Astronomical Observatory in Belgrade

ACTIVITIES
AND
ABSTRACTS OF PAPERS
(1991 – 1995)

Астрономска Опсерваторија у Београду
АКТИВНОСТИ
И
КРАТКИ САДРЖАЈИ РАДОВА
(1991 – 1995)

Edited by M. S. Dimitrijević and L. Č. Popović

БЕОГРАД
1996

PUBLICATIONS OF THE ASTRONOMICAL OBSERVATORY OF BELGRADE

FOUNDED IN 1947

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FOREWORD

The period 1991 - 1995 covered in this publication, represents extremely difficult period of civil war, a sad time when powerfuls without scrupules striked with sanctions against so noble and peaceful science like astronomy. In spite of all, we succeded not only to continue our scientific activity but even to enlarge it. So for example, during the period 1980 - 1990 covered in Publication of the Astronomical Observatory of Belgrade No. 43, 679 bibliographic items have been published, and among them 81 in international scientific journals. From this number, within the period 1986 - 1990, 330 bibliographic items has been published, with 42 among them in international scientific journals of highest rank. Within the period 1991 - 1995 covered by this book, 506 bibliographic items has been published. In 1991, 92, in 1992, 88, in 1993, 116, in 1994, 92 and in 1995, 118. Among 506 bibliographic items, 86 is in international astronomical journals, which is more than two times larger than in 1986 - 1990 period, without sanctions of international powerfuls against astronomy.

To provide a broader insight into the Astronomical Observatory's interest subjects and activities, presented herein is also a list of lectures having been held in the period 1991 - 1995.

Considering the diversity of the scientific activity on the Astronomical Observatory, which is in steady growth, I hope that this publication will, on one hand, furnish useful information to those interested in the current research pursued, and, on the other, provide the necessary information to those wishing to better comprehend the development of astronomy on this soil.

Milan S. Dimitrijević

ПРЕДГОВОР

Период 1991 - 1995 који обухвата ова публикација, представља изузетно тешко раздобље грађанског рата на овим просторима, тужно време у коме су бескрупулозни моћници ударили санкцијама на једну тако племениту и мирољубиву науку каква је астрономија. Упркос свему успели смо не само да одржимо нашу научну активност него и да је повећамо. Тако је на пример, у периоду од 1980. до 1990. године, који је обухваћен у Публикацији 43 ове серије, објављено 679 библиографских јединица, при чему 81 у међународним часописима. Од тога је у петогодишњем периоду 1986 - 1990 објављено 330 библиографских јединица од чега су 42 у најпознатијим међународним часописима. У периоду 1991 - 1995 који обухвата ова књига, објављено је 506 библиографских јединица и то 92 у 1991., 88 у 1992., 116 у 1993., 92 у 1994. и 118 у 1995. Од 506 библиографских јединица 86 је у међународним астрономским часописима што је више него дупло у односу на претходни период без санкција светских моћника против астрономије.

Да би се стекао шири увид у интересовање и активности на Астрономској опсерваторији, у овој Публикацији дат је и преглед предавања одржаних у периоду 1991 - 1995 године.

С обзиром на разноврсност научне активности на Астрономској опсерваторији, која је у сталном порасту, надам се да ће ова Публикација, с једне стране пружити корисне информације заинтересованима за истраживања која се врше, а са друге, обезбедити потребне податке онима који желе боље да сагледају развој астрономије на овом тлу.

Милан С. Димитријевић

CONTENTS

САДРЖАЈ

1. STELLAR CATALOGUES AND MAPS
1. ЗВЕЗДАНИ КАТАЛОЗИ И КАРАТЕ

Teleki G. and Pakvor I., 1990 *DIGITAL DESIGNATIONS OF CATALOGUES AND SURVEYS OF STAR POSITIONS (Series 2)* Bull. Obs. Astron. Belgrade **143**, 95-99.

Digital designations for further 49 catalogues and surveys of star positions are given. These 49 catalogues were not included in "Bibliography of the Catalogues of Star Positions" (Sevarlic et al. 1978). The designations contain 16 information groups with a total of 50 digits for observational catalogues and 10 groups with the total of 36 digits for other catalogues (derived, fundamental) and surveys.

