of chemical elements over the stellar surface.

HD 189849. Magnetic field B_e was measured in metal lines. One of the probable periods of magnetic variations is $P_{\text{mag}} = 6.88449^{\text{d}}$. Additional high precision B_e observations are necessary for the more precise determination of P_{mag} and parameters of magnetic variability.

HD 201601. The magnetic field B_e of this well known star was observed by various methods and results were presented in a large number of papers, cf. Refs. 1, 2, 46, 47, 48, 49, 105, 146, 184, 195, 232, 256, 268 and 327. The star shows “secular” B_e variability with the period $P_{\text{sec}} = 27\,027^{\text{d}}$ – see Ref. 268. Unfortunately, available observations do not cover the full period P_{sec} . A precise description of the magnetic behavior of this star requires long-term monitoring of its B_e field. We also point out that possibly there exist systematic differences of B_e measured with different methods and by various authors.

HD 215441. This star has a very strong magnetic field. Measurements of B_e in metal lines exhibit large scatter and did not yield the dependence of B_e on phase ϕ . Measurements in hydrogen lines show periodic variability coincident with the rotational period $P_{\text{rot}} = 9.4871^{\text{d}}$. It is possible that there is also long period variability of B_e , with the period $P_{\text{long}} = 10\,180^{\text{d}}$.

7.2. Stars of other spectral classes

The sample of non-Ap stars in the catalogue includes objects of various types. These are: supergiants of luminosity class I (HD 45348, HD 194093, and HD 207260), late-type dwarfs (HD 131156 and HD 201091), one close binary system with mass transfer (HD 174638 = β Lyr), one pulsating variable star (HD 16582 = δ Cet) and hot Ae/Be stars with emission lines (HD 37022 and HD 37041).

Spectral classification of some of catalogued stars can be ambiguous, of course. For example, the star HD 37041 mentioned above is of type O9.5Vpe and possibly should be included in the group of hot Bp stars.

We excluded HD 182989 = RR Lyr from our catalogue, since this well-known pulsating star apparently does not have a strong global magnetic field and the periodic variability of its

longitudinal component was not detected (see comments in this subsection).

The structure of the global magnetic fields in non-Ap stars can differ from those in Ap stars. It seems, however, that in the case of several stars collected in our catalog, the surface field integrated over the visible stellar disc is not equal to zero. There apparently exists a nonzero integrated dipole component, and its integrated projection on the line of sight varies with the rotational period. One can assume that such a weak field is the sum of small magnetic spots with strong fields, for instance.

HD 37022. An Ae/Be star with the rotational period $P_{\text{rot}} = 15.422^{\text{d}}$. Authors of Ref. 348 do not provide an estimate of the errors of their B_e determinations. Since the rotational period P_{rot} is rather long, we have grouped individual B_e points in bins not larger than 0.1^{d} . Assuming that B_e does not change within such a small phase range, we were able to estimate the error of a single B_e measurement, $\sigma_e = 372$ G.

HD 174638 = β Lyr. It is a close binary system with mass transfer between both components, with a nonzero magnetic field. Measurements B_e were performed mostly in metal lines of the blue optical region with the photographic method (Fig. A.142). Measurements of B_e within red silicon lines (Fig. A.143) reveal a lower level of effective magnetic field variations.

In principle this binary star should not exhibit a strong global magnetic field. It is possible that the above observations of B_e would not be confirmed by more accurate measurements in the future, similar to the case of HD 182989.

HD 182989 = RR Lyr. It is a well known pulsating star. Photographic measurements showed variations of B_e in this star both with the pulsation period, $P_{\text{puls}} = 0.566867^{\text{d}}$, and the period of the Blazhko effect, $P_{\text{Blaz}} = 40.8^{\text{d}}$ (Romanov et al. 1985). However, the newest high precision measurements by Chadid et al. (2004) showed the absence of a global magnetic field in this star.

8. Discussion: CP stars in our sample

We have compiled average magnetic rotational phase curves $B_e(\phi)$ for 136 stars. Most of them, 127 objects, are classified as chemically peculiar A and B type stars. Therefore we restricted most of the following discussion to this widely investigated group of main sequence stars.

The following subsections and figures present number distributions and statistical properties of various parameters: spectral types, rotational periods, fitting coefficients B_0 , B_1 , B_2 and the distribution of the parameter $r = B_e(\text{max})/B_e(\text{min})$.

8.1. Distribution of spectral types

Figure 1 presents the distribution of stars in our catalog among various spectral types. Magnetic rotational phase curves $B_e(\phi)$ are given mostly for stars of early spectral type (which are almost exclusively chemically peculiar stars). There are only 5 stars of spectral types cooler than F4.

Such a strong bias can be understood when considering that the field topology and intensity of CP stars make their global magnetic fields more easily detectable than in other types of

Fig. 1. Number distribution of stars with known $B_e(\phi)$ phase curves vs. spectral type.

Fig. 2. Number distribution of stars in our catalog vs. decimal logarithm of period P , for all Ap stars with known periods (*upper panel*) and for stars with known phase curves (*lower panel*).

stars. Following the discovery of strong global magnetic fields in 78 Vir (HD 118022) by Babcock (1958), observers concentrated their efforts and interest mostly on stars of this class. Magnetic fields of stars belonging to other spectral classes were seldom measured, since such observations usually did not yield positive results.

Therefore, the present knowledge of the global magnetic fields across the whole spectral sequence on the Hertzsprung-Russell diagram is rather poor and selective.

8.2. Distribution of periods

Figure 2 presents the distribution of stars in our catalog vs. decimal logarithm of period P , separately for all CP stars with known periods (upper panel) and for stars whose period leads to consistent rotational phase curves (lower panel). The width of a single bin is 0.3 dex.

Approx. 60% of all CP stars exhibit periods P_{mag} between 1 and 5 days. The same is true for stars with known phase curves.

8.3. Coefficients B_0 , B_1 , and B_2

Figure 3 shows the number distribution vs. coefficient B_0 for the catalogued stars whose rotational phase curves $B_e(\phi)$ were approximated by sine waves. Figure 3 does not include HD 215441 whose exceptionally strong B_e field exceeds the

Fig. 3. Number distribution of catalogued stars vs. coefficient B_0 for those stars in which the phase curve $B_e(\phi)$ was approximated by a sine wave.

Fig. 4. Number distribution of catalogued stars vs. coefficient B_1 (half amplitude of B_e variability). This figure shows only those stars with a sine wave phase function.

scale of the figure. The average value of B_0 over all single-wave stars is 21 ± 138 G, representing the width of the peak distribution.

Figure 4 displays an analogous number distribution vs. coefficient B_1 (half amplitude of B_e variability) for the catalogued stars with sine wave rotational phase curves $B_e(\phi)$.

The number of stars with the lowest amplitude of B_e variations is underestimated. In fact, the accuracy of magnetic measurements is limited, and many stars with low magnetic variability were not detected as variable stars and therefore were not included in our catalog. This is the reason for the significant deficiency of stars with small half amplitude B_1 (see Fig. 4). We expect that future magnetic measurements of very high accuracy will improve the statistics at the lower values of the B_e distribution.

The amplitude of B_e variations depends, apart from Landé factor and field intensity, on the inclination of the rotational axis. A pole-on or a quasi pole-on star (that is, a star whose pole is along the line of sight, $i = 0$) will never show any rotational modulation of B_e .

Once the measurement accuracy is improved, the number of stars with small B_e variation is expected to raise.

Since the inclination angle of stars is randomly distributed, we have to conclude that CP stars favor configurations with small values of β .

Fig. 5. Number distribution of stars vs. coefficient B_0 for those stars which exhibit a magnetic rotational phase curve with a double wave.

Figure 5 shows the number distribution vs. coefficient B_0 for those stars which exhibit magnetic rotational phase curves with double waves. The average value of B_0 is -473 ± 296 G. Again, the value of 296 G represents the width of the peak distribution. The total number of stars in the figure is small (18 objects), therefore the statistics are poor. However, we conclude that stars with complex B_e phase curves (double waves) more frequently have negative values of B_e .

8.4. Parameter r

We perform the following analysis according to the formalism by Preston (1967b). According to Eq. (4) one can determine the value of i

$$i = \arctan \left[\frac{1-r}{1+r} \cot \beta \right]. \quad (7)$$

The above equation determines the probability density of the occurrence of a value r at the fixed angle β

$$p_\beta(r) = \frac{2(1-r) \tan \beta}{[(1-r)^2 + (1+r)^2 \tan^2 \beta]^{1/2}}. \quad (8)$$

We assume that in our sample the rotational axis directions are uniformly distributed on the sphere. Consequently, the occurrence probability of the particular angle β is proportional to the area of an infinitesimal ring of $\beta = \text{const}$. We have determined probability of the occurrence of β in the range of 0° – 90° with steps of 10° .

We have constructed relations $p_\beta(r)$ for eight fixed values of β in the range $-1 \leq r \leq +1$ corresponding to the centers of bins defined in the above way. We then computed their arithmetic average with the weight proportional to the probability of the occurrence of angle β .

Figure 6 presents the above averaged relation (solid line). This is the number distribution of stars in a uniformly distributed sample vs. the observed parameter r . The histogram represents the distribution of real stars in our catalogue. Figure 6 shows the substantial differences between the observed and theoretical number distributions of the parameter r . We interpret these differences either as a real nonuniformity in β distribution, or as the result of poor statistics and the resulting random fluctuations.

Fig. 6. Measured distribution of the parameter r vs. theoretical distribution, the latter corresponding to the random distribution of β and i angles.

9. Summary and conclusions

We have compiled a catalog of magnetic rotational phase curves $B_e(\phi)$ for 136 stars which exhibit periodic variations of the effective magnetic field B_e . Most of the catalogued objects, 127 stars, are chemically peculiar A and B type stars. The catalog consists of figures which display individual B_e measurements, error bars and phase curves $B_e(\phi)$ approximated either by a sine wave or by a double wave.

The catalog also presents a listing of the following parameters of magnetic phase curves: coefficients B_0 , B_1 , and B_2 of the harmonic expansion of $B_e(\phi)$, the magnetic period P_{mag} (in days) usually equal to the rotational period P_{rot} , Julian Day of the zero phase T_0 and the coefficient r defined by Stibbs (1950). We estimated and listed errors for most of the above parameters of the magnetic B_e variations.

The above analysis is restricted to a very limited number of magnetic phase curve parameters. Detailed analysis of distributions and relations between the parameter r , the angle β and the angle i will be presented in a forthcoming paper.

We are aware that there are a number of magnetic stars with strong effective magnetic field B_e and very low or zero variation. Such stars were not included in our catalog, partly because it was impossible to determine the magnetic period P_{mag} and phases of individual B_e measurements. We stress here that this fact introduces a particular bias in the catalogue, which neglects some groups of magnetic stars. The bias is responsible for the apparent deficiency of stars with the smallest amplitude of sine variations B_1 , see Fig. 4.

Our catalogue shows that approx. 14% of investigated magnetic stars exhibit complex magnetic rotational phase curves, which were approximated by a double wave (18 stars). The remaining 118 stars have simpler phase curves, approximated here by a simple sine wave. It is possible that some stars with simple sine phase curves will have a more complex shape of $B_e(\phi)$ when more accurate magnetic data become available. Also we expect the discovery of new magnetic stars. Both reasons are likely to change the above proportion (14%).

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Table 1. Single wave B_c phase curve parameters for all catalogued stars. Julian Day of zero phase is $JD = 2\,400\,000. + T_0$. An asterisk attached to the HD number indicates that the phase curve of this star has to be fitted by a double wave, and the star is also listed in Table 3. Parameters B_0 , σ_{B_0} , B_1 , σ_{B_1} are given in G, and T_0 , σ_{T_0} are in days.

