1. SOME OF THE MAIN RESULTS OF THE OBSERVATORY'S RESEARCH ACTIVITY

Considering that the essential contributions to the science of fellows of the Belgrade Observatory are those published in international journals, a review of just such achievments should be of particular interest to the astronomical community. The results of observational programmes and review articles appeared in books of international character will be mentioned as well.

Georgije Popović in collaboration with T. A. Agekyan and A. Yu. Mel'nichnikova from the Astronomical Observatory of the St. Petersburg State University, applied a method based on data for stars with large proper motions to determine coordinates of the Solar apex relative to stars of various spectral types. The obtained results show that the velocity centroids for stars of different spectral types are different. According to the values $\ell = 44\overset{\circ}{.}0$ and $b = 7\overset{\circ}{.}0$ obtained using all stars, the Sun is currently approaching the Galactic center and moving away from its symmetry plane, the Sun being located above this plane.

Slobodan Jankov in collaboration with S. V. Beredyugina, I. Ilyin and I. Tuominen from University of Oulu in Finland and with F. C. Fekel from Tennessee State University in Nashville (USA) investigated stellar and orbital parameters of the active RS Canum Venaticorum binary II Pegasi (Beredyugina *et al.* 1998). A detailed model atmosphere analysis of high resolution and high S/N CCD spectra of II Peg has yielded for the first time a self - consistent set of fundamental parameters of the primary component, among them: $T_{eff} = 4600$ K and $\log g = 3.2$. In addition, 121 new high quality radial velocity measurements allowed authors to determine improved orbital parameters, resulting in a new orbital ephemeris of T_{conj}=2449582.9268+6.724333E. The position of the primary of II Peg in the HR diagram with the new parameters corresponds to a K2 IV star with mass of 0.8 Solar masses. Combining all parameters, the radius of the primary is estimated as 3.4 Solar radii and the inclination as 60^{o}, with the assumption that its rotational axis is perpendicular to the orbital plane. Jankov and colleagues conclude that the secondary is probably a M0-M3 V star with a mass of about 0.4 Solar masses.

During 1998, Milan S. Dimitrijević and Luka Č. Popović in collaboration with Sylvie Sahal - Bréchot, continued their efforts to provide to scientific community an as much as possible complete set of reliable Stark broadening data for spectral lines of interest for analysis and modeling of stelar plasma, for stellar opacity calculations, abundance determinations, investigations of subphotospheric layers and other astrophysical problems. The results obtained within the frame of common project with S.

Sahal - Bréchot, as well as the future plans, have been reviewed by Dimitrijević (1998). During the consdidered period, Dimitrijević and Sahal - Bréchot applied semiclasical perturbation method for the analysis of Stark broadening of spectral lines within spectra of S V (Dimitrijević and Sahal - Bréchot 1998a), V V and V XIII (Dimitrijević and Sahal - Bréchot 1998b), Ca IX and Ca X (Dimitrijević and Sahal - Bréchot 1998c), Si XI and Si XIII (Dimitrijević and Sahal - Bréchot 1998d), Mg II (Dimitrijević and Sahal - Bréchot 1998e), Na X (Dimitrijević and Sahal - Bréchot 1998f), O VII and Mg XI (Dimitrijević and Sahal - Bréchot 1998g), Sc X, Sc XI, Ti XI and Ti XII (Dimitrijević and Sahal - Bréchot 1998h), and Y III (Dimitrijevich and Saha - Bresho 1998).

When it was not possible to use the semiclassical perturbation approach with the appropriate accuracy due to the lack of reliable atomic data, the modified semiempirical method of Dimitrijević and Konjević has been applied by Luka Č. Popović and Milan S. Dimitrijević (1998ab), for the analysis of Stark broadening within spectra of Kr II (Popović and Dimitrijević 1998a),Mn II, Mn III, Ga III, Ge III and Ge IV (Popović and Dimitrijević 1998b). In all cases, analysis has been performed with the particular emphasis on the astrophysical implications for stellar plasma analyzis.

Such data are of interest not only for astrophysical investigations but are equally so for laboratory plasma diagnostics and modelling, laser produced plasma investigations, designing and investigations of lasers, for inertial confinemet fusion research, plasma technology, plasma devices designing and development and light sources optimization and investigation. In order to provide to scientific community better conditions for the use of theoretical data obtained in Belgrade, the creation of database containing Stark broadening data and other relevant data, is in progress (L. Č. Popović, M. S. Dimitrijević).