2. DEVELOPMENT AND HISTORY OF ASTRONOMY
2. РАЗВОЈ И ИСТОРИЈА АСТРОНОМИЈЕ

Tolchel'nikova – Murri S. A., Sadžakov S., Dačić M. and Stančić Z., 1991, *THE PRESENT SITUATION WITH THE ABSOLUTE METHODS OF OBSERVA-TIONS IN FUNDAMENTAL ASTROMETRY*, Astrophysics and Space Science **177**, pp. 495-498.

The present situation with absolute methods is in the accumulated results of con-tinuous deviations from the classical basic principles in the current century, and this has led to the obfuscation of the general clear concepts.

Trajkovska, V., 1991, *SCIENTIFIC AND PROFESSIONAL ACTIVITY OF G. TELEKI*, Bull.Obs.Astron.Belgrade, 143, 101-126.

In this paper the scientific and professional activity of our distinguished astronomer George Teleki (20.4.1928, Senta – 23.2.1987, Belgrade) is presented and his complete bibliography is given.

Popović, G. M., Trajkovska, V., 1992, *SCIENTIFIC AND PROFESSIONAL ACTIV-ITY OF VERA ERCEG*, Bull. Astron. Belgrade, 146, 131-134.

In this paper the scientific and professional activity of our astronomer Vera Erceg (26.8.1941 – 6.5.1992) is presented and her bibliography is given.

Sadžakov S. and Dačić M., 1992, *ZVEREV MITROFAN STEPANOVICH*, Bull. As-tron. Belgrade **146**, p.136.

In memoriam for professor Mitrofan Stepanovich Zverev, whose life was briefly reviewed.

Djokić M., 1993, *THE ASTRONOMICAL OBSERVATORY OF THE BELGRADE UNIVERSITY BETWEEN 1926 AND 1941*, Publ. Obs. Astron. Belgrade **44**, pp. 115-117.

The paper deals with the historical development of the Belgrade Astronomical Observatory in the period 1926-1941.

Djokić M., 1993, *TWO DOCUMENTS ABOUT THE BELGRADE UNIVERSITY OBSERVATORY INSTRUMENTS AND EQUIPMENT*, Vasiona 2-3, pp. 43-45.

The content of two documents about the Belgrade University Observatory instru-ments and equipment was discussed.

Sadžakov S. and Dačić M., 1993, *TATOMIR P. ANDJELIĆ*, Bull. Astron. Belgrade **148**, pp. 71-72.

In memoriam for professor Tatomir P. Andjelić, whose life was briefly reviewed.

Dimitrijević M. S., Žarković B., 1994, *TESLINO NAUČNO NASLEDJE*, Savetovanje INOST 94, Zaštita industrijske svojine, transfer i nove tehnologije u srpskim zemljama, Banja Luka pp. 1-12.

The scientific heritage of serbian great scientist Nikola Tesla has been discussed.

Atanacković - Vukmanović O., Dimitrijević M. S., eds. 1995, *ISTRAŽIVANJA U ASTRONOMIJI I, Researches in astronomy I*, Publ.Obs.Astron. Belgrade, **48** pp. 1-202.

This is a collection of short papers on different research fields in astronomy. The greater part of the contributions appearing in this volume have been presented at the Observatory in the frame of the course of lectures entitled "Current Researches in Astronomy".

Dimitrijević M. S., 1995, *ASTRONOMIJA I FIZIKA U SRBA U 18. I PRVOJ POLOVINI 19. VEKA*, Prirodne i matematičke nauke u Srba u 18. i prvoj polovini 19. veka, Novi Sad, 1995, p. 18.

A short history of the developement of astronomy and physics in Serbia in the XVIIIth and the first half of XIXth century has been presented as well as the meteorology.

Dimitrijević M. S., 1995, *ASTRONOMY IN SERBIA*, Proc. of the First Hungarian-Yugoslav Astronomical Conference, Baja, eds. I. Vince, M.S. Dimitrijević, L. Balazs, Publ. Obs. Astron. Belgrade, **49** pp. 71-72.

A short history of the developement of astronomy in Serbia has been presnted as well as the present situation and scientific results

Djokić M., 1995, *ATANASIJE STOJKOVIĆ PROFESSOR OF THE UNIVERSITY OF HARKOV*, Srbi u ruskoj imperiji, Dunaj, Beograd pp. 103-112.