HD	Sp. type	B_0	σ_{B_0}	B_1	σ_{B_1}	P (days)	T_0	σ_{T_0}
2453	A1	-680	17	272	24	520.5	33363.490	5.554
3360	B2V	-18	3	27	7	5.370447	52266.338	0.124
3980	A7p	70	38	1740	91	3.9516	40929.344	0.021
4778	A1p	166	103	1257	121	2.5616	47106.935	0.049
5737	B6p	103	25	391	41	21.654	44691.696	0.308
8441	A2	-166	50	350	81	1.80889	33570.246	.063
9996*	B9p	-252	34	855	59	7692.	33638.387	50.77
10783	A2	829	129	670	176	4.14628	33486.589	0.153
11503	A1p	-238	31	672	43	1.6093	43001.390	0.016
12288	A2p	-1508	57	1070	71	34.79	49895.485	0.439
12447	A0p	-49	31	473	49	1.49070	43495.498	0.021
12767	B9.5p	29	43	277	47	1.892	43497.765	0.095
14437	B9p	1918	61	726	60	28.87	44617.847	0.416
15144	A6Vp	-792	41	124	62	15.88	32461.798	1.440
16582	B2IV	-387	245	1231	355	1.40744	42350.922	0.066
18296	B9p	97	66	197	97	2.8842	33248.996	0.269
		30	40	173	54	2.8842	33249.445	0.177
19832	B9p	42	71	378	87	0.727893	37667.527	0.036
21699	B8IIIp	-84	74	822	95	2.4765	44859.033	0.055
22470	B9p	109	77	1119	123	0.6785	41947.107	0.010
24155	B9p	561	145	999	188	2.53465	43841.124	0.089
24712	A9p	705	31	471	43	12.4617	40570.628	0.192
25267	B9+B9.5V	-181	35	178	46	5.954	43498.005	0.284
25354	A2	-221	316	290	629	3.90072	35788.888	0.629
25823	B9p	366	118	570	153	4.65853	34247.731	0.252
27309	A0p	-1479	166	1363	264	1.10496	42768.266	0.028
27962	A3V	682	61	623	92	2.13006	41319.588	0.043
28843	B5-B9p	-33	112	479	159	1.373813	43441.390	0.081
30466	A0p	978	123	981	133	1.3900	35780.741	0.045
32633*	B9p	-1083	40	3076	45	6.43000	35782.995	0.030
34452	A0p	342	78	745	125	2.4687	37294.864	0.056
35298	B6	661	207	3520	392	1.85336	44597.448	0.025
35456	B6	161	95	1874	157	0.28313	46448.872	0.003
35502	B5	-1853	179	1732	326	1.707	44591.152	0.033
35912	B2V	-283	113	1448	174	0.89786	39571.019	0.015
36313	B8p	87	225	1261	274	0.58931	44590.126	0.022
36485	B2p	-3359	135	1499	349	2.0129	45290.138	0.037
36526	B8	1630	196	2409	287	1.5405	43507.101	0.028
36629	B3	-362	249	1485	324	5.01255	39168.313	0.167
36668	B7	34	247	1285	328	2.1211	44589.414	0.127
37017	B1.5V	-1265	49	984	72	0.901175	43440.322	0.010
37022	O6pe	72	68	333	138	15.422	50308.228	1.085
37041	O9.5Vpe	970	146	1165	249	3.14264	41714.286	0.075
37058	B3p	1016	144	1863	255	1.022	45299.515	0.014
37140	B8	-122	273	681	483	2.7088	44594.642	0.250
37151	B8p	-38	166	501	267	5.6732	44323.826	0.502

Table 1. continued.

HD	Sp. type	B_0	σ_{B_0}	B_1	σ_{B_1}	P (days)	T_0	σ_{T_0}
37210	B8p	-220	271	643	466	11.0494	44589.291	1.176
37479	B2Vp	671	83	2283	120	1.190811	43441.178	0.010
37642	B9p	-227	346	2943	805	1.07977	44589.817	0.064
37776*	B3	-290	55	275	67	1.538675	45724.124	0.020
40312*	A0p	68	9	288	14	3.61866	42764.658	0.026
45348	F0Ib	293	21	333	32	6.90	41001.970	0.097
49333	B7III _n	113	106	1035	189	2.18010	47310.482	0.044
49606	B7III	-218	83	413	108	1.10503	43819.373	0.046
49976	A1p	-163	127	1766	174	2.97668	35758.274	0.053
51418	A0	195	117	476	171	5.631	41581.158	0.362
54118	A0p	-21	65	1364	87	3.27533	46829.614	0.037
55719	A3p	1044	141	876	219	1.00335	41642.046	0.033
58260	B3	2283	95	219	165	1.657	43503.502	0.176
62140*	A8p	22	69	1678	89	4.28488	41254.991	0.037
62140*		-52	14	1606	21	4.28488	41255.021	0.008
64740	B1.5Vp	-229	24	678	33	1.33026	43498.438	0.011
65339*	A3p	-345	26	4389	37	8.0267	35854.246	0.010
		-74	77	4151	119	8.0267	35854.083	0.033
71866	A1p	222	27	2010	34	6.80024	32955.956	0.022
72968	A2p	40	89	549	148	4.66458	33253.586	0.210
73340	B9	-1391	100	742	127	2.66753	43171.646	0.102
74521	A1p	651	42	135	55	7.76851	33606.860	0.654
77350	B9p	-177	63	472	109	4.024	35879.465	0.130
78316	B8IIIp	-25	48	175	62	5.0035	34012.184	0.344
79158	B9IIIp	-33	41	881	55	3.8345	43647.801	0.040
83368	A8p	-9	51	704	81	2.851962	46218.974	0.044
89822	A0p	52	37	100	56	7.5586	35566.464	0.712
90044	B9p	-4	106	1146	183	4.379	46893.138	0.095
90569	A0p	101	197	318	372	1.445	32988.947	0.160
92664	B9p	-705	29	508	45	1.67315	43946.465	0.020
96446	B2	-1238	75	597	110	0.85521	43500.247	0.021
96707	F0p	135	65	527	89	2.49183	40331.707	0.069
98088	A8IVp	-128	138	997	185	5.81714	34726.490	0.193
103192	B9IIIp	-228	68	93	112	2.344	43730.962	0.274
108662	A0p	-361	38	480	51	5.0805	32978.132	0.100
108945	A2Vp	-317	100	737	125	1.92442	42490.168	0.054
110379	F0V	61	22	306	31	12.92696	34410.489	0.197
111133	A1p	-915	65	531	88	16.3078	35877.680	0.396
112185	A1	25	10	76	16	5.0887	41792.085	0.198
		36	8	67	10	5.0887	41792.085	0.158
112381	A0	-3402	119	430	188	2.84	46831.344	0.204
112413	A0	-156	12	686	16	5.46939	50492.670	0.023
		-180	20	1020	31	5.46939	41790.936	0.025
		-222	27	1121	38	5.46939	41790.938	0.032
116458	A0p	-1954	39	361	51	2.3596	41010.295	0.055
118022	A2p	-559	9	421	14	3.722084	50492.232	0.019
		-507	53	369	78	3.722084	42493.460	0.124
119213	A2Vp	630	79	770	127	2.44997	43139.882	0.064
119419	A0p	-614	77	2412	112	2.6006	46881.845	0.017
122532	B9p	-18	44	894	71	3.68137	46912.511	0.044
124224	B9Vp	176	38	541	50	0.520675	42850.109	0.009
125248	A1p	56	108	2654	153	9.2954	34461.181	0.082
		73	44	2176	59	9.2954	34461.314	0.043
125823	B7IIIpv	35	83	516	113	8.8171	43724.005	0.361
		13	31	406	44	8.8171	43724.711	0.188
126515	A2p	-268	61	2176	81	129.95	37004.582	0.874
128898	A0p	-244	54	166	77	4.4794	43743.166	0.403
131156	G8V+K4Ve	13	2	14	3	6.1455	44030.792	0.178

Table 1. continued.

HD	Sp. type	B_0	σ_{B_0}	B_1	σ_{B_1}	P (days)	T_0	σ_{T_0}
133029	B9p	3516	77	1455	205	2.105	33109.683	0.022
		2184	53	243	79	2..105	33109.672	0.135
133652	A0p	−347	65	1995	152	2.3040	48344.814	0.014
133880	B9p	−275	50	3324	76	0.877485	42120.905	0.003
134793	A4	−114	110	532	177	2.7800	35941.897	0.145
137509	B8p	178	107	973	145	4.4912	48342.302	0.112
137909	A9p	143	13	528	17	18.4868	34210.963	0.104
		102	5	671	8	18.4868	43309.186	0.033
		−51	4	1242	7	18.4868	43309.746	0.012
		−46	36	753	54	18.4868	43310.222	0.178
		108	21	524	32	18.4868	43310.221	0.151
137949	F0p	1121	63	637	88	11.13313	36007.100	0.217
140160	A0p	−456	508	901	753	1.59584	40763.340	0.181
142301	B8IIIp	−1134	93	2848	157	1.45955	42593.469	0.011
142990	B6IV	−498	72	1272	84	0.9791	43560.066	0.012
143473	B9p	4434	161	1378	331	2.84263	47270.549	0.066
144334	B8	−523	73	778	103	1.49497	43704.004	0.030
147010	B9p	−4717	97	1200	139	3.920676	45041.014	0.071
		−3589	97	1331	130	3.920676	45041.190	0.070
148112	A0p	−216	52	54	96	3.04296	41803.645	0.428
148199	B9p	343	69	1158	94	7.72553	44771.972	0.101
148330	A2	−95	42	208	80	4.288404	45460.144	0.223
151965	B9	−2332	98	1508	145	1.60841	47683.390	0.024
152107	A3Vp	502	37	296	58	3.86778	42554.552	0.106
		1524	88	130	161	3.86778	33069.585	0.500
153882	A1p	276	27	2009	36	6.00858	34524.526	0.018
164258	A3p	−11	140	1053	229	0.86281	44769.834	0.025
168733	B8p	−630	31	345	52	14.78437	41428.254	0.282
170000	A0p	151	30	327	45	1.71649	40870.326	0.035
		−52	115	281	204	1.71649	40871.163	0.188
170397	B9p	69	68	920	97	2.25454	42610.580	0.058
170973	A0p	285	147	1081	311	18.52	47008.207	0.784
173650	A0p	−97	108	309	174	9.9754	33108.446	1.016
174638	B7Ve	−1291	35	498	48	12.935	44008.693	0.195
		−1	6	43	8	12.935	44008.736	0.456
175362	B6IVp	−1286	64	5376	92	3.67375	44637.022	0.010
		−292	84	4697	121	3.67375	44637.107	0.017
187474	A0p	−84	30	1855	38	2342.	36180.231	9.961
188041	A6p	2759	41	1030	57	223.826	34801.337	2.079
		765	42	257	56	223.826	34807.593	8.243
189849	A4III	180	7	131	10	6.88449	39713.875	0.122
192678	A2	1352	23	415	32	12.91049	36116.531	0.164
194093	F8Ib	30	7	49	10	1.03474	41152.232	0.032
196178	B8p	−1018	74	859	136	1.91645	42590.381	0.030
196502	A2p	43	43	472	61	20.2747	33942.384	0.368
201091	K5V	−4	1	7	1	36.59	50972.715	0.710
201601	A9p	−234	15	779	15	27027.	22098.81	11.222
207260	A2Ia	501	27	589	33	1688.9	41065.746	21.445
215441	B9	14417	235	4109	376	10180.	36064.62	24.480
		16452	393	4671	530	9.4871	36765.450	0.187
220825	A1p	−164	72	389	101	1.14077	43739.058	0.054
223640	B9p	501	36	572	54	3.735239	43738.765	0.053
343872	Ap	1867	70	1709	99	8.8	51764.034	0.081

Table 2. Parameter r of the dipole magnetic field. Asterisk in column 1 indicates that the phase curve of this star was fitted by a double wave. Method: Met – B_e from metal lines, HI – B_e from hydrogen lines, all – both previous methods.

HD	N	σ	r	σ_r	N_V	χ^2	Method	References
2453	28	16	0.443	0.030	25	1.86	Met	1, 26, 256
3360	118	3	-0.189	0.105	115	1.00	Met	360
3980	8	252	-0.921	0.040	5	70.98	Met	121
4778	23	77	-0.764	0.121	20	1.01	HI	171
5737	24	25	-0.583	0.095	21	1.35	HI	37, 181, 256
8441	18	61	-0.357	0.148	15	1.40	all	1, 237
9996*	62	58	-0.711	0.055	59	44.21	all	1, 19, 208, 209, 270, 327
10783	36	139	0.115	0.157	33	1.36	Met	1, 35
11503	18	48	-0.479	0.056	15	2.52	HI	2
12288	21	98	0.171	0.034	18	11.65	all	312, 350
12447	22	29	-0.810	0.099	19	0.92	HI	2
12767	8	26	-0.743	0.155	5	0.91	HI	2
14437	36	69	0.451	0.031	33	4.11	all	312
15144	57	20	0.727	0.100	54	0.28	Met	1, 87
16582	13	166	-0.508	0.250	10	114.05	all	77, 96, 327
18296	51	68	-0.337	0.347	48	1.63	Met	1, 14, 327
	19	31	-0.618	0.259	16	0.96	HI	2, 197, 243
19832	11	49	-0.710	0.181	8	0.73	HI	2
21699	17	97	-0.803	0.116	14	4.48	all	40, 252
22470	14	51	-0.819	0.102	11	1.17	HI	25, 37
24155	6	84	-0.280	0.169	3	0.71	HI	230
24712	38	39	0.199	0.048	35	11.61	all	21, 111, 120, 184, 195, 256, 310, 327
25267	7	24	0.017	0.181	4	0.85	HI	2
25354	5	20	0.349	0.379	2	0.01	Met	1
25823	20	66	-0.214	0.233	17	0.38	Met	1, 71
27309	13	211	0.047	0.110	10	2.46	all	2, 41, 142
27962	16	75	0.048	0.079	13	1.25	all	1, 77, 98
28843	5	69	-0.670	0.246	2	0.77	HI	37
30466	10	198	-0.001	0.100	7	4.95	Met	1, 44, 137
32633*	120	114	-0.499	0.015	117	14.09	all	1, 2, 8, 175, 184, 310, 327
34452	11	41	-0.371	0.108	8	0.47	HI	2, 230
35298	5	151	-0.683	0.097	2	1.15	HI	201
35456	13	144	-0.844	0.077	10	3.38	all	201, 327
35502	6	49	0.040	0.076	3	0.21	HI	201
35912	10	66	-0.636	0.103	7	0.66	Met	55, 327
36313	6	202	-0.744	0.157	3	1.90	HI	201
36485	7	43	0.391	0.096	4	0.22	all	135, 256
36526	6	92	-0.192	0.079	3	0.40	HI	201
36629	8	75	-0.618	0.182	5	0.36	Met	53, 55
36668	6	161	-0.740	0.174	3	1.26	HI	201
37017	40	70	0.124	0.037	37	1.99	HI	24, 135
37022	30	89	-0.603	0.217	27	1.81	Met	286, 348
37041	7	77	-0.084	0.113	4	0.54	HI	69, 75
37058	10	91	-0.293	0.066	7	0.92	all	37, 53, 55, 256
37140	6	165	-0.477	0.395	3	1.03	HI	201
37151	5	42	-0.566	0.320	2	0.14	HI	201, 204
37210	4	184	-0.415	0.370	1	1.57	HI	201
37479	22	110	-0.546	0.051	19	1.98	HI	28, 135
37642	6	327	-0.811	0.104	3	5.91	HI	201
37776*	51	106	–	–	46	4.55	HI	24, 174
40312*	30	11	-0.619	0.044	27	2.42	all	2, 60, 310
45348	26	32	-0.062	0.050	23	5.59	Met	42, 273
49333	8	76	-0.780	0.143	5	0.79	HI	37, 159
49606	11	33	-0.318	0.192	8	29.88	all	230, 267, 330
49976	22	172	-0.825	0.102	19	3.62	Met	1, 91, 92, 184
51418	11	49	-0.408	0.312	8	0.23	Met	29
54118	14	63	-0.924	0.054	11	2.09	HI	81, 230

Table 2. continued.