Gojko Djurašević published three papers (Djurašević 1998, Djurašević, Demircan, Özdemir, *et al.*, 1998, Djurašević, Zakirov, Hojaev, *et al.* 1998) presenting results of his investigation of close binaries, in collaboration with Turkish (O. Demircan, S. Özdemir, M. Tanriver, Z. Müyesseroglu, H. Ak and B. Albayrak) and Uzbek (M. Zakirov, A. Hojaev, G. Arzumanyants) colleagues. In the first paper (Djurašević 1998), Long-term starspots activity of the eclipsing binary *SV Cam* was analysed in order to determine its orbital and physical parameters on the basis of the interpretation of photometric observations made by Patkós during the period 1973 – 1981. The problem is solved in two stages: by obtaining a synthetic light curve in the case when the parameters of the corresponding Roche model are given *a priori* (direct problem), and by determining the parameters of the model for which the best fit between the synthetic light curve and the observations is achieved (inverse problem). A total of 18 light curves are analysed in the framework of the Roche model, involving two spotted regions on the primary component of the system (Sp G3 V), with the temperature contrast between the spotted area and the surrounding photosphere $A_s = T_s/T_1 = 0.65$. The basic parameters of the system and of the spotted areas are estimated.

In the second paper (Djurašević, Demircan, Özdemir, *et al.*, 1998), the UBV observations of the massive binary *BF Aur*, made at the Ankara University Observatory during 1988, 1989 and 1996, have been used for a photometric study of this early-type binary. The asymmetry of the light curves, arising from unequal height of successive

maxima, indicates that the system is active. By analysing these observations in the framework of the Roche model (including the presence of bright regions on the components) one obtains a semidetached configuration of the system, with the cooler secondary component filling its Roche lobe. Authors assumed that at the place where the gas stream from the secondary falls on the primary, relatively small in size but a high temperature contrast active hot-spot (hs) region is formed. As a result of the heating effect caused by the irradiation of the hot-spot region, on the secondary's side facing the hot spot a bright-spot (bs) region is formed. The bright-spot region is larger in size but with significantly lower temperature than the hot spot. This region can be treated as a "reflection cap". By analysing the light curves in the framework of this working hypothesis the basic parameters of the system and the active regions are estimated.

In Djurašević, Zakirov, Hojaev, *et al.* (1998), results of analysis of the activity of the eclipsing binary WZ Cep, based on the interpretation of its photometric observations, have been presented. The B and V light curves obtained by Hoffmann, as well as the new ones obtained at the Maidanak Observatory in the B, V and R passbands during 1995, are analysed and discussed. These two groups of light curves show large differences in their shape and in the depth of the primary minimum. Hoffmann's light curves show big asymmetry, especially conspicuous in the different height of the successive maxima. The new observations give light curves that are almost symmetric having significantly shallower primary minimum. These light curves have been analysed in the framework of the Roche computer model by applying the inverse problem method. The model is generalised for the case of an overcontact configuration also. To explain these light curves asymmetries and variations, the model involved spotted regions on the components. The analysis shows that WZ Cep system is in a slight overcontact configuration and that best fitting is achieved with spotted regions on the primary star (Sp F5), with the temperature contrast between the spotted area and the surrounding photosphere being $A_s = T_s/T_1 \sim 0.70$. The mass ratio was estimated at the value $q = m_2/m_1 \sim 0.33$, based on the light-curve analysis. The obtained solutions show that there are no significant variations of the system's basic parameters estimated by analysing two groups of very different light curves. Consequently, the main variations in the light curves can be explained by the change of the position and the size of the spotted areas on the primary.

Darko Jevremović with C. J. Butler (Armagh Observatory, Northern Ireland), S. A. Drake (Goddard Space Flight Center, USA) D. O'Donoghue and F. van Wyk from the South African Astronomical Observatory (South Africa), presented simultaneous ultraviolet and optical observations of five flares on the very late type M dwarf Gl 866 (dM5.5e) (Jevremović *et al.* 1998). In this study, a procedure to estimate the physical parameters of the flaring plasma has been developed by using a simplified model of the flare and a comparison of observed and computed Balmer decrements. With the developed procedure they have determined the optical thickness, electron temperature and electron density of the flaring plasma at flare maximum, for three spectroscopically observed flares. They found that these three flares cover up to 5 percent of the stellar surface and have areas similar to solar flares.