The activity of Atanasije Stojković professor of the University of Harkov in the period 1804-1813 was described.

Djokić M., 1995, *ASTRONOMICAL WORKS OF ATANASIJE STOJKOVIĆ*, Naučni skup Prirodne i matematičke nauke u Srba u 18. i u provoj polovini 19. veka, Novi Sad, p. 23.

Astronomical contents in the books of Atanasije Stojković : "Fisika" (1801-1803) and "Načalnija osnovanija fizičeskoj astronomiji" (1813) was compared.

Protitch-Benishek V., 1995, *ASTRONOMIJA ILI NAUKA O ZVEZDAMA GAVRILA POPOVIĆA*, Naučni skup : Prirodne i matematičke nauke u Srba u 18. i 19. veku, Novi Sad, str. 30.

Sadžakov S. and Jovanović B.D., 1995, *THE ROLE OF FUNDAMENTAL ASTROM-ETRY IN ASTRONOMICAL RESEARCH*, Publ. Obs. Astron. Belgrade **49**, pp. 191-193.

The role of Fundamental Astrometry in astronomical researches in general is considered. One of its crucial tasks is the setting up of suitable coordinate system affording high accuracy of position determination of celestial bodies of the order of 10^{-8} to 10^{-10} radians.

Sadžakov S.N. and Jovanović B.D., 1995, *FUNDAMENTAL ASTROMETRY ROLE IN ASTRONOMICAL RESEARCH*, Bull. Appl. Math. (BAM) **1070/LXXV**, pp. 1-13.

The paper is devoted to defining of a referent coordinate system in time as well as to its parameters. Creating of an inertial coordinate system is one of the basic assignements in fundamental Astrometry, whose importance increases, day by day, thanks to related scientific disciplines progress in acquisitition of new knowledges about Universe.

Sadžakov S. and Šaletić D., 1995, *ASTROMETRIC SIGNIFICANCE OF OBSER-VATIONAL DATA OBTAINED FROM THE TYCHO AND HIPPARCOS ARTI-FICIAL SATELLITES*, Publ. Obs. Astron. Belgrade **48**, pp. 101-115.

The article deals with the artificial satellites Tycho and Hipparcos, their significance, tasks, features, motion, control, measurements and data reduction, as well as relation of the measured data to extragalactic objects.

3. INSTRUMENTS AND DATA REDUCTION METHODS
3. ИНСТРУМЕНТИ И МЕТОДИ ОБРАДЕ ПОДАТАКА

Jovanović B., 1991, *ON NUMERICAL SOLVING THE N–BODY PROBLEM*, Računarstvo, Sveska 1, Broj **1**, pp. 47-64. (in serbian)

An algorthm for numerical solving of systems of ordinary differential equations of the type $F(t, \ddot{\mathbf{r}}_i, \mathbf{r}_i) = 0$, $(i = 1 \ldots n)$ according to Cowell's method is described. The method is applied to the particular problem of dynamical astronomy (motions of the planets around the Sun), and program implementation of the algorithm is given as well.

Jovanović B., 1991, *THE TRANSFERS BETWEEN CIRCULAR ORBITS IN A PLANE*, Specialistic work , Mat. faculty, Univ. Belgrade (in serbian)

Mijatov M., Trajkovska V., Bozhichkovich D., Sekulović V., 1991, *SYSTEMATIC ERRORS OF $\Delta\delta_\alpha$, $\Delta\delta_\delta$, $\Delta\delta_m$ TYPE OF THE BELGRADE ABSOLUTE DECLINATION CATALOGUE*, Proceedings of the 1st General Conference of the Balkan Physical Union, September 26-28, 1991,Thessaloniki, Greece, Vol. I, 475-477.

The subject of the present paper is the systematic differences $\Delta\delta_\alpha$, $\Delta\delta_\delta$ and $\Delta\delta_m$ of the Belgrade Absolute Declination Catalogue (BCAD) with respect to the fundamental catalogues FK4, FK5 and GC.

The systematic differences obtained appear as a consequence of some systematic error influences due to the circle cerrections, flexure, refraction and an sufficient star brightness fading which are not fully taken into account.