HD	N	σ	r	σ_r	N_V	χ^2	Method	References
55719	31	84	0.097	0.165	28	0.68	Met	32, 93, 256
58260	10	57	0.807	0.079	7	0.58	HI	24, 135
62140*	36	93	-0.934	0.047	33	6.01	Met	62, 91, 310
62140*	14	43	-0.938	0.017	11	10.78	Met	310
64740	21	31	-0.496	0.044	18	1.73	HI	24, 135
65339*	10	113	-0.854	0.010	7	26.34	Met	310
	48	117	-0.959	0.027	45	3.63	HI	25, 33, 74, 96, 190, 327
71866	10	32	-0.802	0.023	7	2.60	Met	310
72968	24	61	-0.733	0.208	21	10.20	Met	1, 91, 327
73340	5	87	0.307	0.091	2	1.59	HI	230
74521	12	75	0.660	0.108	9	22.90	all	184, 230, 327, 333
77350	9	35	-0.456	0.164	6	0.79	all	230, 327, 333
78316	32	30	-0.611	0.280	29	2.48	Met	1, 11, 330, 333
79158	27	51	-0.910	0.062	24	1.45	HI	37, 181, 327
83368	22	80	-0.893	0.078	19	1.85	all	184, 186, 256
89822	12	39	-0.331	0.338	9	3.26	all	1, 2, 20, 230, 237, 330
90044	11	61	-0.863	0.098	8	0.49	all	230, 324
90569	8	14	-0.399	0.397	5	0.01	Met	1
92664	19	35	0.163	0.050	16	1.64	HI	230
96446	15	68	0.354	0.075	12	2.41	all	24, 184
96707	21	51	-0.602	0.153	18	0.81	all	260, 324
98088	19	87	-0.743	0.157	16	1.41	Met	1, 108, 310
103192	5	17	0.301	0.236	2	0.26	HI	2, 230
108662	53	50	-0.142	0.073	50	1.76	Met	1, 11, 118, 333
108945	13	59	-0.408	0.119	10	0.72	all	2, 327, 333
110379	16	26	-0.667	0.109	13	2.19	all	1, 61, 77, 327, 333
111133	25	38	0.270	0.069	22	0.73	Met	1, 23, 142
112185	24	9	-0.509	0.166	21	1.02	HI	2, 182, 271, 334
	12	4	-0.299	0.136	9	0.49	Met	310, 334
112381	5	71	0.777	0.082	2	1.37	HI	230
112413*	18	36	-0.629	0.025	15	8.46	Met	310
	45	51	-0.700	0.028	42	11.75	HI	25, 33, 77, 126, 215, 327
	21	45	-0.670	0.037	18	2.90	HI	33
116458	32	52	0.689	0.037	29	5.74	Met	93, 184, 187, 256
118022*	18	7	0.140	0.018	15	0.71	Met	310
	14	53	0.163	0.126	11	1.24	HI	2, 76, 77
119213	9	71	-0.096	0.098	6	.90	HI	147
119419*	29	100	-0.595	0.043	26	3.81	all	168, 184, 230
122532	24	66	-0.919	0.057	21	2.16	all	168, 184, 230
124224	36	47	-0.510	0.095	20	1.51	HI	2, 25, 60
125248	16	129	-0.931	0.051	13	1.95	HI	2, 25
	35	52	-0.934	0.034	32	3.90	Met	184, 239, 256, 324, 333
125823	19	86	-0.766	0.157	16	1.27	Met	176
	9	34	-0.881	0.084	6	1.57	HI	37
126515*	31	104	-0.781	0.045	28	6.38	all	1, 18, 91, 184, 256, 310, 324
128898	15	59	0.205	0.230	12	2.36	all	2, 81, 184, 256
131156	32	31	-0.058	0.141	29	4.17	Met	27, 299, 311
133029	18	110	0.417	0.056	15	2.55	HI	2, 326
	91	52	0.801	0.058	88	0.94	Met	1, 94
133652	9	77	-0.703	0.056	6	1.79	HI	230
133880*	12	201	-0.848	0.027	9	21.56	HI	172
134793	5	86	-0.612	0.239	2	1.17	Met	1
137509*	16	186	-0.689	0.163	13	5.13	all	184, 230, 256
137909	36	17	-0.574	0.029	33	8.73	HI	2, 76
	17	3	-0.737	0.013	14	0.35	Met	310
	14	32	-0.921	0.006	11	69.00	Met	31, 327
	34	48	-0.877	0.074	31	2.18	Met	63
	33	32	-0.660	0.055	30	2.65	Met	63
137949	18	76	0.277	0.083	15	3.58	Met	1, 26, 91, 256

Table 2. continued.

HD	N	σ	r	σ_r	N_V	χ^2	Method	References
140160	10	195	-0.366	0.273	7	4.77	all	2, 25, 333
142301*	20	131	-0.430	0.035	17	3.33	HI	89
142990	18	70	-0.438	0.074	15	1.49	HI	37, 230
143473	6	20	0.530	0.090	3	0.03	all	184, 230
144334	12	91	-0.194	0.095	9	1.79	HI	37
147010*	12	86	0.595	0.040	9	1.05	HI	168
	19	114	0.460	0.039	16	1.90	Met	184, 256
148112	12	43	0.395	0.226	9	1.52	all	2, 327, 333
148199	13	88	-0.544	0.078	10	1.71	HI	168, 230
148330	13	60	-0.362	0.269	10	5.52	Met	179, 327, 333
151965	9	91	0.216	0.054	6	1.27	HI	230
152107	21	39	0.262	0.102	18	1.69	HI	2, 220, 290
	28	44	0.790	0.096	25	0.24	Met	1, 83, 178, 219, 290, 327
153882	28	113	-0.759	0.020	25	99.26	Met	31, 72, 184, 256, 310
164258	12	123	-0.803	0.136	9	0.70	Met	41, 327
168733	24	39	0.306	0.083	19	1.36	all	86, 184, 256
170000	15	49	-0.369	0.106	12	2.60	HI	60 – H bet.only
	18	92	-0.516	0.323	15	0.65	HI	25 – H Alp.only
170397	12	25	-0.845	0.104	9	0.32	all	2, 184, 230
170973	5	27	-0.580	0.179	2	0.07	all	184, 230
173650	24	51	-0.466	0.326	21	0.24	Met	1
174638	63	57	0.444	0.038	60	2.39	Met	191, 227, 342, 343
	28	13	-0.811	0.139	25	7.66	Met	344
175362*	12	224	-0.614	0.015	9	16.06	HI	37
	30	157	-0.884	0.031	27	7.76	Met	184, 256
187474	56	25	-0.914	0.029	53	1.61	Met	1, 184, 256
188041	53	71	0.457	0.022	50	3.05	Met	4
	44	49	0.500	0.091	41	1.96	Met	1, 15, 16, 184, 256
189849	60	22	0.159	0.041	57	14.22	Met	10, 97, 98, 327
192678	31	36	0.531	0.028	28	3.99	all	1, 41, 255
194093	94	10	-0.234	0.147	91	9.37	Met	76, 140, 189, 229
196178	11	70	0.089	0.075	8	17.68	all	2, 327
196502	56	53	-0.817	0.111	53	9.27	all	1, 7, 22, 190, 327
201091	15		-0.304	0.068	12	4.86	Met	354
201601	208	17	-0.539	0.024	205	15.74	all	1, 2, 46, 47, 48, 49, 105, 146, 184, 195, 268, 256, 327
207260*	157	43	-0.080	0.035	154	4.38	all	136, 194, 325
215441	48	560	0.557	0.028	45	35.12	all	5, 30, 190, 224
	20	391	0.559	0.041	17	1.68	HI	30, 190
220825	13	22	-0.415	0.191	10	0.14	all	2, 25, 327
223640	27	51	-0.064	0.054	24	1.95	HI	224
343872*	17	167	0.044	0.039	14	9.12	Met	329

Table 3. Double wave B_e variations.

HD	B_0	σ_{B_0}	B_1	σ_{B_1}	B_2	σ_{B_2}	z_1	σ_{z_1}	z_2	σ_{z_2}	N_V	χ^2	Method	References
9996	-252	34	855	59	281	42	0.943	0.008	0.096	0.028	57	56.59	all	1, 19, 208, 209, 270, 327
32633	-1083	40	3026	45	1279	61	0.100	0.005	0.877	0.008	115	13.80	all	1, 2, 8, 175, 184, 310, 327
	-1338	54	2626	63	703	72	0.066	0.005	0.859	0.012	10	1.64	Met	184, 310
	-1460	109	2784	165	1125	153	0.083	0.009	0.909	0.024	12	1.26	HI	2
37776	-240	62	308	87	1347	87	0.962	0.052	0.900	0.011	39	5.00	HI	174
40312	83	12	248	19	62	17	0.017	0.013	0.023	0.062	6	1.61	Met	310
62140	-63	14	1638	21	34	150	0.002	0.002	0.052	0.227	9	7.82	Met	310
65339	-375	26	4382	38	316	39	0.005	0.001	0.014	0.018	5	15.83	Met	310
112413	-159	12	704	16	193	19	0.000	0.004	0.994	0.016	13	1.28	Met	310
	-184	20	1014	31	94	22	0.999	0.005	0.927	0.058	40	10.93	HI	25, 33, 77, 126, 215, 327
118022	-556	9	422	14	28	16	0.999	0.005	0.962	0.090	13	0.49	Met	310
119419	-590	76	2443	114	520	149	0.003	0.007	0.164	0.053	24	2.85	all	168, 184, 230
126515	-293	62	2043	84	536	214	0.991	0.008	0.183	0.080	26	1.77	all	1, 18, 91, 184, 256, 310, 324
133880	-419	52	3177	78	918	65	0.004	0.003	0.039	0.012	7	4.07	HI	172
137509	243	119	978	152	960	144	0.986	0.029	0.909	0.029	11	1.74	all	184, 230, 256
142301	-957	103	3013	165	624	281	0.001	0.007	0.165	0.082	15	1.41	HI	89
147010	-4702	97	1268	149	429	189	0.990	0.018	0.933	0.069	7	0.44	HI	168
	-3646	100	1350	130	407	121	0.019	0.019	0.990	0.074	14	1.38	Met	184, 256
175362	-1436	67	5434	92	1097	98	0.006	0.003	0.888	0.012	7	2.16	HI	37
	-299	84	4591	132	859	119	0.005	0.005	0.891	0.030	25	3.48	Met	184, 256
207260	430	32	597	36	268	54	0.975	0.013	0.941	0.022	152	5.52	all	136, 194, 325
343872	1777	73	1904	102	917	104	0.979	0.009	0.829	0.017	12	2.38	Met	329

Table 4. Cross-reference list.