As a beginning of an ongoing program of theoretical investigation of the recombina-

tion emission of cosmologically distributed gas, Milan Ćirković and Srdjan Samurović (1998) present a simple analytical model for treatment of recombination lines originating in such medium. Even a cursory glance at the literature reveals that this is a topic of great interest for modern astrophysics and cosmology. The major motivation for such investigations is the possibility of directly detecting optical counterparts to the QSO absorption line systems, whose properties and origin remain one of the most remarkable mysteries in the entire science to this day, when account is taken of the fact that most of baryons in the universe at epoch corresponding to $z \sim 3$ were located within these objects. The targets discussed in this work are mainly galactic haloes at large $\sim 10^2$ kpc galactocentric distances, but also the "true" intergalactic clouds, if they are in equilibrium with the metagalactic ionizing background. Such objects are ionized to very high degree by the metagalactic ultraviolet power-law background, so that neutral fraction is of the order of $\sim 10^{-5}$, but it still produces strong hydrogen recombination flux which could be detectable on Earth under the favorable circumstances. After this flux is estimated, the authors discuss several related topics, such as the possibility of internal ionizing sources embedded in such clouds, and (for the case of halo clouds) "disk proximity effect", i.e. the influence of leakage of Lyman-continuum photons from the disk of the host galaxy (where they are produced by O and B stars). Finally, several notes on the practical feasibility of such recombination surveys with the best present-day telescopes are given. It is shown that Hα observations are the most promising way to follow, at least before the launch of the *New Generation Space Telescope*, planned for the end of the first decade of the new century. It is also shown that the redshift dependence of the expected recombination flux does not conform to a simple power-law, but the detailed discussion of this topic is defarred for a next work in the series.

Three review articles (invited lectures and progress reports of XV and XVII International Symposiums on the Physics of ionized gases) appeared in 1998 in books of international publishers. One by Atanacković - Vukmanović and Simonneau (1996) on the solution of the non - LTE transfer problem using the method of iteration factors, the second by Dimitrijević (1995) on semiclassical and approximate methods for Stark - broadening investigations of astrophysical and laboratory spectra, and the third by Vince (1996) on temporal variations of Solar spectral lines. Besides, a review article on coexistence of two plasma phases in Solar and AGN coronas by Kubičela, Arsenijević, Popović, Trajković and Bon (1998), has been published in Serbian Astronomical Journal.

The "Large Refractor", that is ZEISS 65/1055 cm equatorial, has been employed for micrometer and CCD (ST-6) measurements of double and multiple stellar systems. Georgije Popović and Rade Pavlović published results of 71 measurements of 35 double or multiple stellar systems, performed during 1997 and 1998. A new double star (PAV 2, Rade Pavlović) has been discovered.

On the visual telescope of the ASKANIA 13.5/160 cm astrograph, photographic observations have been performed with CCD ST-6 and ST-8 cameras. Vojislava Protić - Benišek and Vladimir Benišek observed 9 comets (46P/Wirtanen; C/1995 O1 Hale-Bopp; C/1997 J1 Mueller; C/1997 J2 Meunier - Dupouy; C/1997 D1 Mueller; C/1997 T1 Utsunomiya; C/1998 H1 Stonehouse; C/1998 M5 Linear; C/1998 K5 Linear) and

six minor planets (1036 Ganymed; 1093 Freda; 4954 Eric; 1998 FX2; 1998 FM5; 1998 MK 30). The results are announced in several IAU Circulars.

The "Small Refractor", i.e. ZEISS 20/302 cm equatorial, has been employed in the planed observations of the radiation flux of the 31 Solar spectral line and the measurements of their equivalent widths. The temperature sensitivity of the Mn 539.47 nm line has been determined by Ištvan Vince on the basis of observations of several southern chemisphere stars. The preparations for the 11^{th} August 1999 Solar eclipse observations are being continued.

REFERENCES

Agekyan, T. A., Melchnikova, A. J., Popović, G.: 1998, *DETERMINATION OF THE COORDINATES OF THE SOLAR APEX RELATIVE TO STARS OF VARIOUS SPECTRAL TYPES*, Astronomy Reports (Astronomicheskij Zhurnal), **42**, 134-135.

Atanacković-Vukmanović, O., Simonneau, E.: 1996, *SOLUTION OF THE NON-LTE TRANSFER PROBLEM USING THE METHOD OF ITERATION FACTORS*, in Low temperature and general plasmas, eds. M. Milosavljević, Z. Petrović, Nova Science Publishers, Inc., 1998, 227-241.

Beredyugina, S. V., Jankov, S., Il'in, I., Tuominen, I., Fekel, F. C.: 1998, *THE ACTIVE RS CANUM VENATICORUM BINARY II PEGASI: I. STELLAR AND ORBITAL PARAMETERS*, Astron. Astrophys., **334**, 863-872.