Grujić, R., Damljanović G., 1992, *ENHANCED ACCURACY OF THE BELGRADE ZENITH TELESCOPE'S INCLINATION AFTER SETTING UP THERMAL INSULATION FOR ITS TALCOTT LEVELS*, Bull. Astron. Belgrade **146**, pp. 69–72.

It has been found that the accuracy of the inclination determination of the Belgrade Zenith Telescope was substantially enhanced after thermal insulation has been provided for its Talcott levels. Juxtaposed are results of the inclination determination in 1967 and 1970, the former preceding and the latter following the setting up of the thermal insulation.

Grujić R., Damljanović G., 1993, *REGULATION OF HUMIDITY IN THE ATOMIC CLOCK ROOM OF THE BELGRADE OBSERVATORY*, X Nacionalna konf., Beograd, Publ. Obs. Astron. Belgrade **44**, pp. 127.

On the basis of the collected data on the water elimination from the atomic clock room (the third cellar) of the administrative building of the Belgrade Astronomical Observatory with the instrument (Hygromatik), the examination of the changes of the

eliminated water, temperature and humidity is performed during 1990.1-1993.0 . The interdependence of the amount of the eliminated water, temperature and humidity is derived. These examinations show that the instrument made possible the regulation of humidity keeping the constant level of temperature.

Petković S. M. and Pakvor I., 1993, *APPLICATION OF ELECTROOPTICAL CCD SENSORS FOR REGISTRATON OF STAR TRANSITS WITH THE BELGRA-DE LARGE TRANSIT INSTRUMENT* Bull. Astron. Belgrade **148**, 61-64.

A project for installing of electrooptical CCD sensors on the Large Transit Instrument (LTI) of Belgrade Observatory is given. The works are planned to be carried out in 3 phases. The basic task of the first phase is the realization of the hardware and software with the cheapest selection of the CCD sensor and standard personal computer, for the purpose of functional verification of the entire system. The second phase foresees the selection of the optimal sensor, the analysis of system errors and factors affecting its work and the possibility of multiple observations of star transits. Finaly, the third phase foresees the full automatization of the registration of star transits and the automatic treatment of obtained results. In this paper a detailed review of the planned project of the first phase is given.

Kubičela A., Jevremović D., Popović L. Č., Skuljan J., Arsenijević J. & Vince I., 1994, *INTERFERENCE FRINGES OF A CCD CAMERA*, Bull. Astron. Belgrade **150**, pp. 37–40.

Very high interference disturbance has been noticed in a SBIG ST-6 CCD camera when applied in solar spectrophotometry. The interference fringes have been removed by tilting the plane of the CCD receiver with respect to the optical axis of the spectrograph Littrow lens.

Kubičela A., Jevremović D., Popović L. Č., Skuljan J., Arsenijević J., Vince I. : 1994, *REDUCTION OF A CCD CAMERA INTERFERENCE FRINGES*, JOSO Annual report 1994 (ed. M. Saniga), 203–205.

Quite high interference disturbance has been noticed in a SBIG ST-6 CCD camera when applied in solar spectrophotometry. The interference fringes have been removed by tilting the plane of the CCD receiver with respect to the optical axis of the spectrograph Littrow lens.

Skuljan J., Arsenijević J. and Kubičela A., 1994, *A NEW COMPUTER SYSTEM FOR POLARIMETRIC MEASUREMENTS*, Bull. Astron. Belgrade **149**, pp. 85-90

A new computer-based system for polarimetric measurements has been developed at the Belgrade Observatory to replace the old analog-digital one. The system consits of standard PC computer, expanded with a 12-bit AD/DA card, which is directly applied to the autput signals from the photomultiplier and the position angle marker of the polarization analyser. A special software package has been developed to support

all the steps in the observing process. Finally, the new system has been tested and compared with the old one, using a group of standard polarized stars.

Petković S. M. and Pakvor I., 1995, *THE CONSTRUCTION PRINCIPLES OF THE CCD CAMERA FOR FUNCTIONIG IN THE REAL TIME ON THE BELGRADE LARGE TRANSIT INSTRUMENT* Bull. Astron. Belgrade **151**, 135-139.

The possibilities of CCD sensors and the accompanying hardware for comparison of the local time t(UTC) with the position of star-image in the pixel matrix of the sensors are analysed. It is shown which data are necessary for this comparison as well as the organization of the necessary hardware.