1	Babcock (1958)
2	Borra & Landstreet (1980)
4	Babcock (1954)
5	Babcock (1960)
7	Preston (1967b)
8	Preston & Stepień (1968a)
10	Conti (1969)
11	Preston et al. (1969)
14	Preston (1969)
15	Wolff (1969a)
16	Wolff (1969b)
18	Preston (1970)
19	Preston & Wolff (1970)
20	Conti (1970a)
21	Preston (1972)
22	Wolff & Bonsack (1972)
23	Wolff & Wolff (1972)
24	Borra & Landstreet (1979)
25	Landstreet et al. (1975)
26	Wolff (1975)
27	Borra & Vaughan (1978)
28	Landstreet & Borra (1978)
29	Jones et al. (1974)
30	Borra & Landstreet (1978)
31	Vogt et al. (1980)
32	Bonsack (1976)
33	Borra & Landstreet (1977)
35	Preston & Stepień (1968b)
37	Borra et al. (1983)
40	Glagolevskij & Chunakova (1985)
41	Glagolevskij et al. (1985a)
42	Rakos et al. (1977)
44	Huchra (1972)
46	Bonsack & Pilachowski (1974)
47	Brown & Landstreet (1981)
48	Scholz (1979)
49	Scholz (1971b)
53	Sargent et al. (1967)
55	Conti (1970b)
60	Landstreet & Borra (1977)
61	Boesgaard (1974)
62	Bonsack et al. (1974)
63	Borra & Vaughan (1977)
69	Kemp & Wolstencroft (1973)
71	Wolff (1973)
72	Slovak (1982)
74	Angel et al. (1973)
75	Borra (1975b)
76	Borra et al. (1981)
77	Landstreet (1982)
81	Borra & Landstreet (1975)
83	Wolff & Preston (1978)
86	Jones & Wolff (1974)
87	Bonsack (1981a)
89	Landstreet et al. (1979)

Table 4. continued.

91	Heuvel & van den (1971)
92	Pilachowski et al. (1974)
93	Wood & Campusano (1975)
94	Bonsack (1977)
96	Rudy & Kemp (1978)
97	Kuvshinov (1972)
98	Kuvshinov et al. (1976)
105	Scholz (1975)
108	Hildebrandt et al. (1973)
111	Gollnow (1964)
118	Rustamov & Khotnyanskij (1980)
120	Gollnow (1971)
121	Maitzen et al. (1980)
126	Wolstencroft et al. (1981)
135	Bohlender et al. (1987)
136	Scholz & Gerth (1980)
137	Rudiger & Scholz (1988)
140	Glagolevskij et al. (1989)
142	Glagolevskij et al. (1982)
146	Zverko et al. (1989)
147	Mikulasek et al. (1984)
153	Romanov et al. (1988)
159	Ryabchikova et al. (1988)
168	Thompson et al. (1987)
171	Bohlender (1989)
172	Landstreet (1990)
174	Thompson & Landstreet (1985)
175	Renson (1984)
176	Wolff & Morrison (1974)
178	Gerth (1990a)
179	Ziznovsky & Romanyuk (1990)
181	Shore et al. (1990)
182	Bohlender & Landstreet (1990a)
184	Mathys (1991)
186	Thompson (1983)
187	Albrecht et al. (1977)
189	Plachinda (1990)
190	Weiss et al. (1990)
191	Skulskij (1990)
194	Gerth et al. (1991a)
195	Bychkov et al. (1991)
197	El'kin et al. (1991)
201	Borra (1994)
204	Landstreet (2000)
208	Scholz (1983)
209	Scholz (1978)
215	Shtol' et al. (1992a)
219	Gerth et al. (1992a)
220	Bychkov et al. (1992)
224	El'kin (1992)
227	Skulskij et al. (1992a)
229	Skulskij et al. (1992b)
230	Bohlender et al. (1993)
237	Plachinda et al. (1993)
239	Johnstone & Penston (1987)

Table 4. continued.

243	Glagolevskij et al. (1995)
252	Brown et al. (1985)
255	Wade et al. (1996)
256	Mathys & Hubrig (1997)
260	Bychkov et al. (1997a)
267	Bychkov et al. (1997b)
268	Bychkov & Shtol' (1997)
270	Bychkov et al. (1997c)
271	El'kin et al. (1997)
273	Weiss (1986)
286	Glagolevskij & Chuntunov (1998)
290	Gerth (1994)
299	Borra et al. (1984)
310	Wade et al. (2000a)
311	Plachinda & Tarasova (2000b)
312	Wade et al. (2000b)
324	Leone & Catanzaro (2001)
325	Verdugo et al. (2002)
326	El'kin (2000)
327	Bychkov & Bychkova (2002)
329	Elkin et al. (2002)
330	Chuntunov (2001)
333	Shorlin et al. (2002)
334	Monin et al. (2002)
342	Skulskij (1982)
343	Skulskij (1985)
344	Skulskij & Plachinda (1993)
348	Kudryavtsev et al. (2000)
350	Panchuk et al. (2000)
354	Tarasova et al. (2001)
360	Neiner et al. (2003)

Table 5. Periods of magnetic stars.

HD	<i>P</i> (days)	Reference
2453	520.5	This paper
3360	5.370447	Ref. 360
3980	3.9516	Maitzen et al. (1980)
4778	2.5616	Bohlender (1989)
5737	21.654	Ref. 181
8441	1.80889	This paper
9996*	7692.	This paper
10783	4.14628	This paper, it is close to Genderen (1964)
11503	1.6093	Borra & Landstreet (1980)
12288	34.79	Ref. 312
12447	1.49070	Ref. 2
12767	1.892	Ref. 137
14437	28.87	This paper
15144	15.88	Bonsack (1981b)
16582	1.40744	This paper
18296	2.8842	Preston (1969c)
19832	0.727893	Stępień & Czechowski (1993)
21699	2.4765	Brown et al. (1985)
22470	0.6785	Ref. 37
24155	2.53465	Ref. 230
24712	12.4617	This paper, it is close to Bagnulo et al. (1995)
25267	5.954	Ref. 2
25354	3.90072	Schoneich et al. (1976)
25823	4.65853	This paper
27309	1.10496	North & Adelman (1995)
27962	2.13006	This paper
28843	1.373813	Mathys et al. (1986)
30466	1.3900	Rakosch & Fiedler (1978)
32633*	6.43000	Renson (1972)
34452	2.4687	Bohlender et al. (1993)
35298	1.85336	North (1984)
35456	0.28313	This paper
35502	1.707	Borra (1981)
35912	0.89786	This paper
36313	0.58931	This paper
36485	2.0129	This paper
36526	1.5405	North (1984)
36629	5.01255	This paper
36668	2.1211	North (1984)
37017	0.901175	Borra & Landstreet (1979)
37022	15.422	Stahl et al. (1996)
37041	3.14264	This paper
37058	1.022	This paper
37140	2.7088	North (1984)
37151	5.6732	North (1984)
37210	11.0494	North (1984)
37479	1.190811	Shore & Brown (1990)
37642	1.07977	North (1984)
37776*	1.538675	Shore & Brown (1990)

Table 5. continued.

HD	<i>P</i> (days)	Reference
40312*	3.61866	Ref. 2
45348	6.90	Weiss (1986)
49333	2.18010	Bohlender et al. (1993)
49606	1.10503	This paper
49976	2.97668	Catalano & Leone (1994)
51418	5.631	This paper
54118	3.27533	Bohlender et al. (1993)
55719	1.00335	This paper
58260	1.657	Pedersen (1979)
62140*	4.28488	This paper, it is close to Leroy (1995)
64740	1.33026	Shore & Brown (1990)
65339*	8.0267	Musielok & Madej (1988)
71866	6.80024	Bagnulo et al. (1995)
72968	4.66458	This paper, it is close to Steinitz & Pyper (1970)
73340	2.66753	Bohlender et al. (1993)
74521	7.76851	Catalano & Leone (1993)
77350	4.024	Kozlova et al. (1975)
78316	5.0035	Ref. 11
79158	3.8345	This paper, it is close to Bohlender (1994)
83368	2.851962	Mathys (1991)
89822	7.5586	Catalano & Leone (1991)
90044	4.379	Ref. 324
90569	1.445	Wolff & Morrison (1975)
92664	1.67315	Bohlender et al. (1993)
96446	0.85521	This paper, it is close to Mathews & Bohlender (1991)
96707	2.49183	This paper
98088	5.81714	This paper, it is close to Catalano & Leone (1994)
103192	2.344	Manfroid & Renson (1980)
108662	5.0805	Rice & Wehlau (1994)
108945	1.92442	This paper, it is close to Zverko (1987)
110379	12.92696	This paper
111133	16.3078	North & Adelman (1995)
112185	5.0887	Bohlender & Landstreet (1990)
112381	2.84	Bohlender et al. (1993)
112413	5.46939	Borra & Vaughan (1978)
116458	2.3596	This paper
118022	3.722084	Catalano & Leone (1994)
119213	2.44997	Pyper & Adelman (1985)
119419	2.6006	Bohlender et al. (1993)
122532	3.68137	This paper, it is close to Bohlender et al. (1993)
124224	0.520675	Borra & Landstreet (1980)
125248	9.2954	Mathys (1994)
125823	8.8171	Pedersen & Thomsen (1977)
126515	129.95	Mathys et al. (1986)
128898	4.4794	This paper, it is close to Kurtz et al. (1994)
131156	6.314	Plachinda et al. (2000)
133029	2.105	This paper
133652	2.3040	Lanz et al. (1991)
133880	0.877485	Landstreet (1990)
134793	2.7800	Blanco et al. (1978)
137509	4.4912	Lanz et al. (1991)
137909	18.4868	Leroy (1995)

Table 5. continued.

HD	<i>P</i> (days)	Reference
137949	11.13313	This paper
140160	1.59584	Musielok et al. (1980)
142301	1.45955	Landstreet et al. (1979)
142990	0.9791	Catalano & Leone (1996)
143473	2.84263	This paper
144334	1.49497	North (1987)
147010	3.920676	Catalano & Leone (1993)
148112	3.04296	Hatzes (1991)
148199	7.72553	Bohlender et al. (1993)
148330	4.288404	Ziznovsy & Romanyuk (1990)
151965	1.60841	Lanz & Mathys (1991b)
152107	3.86778	This paper, it is close to Gerth (1990b)
153882	6.00858	This paper, it is close to Mathys (1991)
164258	0.86281	This paper, it is close to Catalano & Leone (1994)
168733	14.78437	This paper, it is close to Jones & Wolff (1974)
170000	1.71649	Musielok & Madej (1988)
170397	2.25454	This paper, it is close to Borra & Landstreet (1980)
170973	18.52	This paper, it is close to Bohlender et al. (1993)
173650	9.9754	Hildebrandt et al. (1985)
174638	12.935	Skulskij (1982)
175362	3.67375	Catalano & Leone (1996)
187474	2342.	This paper, it is close to Hensberge (1993)
188041	223.826	This paper, it is close to Hensberge (1993)
189849	6.88449	This paper
192678	12.91049	This paper
194093	1.03474	Plachinda (1990)
196178	1.91645	This paper
196502	20.2747	Panov (1976)
201091	36.59	Tarasova et al. (2001)
201601	27027.	This paper
207260	1688.9	This paper
215441	10180.	Leckrone (1974)
	9.4871	This paper

Appendix A: Magnetic rotational phase curves

The Appendix presents the catalogue of magnetic rotational phase curves $B_e(\phi)$ for 136 stars in graphical form. All phase curves were expressed in a homogeneous manner, with the effective magnetic field B_e (in G) vs. magnetic phase ϕ . Note that in some cases several phase curves correspond to the same star. This occurs in cases when different observational techniques produced significantly different series of B_e values.

Fig. A.1. HD 2453. Ap star with long period, which is not well determined. Values of P_{rot} range from 521^{d} up to 547^{d} in various papers. We have found the best period $P_{\text{rot}} = 520.5^{\text{d}}$. Open circles – Ref. 1 of our list, filled circles – Ref. 26, filled squares – Ref. 256.

Fig. A.2. HD 3360. Magnetic field B_e was measured in metal lines in Ref. 360, and in hydrogen lines – Ref. 77. Single B_e measurement in Ref. 77 was not used to construct phase curve, due to its low accuracy. Phase curve $B_e(\phi)$ was drawn following Ref. 360.

Fig. A.3. HD 3980. The best period is $P_{\text{mag}} = 3.9516^{\text{d}}$, which was taken from Maitzen et al. (1980).

Fig. A.4. HD 4778. We used the period $P = 2.5616^{\text{d}}$ taken from Bohlender (1989). Measurements of B_e were done in H lines, Ref. 171.

Fig. A.5. HD 5737. Period $P = 21.654^{\text{d}}$ was taken from Ref. 181. Open circles – Ref. 37, filled circles – Ref. 181, filled squares – Ref. 256.

Fig. A.6. HD 8441. We used the compilation of published B_e estimates for the determination of the new period, $P = 1.80889^{\text{d}}$. Further B_e observations are necessary to improve this period. Open circles – Ref. 1, filled circles – Ref. 327.

Fig. A.7. HD 9996. We determined the period $P_{\text{mag}} = 7692^{\text{d}}$. Phase curve $B_e(\phi)$ is complex and was approximated here by a double wave. More homogeneous B_e points are necessary for the unique determination of the phase curve. Open circles – Ref. 1, filled circles – Refs. 1, 19, 208, 209 (phot. method); open squares – Ref. 270 (H lines), open circles – Ref. 327.