Ćirković, M., Samurović, S.: 1998, *ON THE POSSIBLE OBSERVATIONS OF INTERGALACTIC OR HALO CLOUDS IN OPTICAL EMISSION*, Astrophys. Space Sci., **257**, 95-102.

Dimitrijević, M. S.: 1995, *SEMICLASSICAL AND APPROXIMATE METHODS FOR STARK -BROADENING INVESTIGATIONS OF ASTROPHYSICAL AND LABORATORY SPECTRA*, Physics of Ionized Gases, ed. D. Veza, Nova Science Publishers, Inc., 543-558.

Dimitrijević, M. S.: 1998, *STARK BROADENING DATA FOR STELLAR PLASMA RESEARCH*, Astrophysics and Space Sciences, **252**, 415-422.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998a, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST XVI. S V SPECTRAL LINES*, Astron. Astrophys. Suppl. Series, **127**, 543-544.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998b, *STARK BROADENING OF V V AND V XIII SPECTRAL LINES*, Atomic Data and Nuclear Data Tables, **68**, 241-277.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998c, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. XVII. Ca IX AND Ca X*, Astron. Astrophys. Suppl. Series, **128**, 359-360.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998d, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. XVIII. Si XI AND Si XIII*, Astron. Astrophys. Suppl. Series, **129**, 155-156.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998e, *ELECTRON-IMPACT BROADENING OF Mg II SPECTRAL LINES FOR ASTROPHYSICAL AND LABORATORY PLASMA RESEARCH*, Physica Scripta, **58**, 61-71.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998f, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST XIX. Na X SPECTRAL LINES*, Astron. Astrophys. Suppl. Series, **130**, 539-540.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998g, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST XX. O VII AND Mg XI SPECTRAL LINES*, Astron. Astrophys. Suppl. Series, **131**, 141-142.

Dimitrijević, M. S., Sahal-Bréchot, S.: 1998h, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST XXI. Sc X, Sc XI, Ti XI AND Ti XII SPECTRAL LINES*, Astron. Astrophys. Suppl. Series, **131**, 143-144.

Djurašević, G.: 1998, *AN INTERPRETATION OF LIGHT CURVES OF SV CAMELOPARDALIS BY THE INVERSE-PROBLEM METHOD*, Astron. Astrophys. Suppl. Series, **127**, 233-242.

Djurašević, G., Demircan, O, Özdemir, S, Tanriver, M. Müyesseroglu, Z., Ak, H. Albayrak, B.: 1997, *AN ANALYSIS OF THE LIGHT CURVES OF THE EARLY-TYPE BINARY BF AURIGAE*, Astrophys. Space Sci., **253**, 265-274.

Djurašević, G., Zakirov, M., Hojaev, A., Arzumanyants, G.: 1998, *ANALYSIS OF THE ACTIVITY OF THE ECLIPSING BINARY WZ CEPHEI*, Astron. Astrophys. Suppl. Series, **131**, 17-23.

Dimitrievich, M. S., Saha-Bresho, S.: 1998, *SHTARKOVSKOE USHIRENIE SPEKTRAL'NYKH LINIJ Y III*, Zhurn. Prikl. Spektrosk., 65, 476-481.

Jevremović, D., Butler, C. J., Drake, S. A., O'Donoghue, D., Van Wik, F.: 1998, *ULTRAVIOLET AND OPTICAL FLARES ON G1866*, Astron. Astrophys., **338**, 1057-1065.

Kubičela, A., Arsenijević, J., Popović, L. Č., Trajković, N., Bon, E.: 1998, *CO-EXISTENCE OF TWO PLASMA PHASES IN SOLAR AND AGN CORONAS*, Serb. Astron. J., **158**, 43-53.

Popović, L. Č., Dimitrijević, M. S.: 1998a, *STARK BROADENING PARAMETERS FOR Kr II LINES FROM 5s - 5p TRANSITIONS*, Astron. Astrophys. Suppl. Series, **127**, 295-297.

Popović, L. Č., Dimitrijević, M. S.: 1998b, *THE ELECTRON IMPACT BROADENING PARAMETERS IN HOT STAR ATMOSPHERES: Mn II, Mn III, Ga III, Ge III AND Ge IV LINES*, Astron. Astrophys. Suppl. Series, **128**, 203-205.

Vince, I.: 1996, *ON TEMPORAL VARIATIONS OF SOLAR SPECTRAL LINES*, in Low temperature and general plasmas, eds. M. Milosavljević, Z. Petrović, Nova Science Publishers, Inc., 1998, 213-226.