Petković S. M. and Pakvor I., 1995, *CCD AT BELGRADE LARGE TRANSIT INSTRUMENT* Publ. Obs. Astron. Belgrade **49**, 183-186.

A project for the installation of CCD electrooptical sensors on the Large Transit Instrument (LTI) of Belgrade Observatory is given. The basic task is the realization of the hardware and software with the selection of the optimal CCD sensor and standard personal computer for the purpose of functional verification of the entire system.

Petković S. M. and Pakvor I., 1995, *THE PRINCIPLES OF THE COSTRUCTION OF CCD CAMERA FOR FUNCTIONING IN THE REAL TIME AT THE BELGRADE LARGE TRANSIT INSTRUMENT*, IAU Symposium 172, Dynamics, Ephemerides and Astrometry in the Solar System. Book of Abstracts. Paris.

The possibilities of CCD sensors and the following hardware for comparison of the local time t(UTC) with the position of star-image in the pixel matrix of the sensor are analysed. It is shown which data are necessary for this comparison as well as the organization of the necessary hardware. Functioning in the real time during star observations at the Large Transit Instrument (LTI) supposes the establishment of the correspondence between each illuminated pixel of CCD sensor and time t(UTC) obtained from the local T/P standard. The moment of illumination of each individual pixel, the interval of integration time of the illuminated pixel, intensity of the illumination, velocity and direction of star-image motion across matrix of pixels and jitter of the star-image are the basic parameters (excluding LTI instrumental errors) for time determination of meridian passages.

4. ASTROMETRY
4. АСТРОМЕТРИЈА

4.1. Large Meridian Circle
4.1. Велики меридијански круг

Sadžakov S., Cvetković Z. and Dačić M., 1991, *OBSERVATIONAL WORK PER-FORMED WITH THE BELGRADE LARGE MERIDIAN CIRCLE DURING THE PERIOD 1968 – 1988*, Bull. Obs. Astron. Belgrade **143**, pp. 53-58.

The work performed with the Belgrade Large Meridian Circle and the results obtained during the last twenty years are presented.

4.1.1. Determination of star positions and proper motions
4.1.1. Одређивање положаја и сопствених кретања звезда

Cvetković Z., 1991, *AN ANALYSIS OF PROPER MOTIONS OF DOUBLE STARS*, Abstracts 1-st General Confer. Balkan Phys. Union, Thessaloniki, Greece, pp. 7-31 (one page).

Cvetković Z., 1991, *AN ANALYSIS OF PROPER MOTIONS OF DOUBLE STARS*, Proceedings 1-st General Confer. Balkan Phys. Union, Thessaloniki, Greece, pp. 496-498.

The author presents the results of her analysis of the proper motions of A-components of the double stars from the General Belgrade Double-Star Catalogue. A few statistical criteria are applied to the proper motions of the stars mentioned above aimed at identifying orbital motions of the A-components around the mass centres. Two statistical relations known from stellar astronomy are applied in order to determine the parallaxes. The mass-centre proper motions for the catalogue double stars are calculated, as well.

Sadžakov S., Dačić M. and Stančić Z., 1991, *CHARACTERISTICS OF THE CAT-ALOGUE CONTAINING STARS SITUATED IN THE VICINITY OF RADIO SOURCES*, Astrophysics and Space Science **177**, pp. 87- 91.

The results of the accuracy estimate for the measuring of stars situated in the vicinity of radio sources are presented. The root-mean-square error in the right ascension is $\varepsilon_\alpha \cos \delta = \pm 0\overset{s}{.}024$, i.e. $\varepsilon_\delta = \pm 0\overset{''}{.}30$ in declination. The KE-KW difference obtained from the whole observational material is equal to $+0\overset{s}{.}007$ in the right ascension, i.e. to $-0\overset{''}{.}02$ in the declination.

Tel'nyuk–Adamchuk V.V., Kumkova I.I., Sadžakov S. Toma E. and Volianska M.Yu., 1991, *INTERMEDIATE STAR REFERENCE SYSTEMS IN THE VICINITY OF RADIO SOURCES*, Proceedings 127th Colloq. IAU "Reference Systems", pp. 363-367.