Fig. A.8. HD 10783. We determined $P_{\text{mag}} = 4.14628^{\text{d}}$. It is close to the period $P_{\text{mag}} = 4.1565^{\text{d}}$ taken from van Genderen (1964). Open circles – Ref. 1, filled circles – Ref. 35.

Fig. A.9. HD 11503. We used the period $P = 1.190811^{\text{d}}$ taken from Borra & Landstreet (1980). We plotted here B_e observations from Ref. 2 only. B_e observations from Ref. 25 were not used, because apparently they are of very low accuracy.

Fig. A.10. HD 12288. The period $P_{\text{mag}} = 34.79^{\text{d}}$ of Ref. 312 was used. Open circles – B_e measurements from H lines, filled circles – B_e from metal lines.

Fig. A.11. HD 12447. We used the period $P_{\text{mag}} = 1.49070^{\text{d}}$ for plotting B_e data, which were taken from Ref. 2. Data from Ref. 25 were not used because they are of very low accuracy.

Fig. A.12. HD 12767. We used the period $P = 1.892^{\text{d}}$ taken from Ref. 137. Phase curve $B_e(\phi)$ is derived from sparse data, and requires additional observations in phases 0.5–0.9.

Fig. A.13. HD 14437. Open circles – B_e from Ref. 312 (phot. method), filled circles – data from H lines, Ref. 312, filled squares – metal lines & CCD, Ref. 312. Additional B_e observations are necessary, because P_{mag} is not well determined. Our best period is $P_{\text{mag}} = 13.37^{\text{d}}$.

Fig. A.16. HD 18296. We used the period $P_{\text{mag}} = 2.88422^{\text{d}}$ after Preston (1969b). B_e points were measured in hydrogen lines. Open circles – Ref. 2, filled circles – Ref. 197, filled squares – Ref. 243.

Fig. A.14. HD 15144. New high precision B_e data are necessary, since the rotational period $P_{\text{rot}} = 2.9978724^{\text{d}}$ taken from van Genderen (1971) differs from the magnetic period $P_{\text{mag}} = 15.88^{\text{d}}$ (Bonsack 1981b). Open circles – phot. method, Ref. 1, filled circles – Ref. 87.

Fig. A.15. HD 16582 is δ Cep is a pulsating variable star of the β Cep class, with the pulsation period $P_{\text{puls}} = 0.16113668^{\text{d}}$ (Mohan 1981). We determined the magnetic period $P_{\text{mag}} = 1.40744^{\text{d}}$, which perhaps can be identified with the rotational period of this star. Open circles – phot. method, Refs. 77, 96; filled circles – Ref. 327.

Fig. A.17. HD 18296. B_e measurements were obtained from metal lines. Open circles – Ref. 1, filled circles – Ref. 14, filled squares – Ref. 327. We used the period $P_{\text{mag}} = 2.88422^{\text{d}}$ after Preston (1969b).

Fig. A.18. HD 19832. We used B_e estimates from Ref. 2, and the period $P_{\text{mag}} = 0.727893^{\text{d}}$ taken from Stępień & Czechowski (1993).

Fig. A.19. HD 21699. Magnetic B_e curve is fitted only to H line measurements, Ref. 252. We did not use low precision B_e points from metal lines, Ref. 40. Open circles – Ref. 252, filled circles – Ref. 40. We used the period $P_{\text{mag}} = 2.4765^{\text{d}}$ taken from Brown et al. (1985).

Fig. A.20. HD 22470. We used the period $P_{\text{mag}} = 0.6785^{\text{d}}$ taken from Borra et al. (1983), Ref. 37. Open circles – Ref. 37, filled circles – Ref. 25. This star needs additional observations for the unique period determination. Actually the value of $P_{\text{mag}} = 1.9387^{\text{d}}$, taken from Adelman & Boyce (1995) is still very tentative.

Fig. A.21. HD 24155. We used the period $P_{\text{mag}} = 2.53465^{\text{d}}$, taken from Ref. 230. This star requires additional observations, because the number of points is small. The actual B_e phase curve has been fitted to 6 points only.

Fig. A.22. HD 24712. Our period $P_{\text{mag}} = 12.4617^{\text{d}}$ fits well B_e measurements, and it is located inside the error box of the period $P_{\text{mag}} = 12.4610 \pm 0.0011^{\text{d}}$ by Bagnulo et al. (1995). Open circles – Refs. 21, 111, 120 (metal lines, phot. measurements); filled circles – Refs. 184, 256 (metal lines), open squares – Ref. 310 (LSD method); filled squares – Refs. 195, 327 (H line).

Fig. A.23. HD 25267. Period $P_{\text{mag}} = 5.954^{\text{d}}$ was adapted from Ref. 2. This star requires additional B_e observations for more exact period and magnetic curve determination.

Fig. A.24. HD 25354. We used the period $P_{\text{mag}} = 3.90072^{\text{d}}$, taken from Schoneich et al. (1976). Magnetic phase curve was derived from 5 B_e points only. Additional B_e observations are necessary.

Fig. A.25. HD 25823. We used our magnetic period $P_{\text{mag}} = 4.65853^{\text{d}}$. This period is shorter than the photometric period $P_{\text{phot}} = 7.227424^{\text{d}}$ (it is either rotational or orbital period) from Musielok & Madej (1988). Open circles – Ref. 1, filled circles – Ref. 71.

Fig. A.28. HD 28843. We used the period $P_{\text{mag}} = 1.373813^{\text{d}}$ taken from Mathys et al. (1986). Magnetic rotational phase curve was formally derived from 5 points only. New B_e observations are necessary.

Fig. A.26. HD 27309. We used our magnetic period $P_{\text{mag}} = 1.10496^{\text{d}}$. Photometric period $P_{\text{phot}} = 1.5688840^{\text{d}}$ from North & Adelman (1995) apparently does not correspond to the magnetic observations. Additional B_e observations are necessary for the improvement of P_{mag} . Open circles – Refs. 2, 41 (H lines); filled circles – Ref. 142 (metal lines).

Fig. A.29. HD 30466. The most probable magnetic period $P_{\text{mag}} = 1.3900^{\text{d}}$ was taken from Rakosch & Fiedler (1978). The number of B_e points is low. New high precision measurements are necessary. Open circles – Ref. 1, filled circles – Ref. 142, open squares – Ref. 327.

Fig. A.27. HD 27962. No credible photometric period is available. We determined the most probable magnetic period, $P_{\text{mag}} = 2.13^{\text{d}}$. Open circles – Ref. 1, filled circles – Ref. 98, open squares – Ref. 77.

Fig. A.30. HD 32633. We used here the period $P = 6.4300^d$, taken from Renson (1972), and obtained complex double wave magnetic rotational phase curve. This figure displays all the available B_e data. Open circles – Refs. 1, 8, 175, 327 (phot. method), filled circles – Refs. 184, 310 (LSD), open squares – Ref. 2 (H lines). Phase curves obtained by various methods significantly differ, see two following figures.

Fig. A.31. HD 32633. We applied the period $P = 6.4300^d$, taken from Renson (1972). This phase curve was obtained from high accuracy LSD measurements. There exists only one B_e point around $\phi \approx 0.5$, and the new data would be very important to determine the phase curve. Open circles – Ref. 310 (LSD method), filled circles – Ref. 184.

Fig. A.32. HD 32633. We used the period $P_{\text{mag}} = 6.4300^d$, taken from Renson (1972). This is the magnetic rotational phase curve derived from B_e points measured in H lines – Ref. 2.

Fig. A.33. HD 34452. Bohlender et al. (1993), Ref. 230, determined the period $P_{\text{mag}} = 2.466264^d$. However, we propose that the best period is $P_{\text{mag}} = 2.4687^d$, and used it to plot this figure. The rotational phase curve does not include photographic B_e observations from Ref. 41. Open circles – Ref. 2, filled circles – Ref. 230.

Fig. A.34. HD 35298. Good photometric period $P_{\text{phot}} = 1.85336^d$ was taken from North (1984). Number of B_e observations is rather small. Magnetic field B_e (Ref. 201) is strong and is highly variable with the rotational phase, but the accurate phase curve determination requires more B_e observations.

Fig. A.35. HD 35456. The best our magnetic period $P_{\text{mag}} = 0.28313^{\text{d}}$. Such an ultrashort period results from B_e data in Ref. 201. (In Ref. 201 one can see that B_e changed by 3074 G in 0.086 days.) More B_e observations are necessary for the reliable P_{mag} and $B_e(\phi)$ determinations. Open circles – Ref. 201 (H line), filled circles – Ref. 327 (phot. method).

Fig. A.36. HD 35502. We used the period $P = 1.707^{\text{d}}$, taken from Borra (1981). More B_e observations are necessary to obtain a complete phase curve. H line B_e points are from Ref. 201.

Fig. A.37. HD 35912. We have determined the probable period of magnetic variability, $P_{\text{mag}} = 0.89786^{\text{d}}$, using the available observations of B_e . New magnetic observations are necessary to improve the phase curve. Open circles – Ref. 55, filled circles – Ref. 327.

Fig. A.38. HD 36313. We determined the best magnetic period $P_{\text{mag}} = 0.77677^{\text{d}}$. Phase curve $B_e(\phi)$ should be improved by additional B_e points. Magnetic observations were taken from Ref. 201 (H lines).

Fig. A.39. HD 36485. We determined the probable period of the magnetic variability, $P_{\text{mag}} = 2.0129^{\text{d}}$. Additional B_e measurements are required to improve the phase curve $B_e(\phi)$. Values of B_e obtained by different methods probably exhibit large systematic differences. Open circles – Ref. 55 (H line), filled circles – Ref. 256 (met. lines).

Fig. A.40. HD 36526. We used the period $P = 1.5405^{\text{d}}$, taken from North (1984). Magnetic field of the star is strong and its longitudinal component is highly variable with the rotational phase. More B_e observations are necessary to obtain a complete phase curve.

Fig. A.41. HD 36629. We determined the most probable magnetic period, $P_{\text{mag}} = 5.01255^{\text{d}}$. The number of available B_e observations is small and of low accuracy. Also here magnetic field is strong and its $B_e(\phi)$ exhibits large amplitude. Additional B_e observations are necessary to improve the magnetic rotational phase curve. Open circles – Ref. 55, filled circles – Ref. 53 (metal lines, and phot. method were used in both papers).

Fig. A.42. HD 36668. We used the period $P_{\text{mag}} = 2.1211^{\text{d}}$, taken from North (1984). The number of B_e observations is small. The magnetic field of this star is strong. We need more points to obtain a satisfactory $B_e(\phi)$ phase curve.

Fig. A.43. HD 37017. We used the period $P_{\text{mag}} = 0.901175^{\text{d}}$, taken from Borra & Landstreet (1979), Ref. 24. Open circles – Ref. 135 (H lines), filled circles – Ref. 24 (H lines), open squares – Ref. 135 (He 5867 line).

Fig. A.44. HD 37022. Ae/Be star with the rotation period $P_{\text{rot}} = 15.422^{\text{d}}$ taken from Stahl et al. (1996). Filled squares – Ref. 286, open circles – Ref. 348 (absorption line CIV 5801), filled circles – Ref. 348 (abs. line CIV 5812), open squares – Ref. 348 (abs. line HeI 4713), open triangles – Ref. 348 (abs. line HeI 4541).

Fig. A.45. HD 37041. We determined the most probable period of magnetic variability, $P_{\text{mag}} = 3.14269^{\text{d}}$. Only few B_e points are available, additional observations are necessary for the reliable P_{mag} determination. Open circles – Ref. 69 (H lines), filled circles – Ref. 75 (He 6678 line).

Fig. A.46. HD 37058. We determined and used here the best magnetic period $P_{\text{mag}} = 1.022^{\text{d}}$, and this value disagrees with the period frequently quoted earlier, equal to 14.612^{d} , see Ref. 256. Magnetic points B_e are sparse. Open circles – Ref. 37 (H line), filled circles – Refs. 53, 55 (metal lines, phot. method), open squares – Ref. 256 (metal lines).

Fig. A.48. HD 37151. Photometric period $P_{\text{phot}} = 5.6732^{\text{d}}$ (North 1984) seems the best for the definition of the rotational magnetic phase curve. Number of available B_e points is very low, and new magnetic measurements are necessary. Open circles – Ref. 201 (H line), filled circles – Ref. 204 (H line).

Fig. A.47. HD 37140. We used the period $P_{\text{mag}} = 2.7088^{\text{d}}$, taken from North (1984). The number of existing B_e points is very small. We need more magnetic observations of this star. Open circles – Ref. 201 (H lines).

Fig. A.49. HD 37210. We used the photometric period $P_{\text{phot}} = 11.0494^{\text{d}}$, taken from North (1984). Only few B_e points are available, new magnetic observations are necessary to obtain better phase curve. Open circles – Ref. 201 (H lines).

