

## BELGRADE MERIDIAN CIRCLE OBSERVATIONS OF STARS OF INTEREST FOR THE INVESTIGATIONS OF THE STARK BROADENING INFLUENCE ON STELLAR SPECTRAL LINES

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**Abstract.** Belgrade meridian circle observations of stars of B6-A9 spectral type, which are of interest for the investigations of the Stark broadening influence on stellar spectra has been reviewed. In spectra of such stars the Stark broadening is the dominant pressure broadening mechanism and data on their positions (right ascension and declination) are needed e.g. for the formulation of projects for space telescopes.

### 1. INTRODUCTION

Stark broadening data are of interest for a number of astrophysical problems as diagnostics and modeling of stellar plasma, abundance research, stellar spectra interpretation and modeling, radiative transfer etc. Among different pressure broadening mechanisms, Stark broadening is the dominant one for stars with the effective temperature larger or of the order of magnitude of 10000 K. Such stars are A, B and O type stars and white dwarfs. However, for O stars and early B type stars, electron density is so small that the pressure broadening is negligible in comparison with Doppler broadening, except for transitions involving high principal quantum numbers. The most interesting stars for the investigation of Stark broadening influence on stellar spectral lines are white dwarfs, A type and late B type stars.

With the placement of telescopes on the orbit around the Earth, and with the development of satellite observations, it becomes possible to investigate spectral lines of even trace elements and their ions. Now exist possibilities to formulate and submit various observational projects with the use of telescopes and various devices on orbit. One can see from instructions for project applications for observations with the help of Hubble Space telescope (Madau, 1994), that basic data needed, are the name of target and its precise position (right ascension and declination), total apparent magnitude, instrumental configuration and operation mode, as well as spectral elements and wavelength range. For application is needed also the number of the telescope orbits needed for observation and additional comments and requests if exist.

As one can see, the object position is one of very important basic data needed for the project application. The aim of this paper is to review observational data for the B6-A9 spectral type stars obtained with the Belgrade Meridian circle. For such stars The Stark broadening mechanism is the dominant pressure broadening mechanism, so that such data may be used for the formulation of eventual projects for stellar spectral lines investigations with the help of the Hubble telescope and similar devices on satellites.

## 2. B6-A9 SPECTRAL TYPE STAR OBSERVATIONS WITH THE BELGRADE MERIDIAN CIRCLE

Seven observational catalogues have been done from 1968 to 1995 on the Belgrade meridian circle, an instrument typical for astrometrical observations. During this period of almost three decads, positions of a large number of stars were determined, among them B6-A9 spectral type star positions, of interest for Stark broadening investigations. So we will review observational programs realized on the Belgrade meridian circle and will show the number of B6-A9 spectral type stars included.

The first observational program was the Belgrade Catalogue of Latitude Stars with 3957 stars included, which declinations have been determined with the relative method (Sadžakov and Šaletić, 1972). After this, follows the catalogue of right ascensions and declinations of Northern hemisphere zenith telescopes (NPZT) program stars. This catalogue (Sadžakov et al., 1981) contains the positions of 1638 stars, with more than 300 fundamental stars within the FK4 system.

From 1981 to 1987, the double star positions were determined (Sadžakov i Dačić, 1990), for stars whose components were not separable photographically or photoelectrically at that time. Among these stars, which number in our program is 1576, we found 483 stars with the spectral type within the B6-A9 range. We can obtain their positions for J2000.0 epoch and choose most interesting for spectral line investigations with the help of the Hubble telescope.

The Catalogue of stars in the vicinity of radio sources (Sadžakov et al., 1991) was done from 1982 up to 1987. With this catalogue, Belgrade observatory gave its contribution to the efforts to connect optical and radio interferometrical observations, i.e. to make transfer from the dynamical to the kinematical reference system. This program contains around 300 stars and we identified 48 B6-A9 spectral type stars.

Moreover, several smaller observational stellar catalogues have been made with the Belgrade meridian circle. The program of Ondrejov photograph zenith telescope contained 223 stars observed within 1985-1990 periode (Sadžakov et al., 1992). Among them 71 stars are of interest for this article.