In the framework of CONFOR program the formation of star lists of two intermediate reference star systems is being carried out. The first list, RRS2, contains meridian stars in the fields centered at extragalactic radio/optical sources. The second one is formed on the base of 12-14 magnitude stars. The observations are in progress now. The main purpose of this program is to form a base for investigation of mutual orientation of fundamental reference system and new ones.

Cvetković Z., 1992, *CHARACTERISTICS OF PROPER MOTIONS IN THE PRELIMINARY COMPILED DOUBLE STAR CATALOGUE*, Bull. Astron. Belgrade **145**, pp. 33-37.

The author presents the analysis of the proper motions of A–components of the double stars from the Preliminary Compiled Catalogue of DS–Programme Star Positions. A few statistical criteria are applied to the proper motions of the stars mentioned above aimed at identifying orbital motions of the A–components around the mass centres. Two statistical relations known from stellar astronomy are applied in order to determine the parallaxes. The mass–centre proper motions for the catalogue double stars are calculated, as well.

Cvetković Z., 1992, *OBSERVATIONAL CATALOGUES OF DOUBLE STAR POSITIONS (1980 – 1987) AND THEIR PROPERTIES*, Bull. Astron. Belgrade **145**, pp. 39-51.

This work deals with the systematic differences $\Delta\alpha$ and $\Delta\delta$ of observational catalogues of the DS programme stars made between 1980–1987. These differences are examined through the comparison with the preliminary derived mean system. By applying the Whittaker–Robinson–Vondrak method of smoothing observational data, the elimination of the discovered systematic influences of type $\Delta\delta_\delta$ in three catalogues is performed.

Cvetković Z., 1992, *A PRELIMINARY COMPILATION OF DS-PROGRAMME STAR POSITIONS*, Astron. Astrophys. Suppl. Ser. 96, pp. 191-206.

This catalogue contains compiled right ascensions, for 930, and declinations, for 1225, double stars of the programme named DS. The positions are compiled from the observed values obtained with the meridian circles of six observatories between 1980 and 1987. The average root-mean-square (rms) error of a compiled right ascension is $\varepsilon_\alpha \cos\delta = \pm 0\overset{s}{.}019$, i.e. $\varepsilon_\delta = \pm 0\overset{''}{.}27$ in declination. The mean epoch of the catalogue is 1982.91 in right ascension, i.e. 1983.19 in declination.

Sadžakov S., Dačić M. and Cvetković Z., 1992, *CHARACTERISTICS OF THE BELGRADE STAR CATALOGUE PROGRAMME OF PZT ONDREJEV (BCPZT)*, Bull. Astron. Belgrade **145**, pp. 107-114.

The Belgrade star catalogue obtained using the Belgrade Large Meridian Circle (2r=190 mm, f=2578 mm) observations has been terminated recently according to the PZT Ondrejev programme. In this article the obtained results have been compared with the PZT Ondrejev star catalogue (2r=250 mm, f=3780 mm) as well as with the AGK3. Systematic errors arrived at in these comparisons indicate the star positions (α, δ) in the Belgrade and Ondrejev catalogues determined with high accuracy whereas proper motions given in the AGK3 are burdened with systematic errors, which increase with time.

Sadžakov S., Dačić M. and Cvetković Z., 1992, *CATALOGUE OF POSITIONS OF 223 ONDREJOV PZT STARS OBSERVED AT BELGRADE OBSERVATORY*, Bull. Astron. Belgrade **146**, pp. 1-13.

On the basis of the data obtained with the Large Meridian Circle during the period 1985–1990 a catalogue of positions for 223 Ondrejov PZT stars, as well as the individual corrections to the fundamental-star positions, are presented.

Sadžakov S., Dačić M. and Cvetković Z., 1992, *SYSTEMATIC EFFECTS IN THE BELGRADE CATALOGUE OF DOUBLE STARS*, Bull. Astron. Belgrade **146**, pp. 15-20.

The comparison of the Belgrade Catalogue of Double Stars (BCDS) with the Preliminary Compilation of DS-Programme Star Positions (PCDS) was analysed in right ascension, declination, magnitude and spectral type. Existence of systematic $\Delta\alpha$ and $\Delta\delta$ deviations for all star types is evidenced. The effects can probably be explained by the difference in the atmospheric refraction for different spectral types. This depends on the quality of the determined right ascensions and declinations derived from observations of stars at particular observatories.