Fig. A.50. HD 37479. We used the period $P_{\text{mag}} = 1.190811^{\text{d}}$, taken from Shore & Brown (1990). Open circles – Ref. 28 (B_e from H lines), filled circles – Ref. 135 (H lines), open squares – Ref. 135 (HeI 5876 line)

Fig. A.51. HD 37642. We used the period $P_{\text{mag}} = 1.07977^{\text{d}}$, taken from North (1984). Very few B_e points are available. Longitudinal magnetic field is strong and exhibits strong variability, but more observations are necessary to obtain the magnetic rotational phase curve and the P_{mag} .

Fig. A.54. HD 40312. As above, we applied the period $P_{\text{mag}} = 3.61866^{\text{d}}$ determined for B_e points in Refs. 2 and 310. Magnetic data of high accuracy in Ref. 310 (metal lines) reveal deviations from sine wave near $\phi = 0.5$. Therefore the $B_e(\phi)$ phase curve was fitted here by a double wave. Filled circles – Ref. 310 (metal lines, LSD method).

Fig. A.52. HD 37776. We used the period $P = 1.538675^{\text{d}}$, taken from Shore & Brown (1990). The phase curve has a very complicated form. The averaged curve was constructed only with B_e points measured in H_β line. These measurements were taken from Ref. 174.

Fig. A.55. HD 45348. We used the period $P_{\text{mag}} = 6.90^{\text{d}}$, taken from Weiss (1986). The amplitude of B_e variations is low. New magnetic observations of high accuracy are necessary here, in particular for the precise determination of the period P_{mag} . Filled circles – Ref. 42, open circles – Ref. 273 (metal lines, phot. method).

Fig. A.53. HD 40312. The above phase curve was computed with the improved magnetic period $P_{\text{mag}} = 3.61866^{\text{d}}$. We determined P_{mag} from B_e measurements in Refs. 2 and 310. Open circles – Ref. 2 (H lines), filled circles – Ref. 310 (metal lines, LSD method).

Fig. A.56. HD 49333. Magnetic field B_e was investigated in Refs. 37, and 230 from hydrogen lines. We used the period $P_{\text{mag}} = 2.18010^{\text{d}}$, taken from Bohlender et al. (1993), Ref. 230. Measurements are scarce, new additional B_e observations are necessary.

Fig. A.59. HD 51418. Behavior of B_e vs. phase ϕ was studied in Ref. 29 using the photographic technique. Musielok & Madej (1988) determined the period $P_{\text{mag}} = 5.4379^{\text{d}}$, however, we adapted the magnetic period $P_{\text{mag}} = 5.631^{\text{d}}$. New measurements of high precision are necessary to improve the period and the phase curve.

Fig. A.57. HD 49606. We determined the best magnetic period, $P_{\text{mag}} = 1.10503^{\text{d}}$. The available B_e points are scarce, and new observations are necessary to obtain more exact phase curve. Open circles – Refs. 230, 267 (H lines), filled circles – Ref. 330 (metal lines, LSD method).

Fig. A.60. HD 54118. We used the magnetic period $P_{\text{mag}} = 5.631^{\text{d}}$ taken from Bohlender et al. (1993). Open circles – Ref. 81 (H_{β}), filled circles – Ref. 230 (H_{α}).

Fig. A.58. HD 49976. We used the period $P = 2.18010^{\text{d}}$, taken from Catalano & Leone (1994). Magnetic variability of this star was investigated in Ref. 92. Open circles – Ref. 92, filled circles – Ref. 184, filled squares – Ref. 91.

Fig. A.61. HD 55719. Bonsack (1976), Ref. 32, claims that the best magnetic rotational P_{mag} is in the range $30.39^{\text{d}} - 36.48^{\text{d}}$. We determined and used here the other, more credible value $P_{\text{mag}} = 1.00335^{\text{d}}$. Open circles – Ref. 32, filled circles – Ref. 256, filled squares – Ref. 93.

Fig. A.62. HD 58260. We used the period $P = 1.657^d$, taken from Pedersen (1979). Magnetic variability of this star was measured in hydrogen lines. The star has strong positive B_e field with moderate amplitude of variations. Open circles – Ref. 24, filled circles – Ref. 135.

Fig. A.65. HD 64740. We used the period $P_{\text{mag}} = 1.657^d$, taken from Shore & Brown (1990). Open circles – Ref. 24 (H_β line), filled circles – Ref. 135 (H_β), filled squares – Ref. 135 (He I 5876).

Fig. A.63. HD 62140. The best magnetic period $P_{\text{mag}} = 4.28488^d$. It is close to the period $P_{\text{mag}} = 4.2867^d$ obtained by Leroy (1995). The figure displays all the available B_e observations. Open circles – Ref. 62, filled squares – Ref. 91, filled circles – Ref. 310. Points of high accuracy exhibit systematic deviations from the phase curve around $\phi = 0.5$.

Fig. A.66. HD 65339 = 53 Cam. We used the period $P_{\text{mag}} = 8.0267^d$, taken from Musielok & Madej (1988). The figure presents the most accurate B_e measurements obtained in Ref. 310 from metal lines with the LSD method. We note systematic deviation of phase curve from a simple sine wave near $\phi \approx 0.5$. Therefore, we fitted $B_e(\phi)$ phase curve by a double wave.

Fig. A.64. HD 62140. Magnetic period $P_{\text{mag}} = 4.28488^d$. Figure displays magnetic B_e points of high accuracy from Ref. 310. The phase curve is described by double wave.

Fig. A.67. HD 65339 = 53 Cam. The period $P_{\text{mag}} = 8.0267^{\text{d}}$ was used here. Phase curve $B_e(\phi)$ was derived from hydrogen line measurements. We did not find any significant deviations from a sine wave. This is most likely due to lower accuracy of B_e points, than in the previous figure. Open circles – Ref. 24 (H_β), filled circles – Ref. 135 (H_β), filled squares – Ref. 135.

Fig. A.68. HD 71866. The best magnetic period $P_{\text{mag}} = 6.80024^{\text{d}}$ was used here. It is close to the period $P_{\text{mag}} = 6.80022^{\text{d}}$, taken from Bagnulo et al. (1995). We plot here only the most accurate LSD points from Ref. 310.

Fig. A.69. HD 72968. We used the best magnetic period $P_{\text{mag}} = 4.66458^{\text{d}}$, which is close to the period $P_{\text{mag}} = 4.606^{\text{d}}$ by Steinitz & Pyper (1970). Magnetic field measurements which were obtained by photographic method – Refs. 1 and 91, are not accurate enough. More B_e points of high precision are necessary to define a more accurate magnetic phase curve. Open circles – Ref. 1, filled circles – Ref. 327, open squares – Ref. 91.

Fig. A.70. HD 73340. We used the period $P_{\text{mag}} = 2.66753^{\text{d}}$, taken from Bohlender et al. (1993). The number of B_e points is low, additional observations are necessary.

Fig. A.71. HD 74521. We used the photometric period $P_{\text{phot}} = 7.76851^{\text{d}}$, (Catalano & Leone 1993). Magnetic field B_e and the amplitude of its variations are small, and the photographic B_e points of low accuracy were not used here (Ref. 1). Open circles – Ref. 230, filled circles – Ref. 184, open squares – Ref. 327, filled squares – Ref. 333.

Fig. A.74. HD 79158. We used the best magnetic period $P_{\text{mag}} = 3.8345^{\text{d}}$, which is close to the photometric period $P_{\text{phot}} = 3.83483^{\text{d}}$, taken from Bohlender (1994). Magnetic field B_e measurements were obtained from H_{β} line. Open circles – Ref. 181, filled circles – Ref. 37, filled squares – Ref. 327.

Fig. A.72. HD 77350. We used the period $P_{\text{mag}} = 4.024^{\text{d}}$, it is close to the photometric period $P_{\text{phot}} = 4.191^{\text{d}}$ (Kozlova et al. 1975). Magnetic field B_e and the amplitude of its variations are small, therefore, we did not use photographic B_e points of low accuracy (Ref. 1). Open circles – Ref. 327, filled circles – Ref. 230, filled squares – Ref. 333.

Fig. A.75. HD 83368. We used the period $P_{\text{mag}} = 2.851962^{\text{d}}$, taken from Mathys (1991). Behavior of B_e in this star was investigated by various methods. Open circles – Ref. 184 (metal lines), filled circles – Ref. 256 (metal lines), open squares – Ref. 186 (H_{β} line).

Fig. A.73. HD 78316. The period $P_{\text{mag}} = 5.0035^{\text{d}}$ was adapted from Ref. 11. Open circles – Ref. 1, filled circles – Ref. 11, open squares – Ref. 333, filled squares – Ref. 330.

Fig. A.76. HD 89822. We used the period $P_{\text{mag}} = 7.5586^{\text{d}}$, taken from Catalano & Leone (1991). The star is a spectroscopic binary. Magnetic properties were investigated with various methods. Measurements from Ref. 109 were not used due to low accuracy. Open circles – Refs. 2, 230 (H lines), filled circles – Ref. 1 (metal lines, phot. method), open squares – Ref. 20 (metal line, only for primary star), filled squares – Refs. 237, 330 (metal lines, CCD images).

Fig. A.77. HD 90044. The period $P_{\text{mag}} = 4.379^{\text{d}}$ was adapted from Ref. 324. Open circles – Ref. 324 (metal lines), filled circles – Ref. 230 (H lines).

Fig. A.78. HD 90569. We used the period $P_{\text{mag}} = 1.445^{\text{d}}$, taken from Wolff & Morrison (1975). Determinations of B_e are scarce, existing data suggest that the longitudinal magnetic field does not vary significantly. New high accuracy magnetic field data are necessary to improve parameters of the magnetic variability.

Fig. A.79. HD 92664. We used the period $P_{\text{mag}} = 1.67315^{\text{d}}$, taken from Bohlender et al. (1993). Magnetic field B_e was measured in hydrogen lines – Refs. 81 and 230. The value of B_e from Ref. 81 was not used here due to low accuracy.

Fig. A.80. HD 96446. We determined and applied here the period $P_{\text{mag}} = 0.85521^{\text{d}}$. It is close to the period $P_{\text{mag}} = 0.85137^{\text{d}}$, given by Mathews & Bohlender (1991). Measurements of B_e in hydrogen lines yield systematically larger values than those in metal lines. Open circles – Ref. 184 (metal lines), filled circles – Ref. 24 (H lines).

Fig. A.81. HD 96707. The present magnetic period $P_{\text{mag}} = 2.49183^{\text{d}}$. It is close to the previous period $P_{\text{mag}} = 2.55305^{\text{d}}$, taken from Bychkov et al. (1997a), Ref. 260. Additional high accuracy magnetic observations are necessary to improve phase curve $B_e(\phi)$. Averaged curve was plotted without B_e points from Ref. 91, which are of low accuracy. Open circles – Ref. 324 (metal lines), filled circles – Ref. 260 (metal lines), filled squares – Ref. 260 (H lines).

Fig. A.82. HD 98088. We determined and used here the magnetic period $P_{\text{mag}} = 5.81714^{\text{d}}$. It is nearly equal to the period $P = 5.905130^{\text{d}}$, taken from Catalano & Leone (1994). Additional high precision B_e observations are necessary to improve parameters of the magnetic variability. Open circles – Refs. 1, 108 (metal lines, phot. method), filled circles – Ref. 310 (metal lines, LSD method).

Fig. A.83. HD 103192. We used the period $P_{\text{mag}} = 2.344^{\text{d}}$, taken from Manfroid & Renson (1980). More B_e observations are necessary to improve parameters of the magnetic variability. Open circles – Ref. 230 (H lines), filled circles – Ref. 2 (H lines).

Fig. A.84. HD 108662. We used the period $P_{\text{mag}} = 5.0805^{\text{d}}$, taken from Rice & Wehlau (1994). Magnetic field B_e was observed essentially with photographic method, there exists only the single measurement made with the LSD method. More B_e measurements of high precision are necessary to obtain more accurate parameters of magnetic variability. Open circles – Ref. 118, filled circles – Ref. 1, open squares – Ref. 11, filled squares – Ref. 333.

Fig. A.85. HD 108945. We determined and used here the most probable magnetic period $P_{\text{mag}} = 1.92442^{\text{d}}$. It is close to the period $P_{\text{mag}} = 1.83736^{\text{d}}$, taken from Zverko (1987). New high accuracy magnetic field data are necessary to determine parameters of $B_e(\phi)$. Open circles – Ref. 327 (H lines), filled circles – Ref. 2 (H lines), filled squares – Ref. 333 (metal lines, LSD method).

Fig. A.87. HD 111133. We used the period $P_{\text{mag}} = 16.3078^{\text{d}}$, taken from North & Adelman (1995). Magnetic behavior of this star was investigated with photographic methods only. Additional B_e measurements of high precision are necessary to improve parameters of magnetic variability. Open circles – Ref. 23, filled circles – Ref. 142, open squares – Ref. 1.

Fig. A.86. HD 110379. We determined the most probable period of magnetic variability $P_{\text{mag}} = 12.92696^{\text{d}}$. Additional high precision B_e observations are necessary to determine precisely $B_e(\phi)$. Open circles – Refs. 1, 61 (metal lines, phot. method), filled circles – Ref. 77 (H lines), filled squares – Ref. 333 (metal lines, LSD method), open squares – Ref. 327 (metal lines).