Within the period when Hipparcos was collecting the data, high luminosity stars (HLS) and radio stars have been observed with the Belgrade meridian circle (Sadžakov et al., 1996). In the same time stars from an enlarged list of stars in the vicinity of radio sources have been observed (Sadžakov et al., 1997). In the list of FK5 fundamental stars observed for this programs, 138 B6-A9 spectral type stars have been identified..

We show here as example, a page from a catalogue of stellar positions. One can see that besides the position (right ascension and declination), some additional

Table 1. One page of the observational catalogue

No	BD	$m_v$	$S_p$	$\alpha$	$E_p$	$\delta$	$E_p$
1	41.04933	6.1	A2	0 02 02.099	1984.31	41 48 50.61	1984.31
2	36.00004	8.8	A5	0 06 16.094	1984.30	36 56 14.48	1984.30
3	45.00016	8.1	A3	0 07 26.710	1983.61	46 06 44.22	1983.61
4	53.00025	8.3	A0	0 11 56.656	1983.61	53 32 59.22	1983.61
5	42.00041	6.1	A0	0 13 43.563	1984.30	43 19 02.62	1984.30
6	53.00031	7.8	A3	0 14 01.491	1983.61	54 22 57.10	1983.62
7	35.00035	7.1	A0	0 14 06.000	1984.33	36 21 09.10	1984.30
8	25.00029	7.6	A2	0 15 54.438	1984.30	25 51 48.08	1984.30
9	53.00054	8.8	A5	0 20 09.390	1984.30	54 03 08.22	1984.30
10	-4.00040	7.8	A0	0 21 26.482	1983.87	-3 45 07.12	1983.87
11	70.00039	8.0	A0	0 39 31.085	1983.61	71 05 32.49	1984.11
12	32.00124	8.1	A3	0 41 40.970	1985.08	33 20 40.35	1984.98
13	50.00143	7.2	A0	0 45 08.322	1985.08	51 10 20.64	1985.08
14	68.00057	8.0	A2	0 49 33.628	1983.61	68 35 41.36	1983.61
15	51.00179	6.3	A0	0 50 53.942	1983.62	52 25 06.37	1983.61
16	-19.00147	7.2	A0	0 55 09.602	1984.39	-19 16 07.80	1984.39
17	43.00193	6.0	B9	0 57 13.070	1985.08	44 26 39.05	1985.08
18	46.00241	8.0	A0	0 59 53.927	1983.62	47 25 49.76	1983.61
19	-20.00191	8.7	A2	1 02 46.099	1984.39	-20 07 21.62	1984.24
20	46.00285	9.0	A0	1 09 09.629	1985.08	46 44 07.43	1985.08
21	50.00236	8.9	A0	1 09 19.693	1984.06	51 15 35.44	1984.31
22	48.00392	7.1	A0	1 14 49.088	1985.08	48 44 43.70	1985.08
23	53.00271	8.2	A2	1 14 57.706	1985.08	53 39 14.55	1985.08
24	65.00151	8.3	A0	1 15 34.065	1984.31	65 53 42.70	1984.31
25	36.00220	6.4	A3	1 15 56.394	1985.08	37 07 24.94	1985.08
26	72.00069	7.3	A0	1 20 18.976	1984.31	72 35 11.89	1984.31
27	-25.00555	6.8	A5	1 21 11.773	1985.09	-24 36 49.62	1985.09
28	-6.00270	6.8	A0	1 22 29.358	1985.08	-6 12 22.44	1985.08
29	2.00211	6.6	B8	1 24 18.352	1985.08	3 16 35.60	1985.08
30	35.00296	8.3	A2	1 31 18.652	1984.31	35 56 03.84	1984.31

characteristics enabling better identification of the star and the epoch of observation are included. The columns of the shown example represent :

The first column - the ordinal number (for the program or for the given list);

The second column - the number according to the Bon list (Bonner Durchmusterung) which contains more than 300000 northern sky stars up to 9.5 apparent magnitude;

The third column - visual apparent stellar magnitude;

The fourth column - spectral type;

The fifth column - right ascension (hour, minute and second of time);

The sixth column - epoch of the right ascension observation (determination);

The seventh column - declination (degree, minute and second of arc);

The eighth column - epoch of the declination observation (determination);

We hope that this review of Belgrade meridian circle observation and corresponding observational data will be of help to our colleagues wishing to prepare projects for satellite telescopes.

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