Fig. A.88. HD 112185. We used the period $P_{\text{mag}} = 5.0887^{\text{d}}$, taken from Bohlender & Landstreet (1990). Figure displays the $B_e(\phi)$ phase curve based on measurements in hydrogen lines, which are of acceptable precision; cf. Refs. 2, 182, 271 and 334.

Fig. A.89. HD 112185. We used the period $P_{\text{mag}} = 5.0887^{\text{d}}$, taken from Bohlender & Landstreet (1990). Figure displays the phase curve based on precise B_e points measured in metal lines. Open circles – Ref. 310 (LSD method), filled circles – Ref. 334.

Fig. A.90. HD 112381. We used the period $P_{\text{mag}} = 2.84^{\text{d}}$, taken from Bohlender et al. (1993). More B_e observations of high accuracy are necessary to obtain more accurate parameters of the phase curve. Filled circles – Ref. 230 (H lines).

Fig. A.91. HD 112413. We used the period $P_{\text{mag}} = 5.46939^{\text{d}}$, taken from Borra & Vaughan (1978). The figure presents the rotational phase curve $B_e(\phi)$ derived from B_e measurements of Ref. 310 (metal lines, LSD method). The averaged phase curve $B_e(\phi)$ is a double wave.

Fig. A.92. HD 112413. We used the period $P_{\text{mag}} = 5.46939^{\text{d}}$, taken from Borra & Vaughan (1978). Magnetic rotational phase curve was derived from B_e points measured in hydrogen lines, Refs. 25, 33, 77, 126, 215 and 327. The phase curve was fitted by a double wave. Open circles – Ref. 215, filled circles – Ref. 25, open squares – Ref. 126, filled squares – Ref. 327, open triangles – Ref. 33, filled triangles – Ref. 77.

Fig. A.93. HD 112413. We used the period $P_{\text{mag}} = 5.46939^{\text{d}}$ (Borra & Vaughan 1978). The figure shows that there exists a large scatter of the observed B_e measurements, which strongly increases uncertainty of the average phase curve. Magnetic B_e measurements were taken from Ref. 33, the phase curve takes form of a sine wave.

Fig. A.94. HD 116458. We determined the most probable period, $P_{\text{mag}} = 2.3596^d$. New magnetic observations are necessary to obtain the better period and phase curve. Open circles – Ref. 184, filled circles – Ref. 256, filled squares – Ref. 187, open squares – Ref. 93.

Fig. A.97. HD 119213. We used the period $P_{\text{mag}} = 2.44997^d$, taken from Pyper & Adelman (1985). Photographic magnetic field measurements which were obtained in metal lines, Ref. 113, did not yield any credible results. Magnetic behavior of this star could be understood from hydrogen line B_e measurements – Ref. 147.

Fig. A.95. HD 118022. We used the period $P_{\text{mag}} = 3.722084^d$, taken from Catalano & Leone (1994). Figure presents the $B_e(\phi)$ curve obtained with LSD method, metal lines – Ref. 310. Averaged phase curve is fitted a by double wave.

Fig. A.98. HD 119419. We used the period $P_{\text{mag}} = 2.6006^d$, taken from Bohlender et al. (1993). Magnetic rotational phase curve is described by a double wave. There is no significant difference between B_e measurements observed both in metal lines and in H lines. Open circles – Ref. 184 (metal lines), filled circles – Ref. 230 (H lines), filled squares – Ref. 168 (H lines).

Fig. A.96. HD 118022. We used the period $P_{\text{mag}} = 3.722084^d$ (Catalano & Leone 1994). Phase curve was obtained from B_e points observed in hydrogen lines, and was approximated by a sine wave. Open circles – Ref. 2, filled circles – Ref. 77, filled squares – Ref. 76.

Fig. A.99. HD 122532. We determined and used here the best magnetic period $P_{\text{mag}} = 3.68137^{\text{d}}$. It is close to the period $P_{\text{mag}} = 3.6807^{\text{d}}$, taken from Bohlender et al. (1993). Magnetic rotational phase curve $B_e(\phi)$ is approximated by a sine wave. There are no noticeable systematic differences between B_e estimates obtained either in hydrogen or in metal lines. Hydrogen B_e observations exhibit larger scatter than H lines data. Filled circles – Ref. 184 (metal lines), open squares – Ref. 168 (H lines), filled squares – Ref. 230 (H lines).

Fig. A.100. HD 124224. We used the period $P_{\text{mag}} = 0.520675^{\text{d}}$ taken from Borra & Landstreet (1980), Ref. 2. Magnetic field B_e was measured only in hydrogen lines: H_β – Refs. 2, 60; H_α and H_γ – Ref. 25. However, H_α data from Ref. 25 were not used due to low accuracy. Open circles – Ref. 2, filled circles – Ref. 25, filled squares – Ref. 60.

Fig. A.101. HD 125248. We used the period $P_{\text{mag}} = 9.2954^{\text{d}}$, taken from Mathys (1994). Averaged phase curve was obtained from B_e points measured in hydrogen line wings. Open circles – Ref. 25, filled circles – Ref. 2.

Fig. A.102. HD 125248. We used the period $P_{\text{mag}} = 9.2954^{\text{d}}$, taken from Mathys (1994). Averaged phase curve $B_e(\phi)$ was obtained from metal lines. Open circles – Refs. 184, 184, 239, 256 and 324. Filled circles – Ref. 333.

Fig. A.103. HD 125823. We used the period $P_{\text{mag}} = 8.8171^{\text{d}}$, taken from Pedersen & Thomsen (1977). Magnetic $B_e(\phi)$ phase curve was obtained from hydrogen line B_e measurements, Ref. 37.

Fig. A.104. HD 125823. We used the period $P_{\text{mag}} = 8.8171^{\text{d}}$, taken from Pedersen & Thomsen (1977). Phase curve $B_e(\phi)$ was obtained from metal line observations, Ref. 176.

Fig. A.107. HD 131156. We used the period $P_{\text{mag}} = 6.1455^{\text{d}}$, taken from Plachinda & Tarasova (2000a,b). The star is an active yellow dwarf (solar type star), which displays periodic variations of B_e with rotational phase. Measurements of B_e were obtained in metal lines. Filled squares – Ref. 47, open circles – Ref. 299, filled circles – Ref. 311.

Fig. A.105. HD 126515. We used the period $P_{\text{mag}} = 129.95^{\text{d}}$, taken from Mathys et al. (1986). Magnetic phase curve $B_e(\phi)$ of this star is best fit by a double wave. Open circles – Refs. 1, 18 and 91 (metal lines, phot. method), filled circles – Refs. 184, 256 and 324 (metal lines), filled squares – Ref. 310 (metal lines, LSD method).

Fig. A.108. HD 133029. We have determined and used here the new magnetic period $P_{\text{mag}} = 2.105^{\text{d}}$. This figure displays magnetic rotational phase curve fit to B_e points, which were measured in hydrogen lines. Open circles – Ref. 2, filled circles – Ref. 327.

Fig. A.106. HD 128898. We determined and used the best magnetic period $P_{\text{mag}} = 4.4794^{\text{d}}$. It is very close to the period $P_{\text{mag}} = 4.4790^{\text{d}}$ by Kurtz et al. (1994). More B_e points of high accuracy are necessary to improve parameters of the phase curve. Open circles – Ref. 256, filled circles – Ref. 2, open squares – Ref. 184, filled squares – Ref. 81.

Fig. A.109. HD 133029. We determined new magnetic period $P_{\text{mag}} = 2.105^{\text{d}}$. Measurements of B_e from metal lines were done with the photographic method, and the corresponding phase curve is displayed here. Open circles – Ref. 94, filled circles – Ref. 1.

Fig. A.112. HD 134793. We used the period $P_{\text{mag}} = 2.7800^{\text{d}}$, taken from Blanco et al. (1978). Magnetic field B_e was measured in metal lines in Ref. 1. Additional measurements are necessary to improve parameters of magnetic variability.

Fig. A.110. HD 133652. We used the period $P_{\text{mag}} = 2.3040^{\text{d}}$, taken from Lanz et al. (1991). Available B_e measurements were obtained from hydrogen lines, Ref. 230. Additional observational data are necessary to obtain accurate $B_e(\phi)$ curve.

Fig. A.113. HD 137509. We used the period $P_{\text{mag}} = 4.4912^{\text{d}}$, taken from Lanz et al. (1991). Phase curve is best described by a double wave. Filled squares – Ref. 256, open circles – Ref. 230, filled circles – Ref. 184.

Fig. A.111. HD 133880. We used the period $P_{\text{mag}} = 0.877485^{\text{d}}$, taken from Landstreet (1990), Ref. 172. Magnetic field B_e was measured in hydrogen lines only – Refs. 81 and 172. Measurements from Ref. 81 were not used due to low accuracy. Phase curve $B_e(\phi)$ is a double wave.

Fig. A.114. HD 137909. We used the period $P_{\text{mag}} = 18.4868^{\text{d}}$ by Leroy (1995). Averaged hydrogen $B_e(\phi)$ was measured in wings of H_β line, see Refs. 2 and 76. Magnetic B_e data, collected in Refs. 25, 77 and 190, were rejected due to low accuracy, and some of them were measured in other Balmer lines. Open circles – Ref. 2, filled circles – Ref. 76.

Fig. A.115. HD 137909. We used the period $P_{\text{mag}} = 18.4868^{\text{d}}$, taken from Leroy (1995). Phase curve was obtained from B_e points determined in metal lines with the LSD method. This is one of the most accurate methods of B_e determinations.

Fig. A.118. HD 137909. We used the period $P_{\text{mag}} = 18.4868^{\text{d}}$, taken from Leroy (1995). Magnetic B_e points were measured in Fe II 4520 line by the “differential” method, see Ref. 63.

Fig. A.116. HD 137909. We used the period $P_{\text{mag}} = 18.4868^{\text{d}}$, taken from Leroy (1995). This figure displays phase curve obtained from metal lines. The $B_e(\phi)$ curve is very similar to that obtained by the LSD method, but the amplitude got larger. Measurements of B_e in Refs. 31 and 327 were measured in metal lines of red spectral region.

Fig. A.119. HD 137949. We determined the new probable magnetic period, $P_{\text{mag}} = 11.13313^{\text{d}}$. This is a very interesting star, and is similar to γ Equ in many aspects. More B_e observations are necessary to determine P_{mag} and to improve other parameters of magnetic variations. Filled squares – Ref. 1, open squares – Ref. 26, open circles – Ref. 91, filled circles – Ref. 256.

Fig. A.117. HD 137909. We used the period $P_{\text{mag}} = 18.4868^{\text{d}}$, taken from Leroy (1995). Measurements of B_e were obtained in the Fe II 4520 line, Ref. 63. These are the most accurate B_e observations ever obtained for this star. Figure presents magnetic field data obtained by so called “integral” method.

Fig. A.120. HD 140160. We used the period $P_{\text{mag}} = 1.59584^{\text{d}}$, taken from Musielok et al. (1980). More B_e of high accuracy are necessary for more exact description of the phase curve $B_e(\phi)$. Filled squares – Ref. 2, open circles – Ref. 25, filled circles – Ref. 333.

Fig. A.121. HD 142301. We used the period $P_{\text{mag}} = 1.45955^{\text{d}}$, taken from Landstreet et al. (1979). Phase curve $B_e(\phi)$ is best described by a double wave.

Fig. A.124. HD 144334. Phase curve $B_e(\phi)$ was computed with the photometric period $P_{\text{phot}} = 1.49497^{\text{d}}$ taken from North (1987), and the magnetic period $P_{\text{mag}} = 3.61^{\text{d}}$ (Borra et al. 1983) was not used here. There exists a small number of B_e measurements. New B_e points are necessary to improve the period and other parameters of magnetic variability.

Fig. A.122. HD 142990. The best period of magnetic variations used here, $P_{\text{mag}} = 0.9791^{\text{d}}$. It is close to the period $P_{\text{mag}} = 0.979070^{\text{d}}$ taken from Catalano & Leone (1996). Magnetic field B_e was measured in hydrogen lines only. Additional B_e observations are required to improve the period P_{mag} , and other parameters of the magnetic phase curve. Filled circles – Ref. 37, open circles – Ref. 230.

Fig. A.125. HD 147010. We used the period $P_{\text{mag}} = 3.920676^{\text{d}}$, taken from Catalano & Leone (1993). Figure presents the averaged phase curve measured in hydrogen lines, and it is best represented by a double wave.

Fig. A.123. HD 143473. We determined the magnetic period, $P_{\text{mag}} = 2.84263^{\text{d}}$. There exists a small number of B_e measurements. Additional magnetic observations are necessary to improve the period and other parameters of the magnetic variability. Filled circles – Ref. 184, open circles – Ref. 230.

Fig. A.126. HD 147010. We used the period $P_{\text{mag}} = 3.920676^{\text{d}}$, taken from Catalano & Leone (1993). Magnetic rotational phase curve was obtained from B_e observations in metal lines. It is also a double wave, but the zeroth order component of phase curve in this figure (the constant) is smaller by about 1 kG than that in the hydrogen curve. Open circles – Ref. 184, filled circles – Ref. 256.

Fig. A.127. HD 148112. We used the period $P_{\text{mag}} = 3.04296^{\text{d}}$, taken from Hatzes (1991). This star exhibits low level of magnetic variability. Averaged phase curve $B_e(\phi)$ did not include B_e measurements from Ref. 25 due to low accuracy. New measurements of high precision are necessary to improve the period and parameters of the magnetic rotational phase curve. Filled squares – Ref. 333, open circles – Ref. 327, filled circles – Ref. 2.

Fig. A.128. HD 148199. We used the period $P_{\text{mag}} = 7.72553^{\text{d}}$, taken from Bohlender et al. (1993). Magnetic field B_e was determined in hydrogen lines. Open circles – Ref. 168, filled circles – Ref. 230.

Fig. A.129. HD 148330. We used the period $P_{\text{mag}} = 4.288404^{\text{d}}$, Ziznovsky & Romanyuk (1990). Magnetic behavior of this star is not well understood. More observations are necessary to determine parameters of the phase curve. Open circles – Ref. 179, filled circles – Ref. 327, filled squares – Ref. 333.

Fig. A.130. HD 151965. We used the period $P_{\text{mag}} = 1.60841^{\text{d}}$, taken from Lanz & Mathys (1991b). Magnetic field B_e was observed in hydrogen lines – Ref. 230.

Fig. A.133. HD 152107. We determined and applied here the period $P_{\text{mag}} = 3.86778^{\text{d}}$. It is close to the period $P_{\text{mag}} = 3.86778^{\text{d}}$ by Gerth (1990b). The phase curve was obtained from B_e measurements in metal lines. The scatter of B_e points is very large. The phase curve should be improved by the additional high accuracy observations. Open squares – Ref. 1, open circles – Refs. 178, 219 and 290, filled circles – Ref. 327.

Fig. A.131. HD 152107. Figure presents magnetic behavior of this star in a long time scale.

Fig. A.132. HD 152107. We determined and used here the period $P_{\text{mag}} = 3.86778^{\text{d}}$. It is close to the period $P_{\text{mag}} = 3.85646^{\text{d}}$, taken from Gerth (1990b). The average phase curve $B_e(\phi)$ was obtained from hydrogen lines. Open circles – Ref. 220, filled squares – Ref. 290, filled circles – Ref. 2.

Fig. A.134. HD 153882. The best magnetic period used here, $P_{\text{mag}} = 6.00858^{\text{d}}$. It is close to the period $P_{\text{mag}} = 6.00890^{\text{d}}$, taken from Mathys (1991). Filled squares – Ref. 184, open squares – Ref. 31, open circles – Ref. 72, filled circles – Ref. 256, filled triangles – Ref. 310.

Fig. A.135. HD 164258. Magnetic field of this star was measured in metal lines with photographic method. The best period of magnetic variations used here, $P_{\text{mag}} = 0.86281^{\text{d}}$. It is close to the magnetic period $P_{\text{mag}} = 0.829^{\text{d}}$, taken from Catalano & Leone (1994). Additional high precision B_e observations are necessary for more precise determination of P_{mag} and parameters of magnetic variability. Filled squares – Ref. 98, open squares – Ref. 327, Open squares – Ref. 41, open circles – Ref. 327.

Fig. A.136. HD 168733. The best magnetic period used here, $P_{\text{mag}} = 14.78437^{\text{d}}$. It is close to the magnetic period $P_{\text{mag}} = 14.6^{\text{d}}$, determined by Jones & Wolff (1974). Magnetic field B_e was measured in metal lines. Measurements from Ref. 93 were not used due to low accuracy. Additional high accuracy measurements are necessary to improve period and parameters of magnetic variability. Filled squares – Ref. 256, open circles – Ref. 86, filled circles – Ref. 184.

Fig. A.137. HD 170000. We used the period $P_{\text{mag}} = 1.71649^{\text{d}}$, taken from Musielok & Madej (1988). Magnetic field points B_e were measured in H_β line – Ref. 60. This is the most accurate $B_e(\phi)$ phase curve available for this star.

Fig. A.138. HD 170000. We used the period $P_{\text{mag}} = 1.71649^{\text{d}}$, taken from Musielok & Madej (1988). Phase curve $B_e(\phi)$ was measured in H_α line – Ref. 25. Note that this phase curve remains in antiphase as compared to phase curve in the previous figure, i.e. points $\phi = 0$ differ by $0.5 \times P_{\text{mag}}$.

Fig. A.139. HD 170397. The best period of magnetic variability used here, $P_{\text{mag}} = 2.25454^{\text{d}}$. It is close to the magnetic period $P_{\text{mag}} = 2.24^{\text{d}}$, taken from Borra & Landstreet (1980). More B_e measurements are necessary to improve the period and other parameters of phase curve. Open circles – Ref. 2, open squares – Ref. 184, filled squares – Ref. 230.

Fig. A.141. HD 173650. We used the period $P_{\text{mag}} = 9.9754^{\text{d}}$, taken from Hildebrandt et al. (1985). Magnetic points B_e were measured in metal lines with the photographic technique, see Ref. 1. Additional high accuracy measurements are necessary to improve parameters of the magnetic variability of this star.

Fig. A.140. HD 170973. The best period of magnetic variability, used here, $P_{\text{mag}} = 18.52^{\text{d}}$. It is close to the magnetic period $P_{\text{mag}} = 18.2^{\text{d}}$, taken from Bohlender et al. (1993). Available B_e measurements are very scarce. New measurements of high precision are necessary to improve the period and parameters of the magnetic rotational phase curve. Open circles – Ref. 230, filled circles – Ref. 184.

Fig. A.142. HD 174638 = β Lyr. We used the period $P_{\text{mag}} = 12.935^{\text{d}}$, taken from Skulskij (1982). Measurements of B_e included in this figure were performed mostly in metal lines of blue optical region, with the photographic method. Filled squares – Ref. 342, open squares – Ref. 191, open circles – Ref. 227, filled circles – Ref. 343.

Fig. A.143. HD 174638 = β Lyr. We used the period $P_{\text{mag}} = 12.935^{\text{d}}$, taken from Skulskij (1982). Measurements of B_e in this figure were done in red lines of silicon, and show lower level of B_e variability than these in Fig. A.142. Open circles – line SiII 6347, filled circles – SiII 6371.

Fig. A.146. HD 187474. We determined and used the period $P_{\text{mag}} = 2342^{\text{d}}$. It is close to the period $P_{\text{mag}} = 2345^{\text{d}}$, taken from Hensberge (1993). Magnetic field B_e was measured in metal lines only. Open squares – Ref. 256, open circles – Ref. 184, filled circles – Refs. 1 and 184 – Babcock's measurements.

Fig. A.144. HD 175362. We used the period $P_{\text{mag}} = 3.67375^{\text{d}}$, taken from Catalano & Leone (1996). Phase curve $B_e(\phi)$ is described by a double wave. B_e points were determined in hydrogen lines – Ref. 37.

Fig. A.147. HD 188041. We determined and used here the period $P_{\text{mag}} = 223.826^{\text{d}}$. It is very close to the period $P_{\text{mag}} = 223.9^{\text{d}}$, taken from Hensberge (1993). Phase curve $B_e(\phi)$ was obtained from B_e points presented in Ref. 4 (measurements in metal lines).

Fig. A.145. HD 175362. We used the period $P_{\text{mag}} = 3.67375^{\text{d}}$, taken from Catalano & Leone (1996). Magnetic $B_e(\phi)$ phase curve was obtained from photographic B_e data. Points of Ref. 52 were rejected due to low accuracy. Open circles – Ref. 184, filled circles – Ref. 256.

Fig. A.148. HD 188041. We determined and used here the period $P_{\text{mag}} = 223.826^{\text{d}}$. It is very close to the period $P_{\text{mag}} = 223.9^{\text{d}}$, taken from Hensberge (1993). Phase curve was derived from B_e measurements published in Refs. 1, 15, 16, 184 and 256. B_e data in Ref. 232 were not used here, because they strongly differ between themselves. Filled squares – Refs. 15 and 16, open squares – Ref. 256, open circles – Ref. 184, filled circles – Ref. 1.

Fig. A.150. HD 192678. We used here one of the probable magnetic periods, $P_{\text{mag}} = 12.91049^{\text{d}}$. It is over twice larger than the period $P_{\text{mag}} = 6.4186^{\text{d}}$, given by Wade et al. (1996). Additional B_e measurements of high precision are necessary for the unique determination of the period P_{mag} and phase curve $B_e(\phi)$. Filled squares – Ref. 41, open squares – Ref. 1, open circles – Ref. 255 (H_β line), filled circles – Ref. 255 (metal lines).

Fig. A.149. HD 189849. Magnetic field B_e was measured in metal lines. We determined and used here the period $P_{\text{mag}} = 6.88449^{\text{d}}$. It is in the range $P_{\text{mag}} = 4\text{--}6^{\text{d}}$, determined by Kuvshinov (1972), Ref. 97. More B_e points are necessary here. Filled squares – Ref. 98, open squares – Ref. 327, open circles – Ref. 10, filled circles – Ref. 97.

Fig. A.151. HD 194093. We used the period $P_{\text{mag}} = 1.03474^{\text{d}}$, taken from Plachinda (1990), Ref. 189. Magnetic field B_e was determined from metal lines. Measurements in Refs. 56 and 131 were not used here due to low accuracy. Open squares – Ref. 76, open circles – Ref. 140, filled squares – Ref. 189, filled circles – Ref. 299.

Fig. A.152. HD 196178. We determined and used here the period $P_{\text{mag}} = 1.91645^{\text{d}}$. The number of available B_e observations is small. The unique determination of the period and other parameters of the phase curve requires additional high precision B_e observations. Open circles – Ref. 2, filled circles – Ref. 327.

Fig. A.154. HD 201091. We used the period $P_{\text{mag}} = 36.59^{\text{d}}$, taken from Tarasova et al. (2001), Ref. 354. The effective magnetic field B_e was measured in metal lines. The above phase curve was constructed on B_e points taken only from Ref. 354. Measurements from Refs. 47, 70 and 299, were not used due to low accuracy.

Fig. A.153. HD 196502. We used the period $P_{\text{mag}} = 20.2747^{\text{d}}$, taken from Schoneich et al. (1976). Magnetic field of this star was measured using various techniques. Open squares – Ref. 1, open circles – Ref. 7, filled squares – Ref. 22, filled circles – Ref. 190, open triangles – Ref. 327.

Fig. A.155. HD 201601. We have found the period $P_{\text{mag}} = 27027^{\text{d}}$. Open squares – Ref. 1, filled squares – Ref. 46, open circles – Ref. 2, filled circles – Ref. 47, open triangles – Refs. 48, 49 and 105, filled triangles – Ref. 146, open diamonds – Ref. 184, filled diamonds – Refs. 195 and 268, open asterisks – Ref. 256, filled asterisks – Ref. 327.

Fig. A.156. HD 207260. We have found the most probable period $P_{\text{mag}} = 1688.9^{\text{d}}$. Phase curve $B_e(\phi)$ is described best by a double wave. New B_e high precision measurements are necessary to the unique determination of P_{mag} and other parameters of the magnetic variability. Open squares – Ref. 136, filled squares – Ref. 325, open circles – Ref. 194.

Fig. A.158. HD 215441. We determined that the variability with the large period $P_{\text{long}} = 10180^{\text{d}}$ cannot be ruled out. The figure shows $B_e(\phi)$ curve plotted using this period. Open squares – Ref. 5, filled squares – Ref. 190, open circles – Ref. 30, filled circles – Ref. 224.

Fig. A.157. HD 215441. Measurements of B_e in hydrogen lines exhibit periodic variability with the rotational period $P_{\text{rot}} = 9.4871^{\text{d}}$ taken from Leckrone (1974). Filled circles – Ref. 30, open circles – Ref. 190.

Fig. A.159. HD 220825. We determined and used here the period $P_{\text{mag}} = 1.14077^{\text{d}}$. It is very close to the period $P = 1.412^{\text{d}}$, taken from Kerschbaum & Maitzen (1991). The number of available B_e points is small. Additional high precision B_e observations are necessary to improve parameters of the magnetic variability. Open squares – Ref. 2, filled squares – Ref. 327, filled circles – Ref. 25.

Fig. A.160. HD 223640. We used the period $P_{\text{mag}} = 3.735239^{\text{d}}$, taken from Adelman & Knox (1994). Magnetic field B_e was measured in metal lines, see Ref. 1, and in hydrogen lines, Ref. 224. Measurements from Ref. 1 were not used to construct phase curve due to low accuracy.

Fig. A.161. HD 343872. We determined and used here the best magnetic period $P_{\text{mag}} = 8.8^{\text{d}}$. Magnetic field B_e of this star was measured in metal lines – Ref. 329. Phase curve obviously is a double wave.