Sadžakov S., Dačić M., Cvetković Z. and Ćatović Z., 1992, *CHARACTERISTICS OF THE BELGRADE DOUBLE STAR CATALOGUE*, Bull. Acad. Serbe Sci. Arts **18**, pp. 13-15.

The results of the comparison of the Belgrade catalogue of Double Stars to a few others as well as the systematic errors of the types $\Delta\alpha$, $\Delta\delta$, are presented.

Sadžakov S., Cvetković Z. and Dačić M., 1993, *SYSTEMATIC ERRORS IN OBSERVATIONAL DOUBLE STAR CATALOGUES*, Bull. Astron. Belgrade **147**, pp. 1-10.

The comparison of the Preliminary Compilation of DS-Programme Star Positions (PCDS) with the catalogues of double stars (Belgrade, Kiev, Kharkov, Odessa, Moscow 1, Moscow 2, Kazan) was made in right ascension, declination, magnitude and spectral type. Existence of systematic $\Delta\alpha$ and $\Delta\delta$ type errors for all star type and in all catalogues is indicated.

Sadžakov S., Dačić M. and Cvetković Z., 1993, *CHARACTERISTICS OF THE BELGRADE CATALOGUE OF DOUBLE STARS*, Annals of Shanghai Observatory **14**, pp. 95-99.

The comparison of the Belgrade Catalogue of Double Stars (BCDS) with the Preliminary General Catalogue of Double Stars (PGCDS) was analysed in right ascension, declination, magnitude and spectral type. Existence of $\Delta\alpha$ and $\Delta\delta$ systematic errors for all spectral types is indicated. The effect can probably be explained by the difference in the atmospheric refraction for different spectral types. This depends on the quality of the determined right ascensions and declinations derived from observations of stars at some observatories.

Sadžakov S., Dačić M. and Cvetković Z., 1993, *CHARACTERISTICS OF THE CATALOGUE OF POSITIONS FOR 223 PZT- ONDREJOV–PROGRAMME STARS*, Astron. Astrophys. Suppl. Ser. **97**, pp. 417- 420.

The observations of 223 stars of the PZT-Ondrejov-programme and of 173 fundamental stars were made in the period from 1985-1990 with the Large Meridian Circle of the Belgrade Observatory. The measurements were visual and the relative method was used. The positions of the programme stars in the catalogue are given in the FK5 system for the equator and equinox of J2000.0 and the epoch corresponding to our observations. The catalogue also contains the individual corrections for the observed FK5 stars. The programme stars were observed on the average 3.95 times in both right ascension and declination; in the case of the fundamental ones the corresponding number of observations was 3.84. The rms-error of a single observation is $\varepsilon_\alpha \cos\delta = \pm 0\overset{s}{.}020$ in right ascension, $\varepsilon_\delta = \pm 0\overset{''}{.}30$ in declination, for the programme stars, i.e. $\varepsilon_\alpha \cos\delta = \pm 0\overset{s}{.}017$ in right ascension and $\varepsilon_\delta = \pm 0\overset{''}{.}25$ in declination for the fundamental ones. The mean observational epoch for the programme stars in the catalogue is 1987.34 in both right ascension and declination; for the fundamental stars 1987.37 also in both right ascension and declination.

Sadžakov S., Cvetković Z. and Dačić M., 1994, *THE INFLUENCE OF THE SPECTRAL TYPE OF A STAR ON ITS DECLINATION*, Proceedings of the Conference on Astrometry and Celestial Mechanics, Poznan, Poland, pp. 413-417.

The comparison of declinations from the Preliminary Compilation of DS-Programme Star Positions (PCDS) with those contained in the catalogues observed with meridian circles of several northern observatories (Belgrade, Kiev, Moscow 1, Moscow 2, Kazan) shows differences depending on the spectral type of stars involved. The effect can probably be explained by the differences in the atmospheric refraction for different spectral types.

The systematic differences in declination may be presented by $0\overset{''}{.}017$ ($\pm 0\overset{''}{.}002$, m.e.) tgz per spectral class; stars of types earlier than G are displaced towards the zenith of the observer, stars of later type are shifted away. The constant of refraction change depending on the star colour indicated.

Sadžakov S., Dačić M. and Cvetković Z., 1994, *SYSTEMATIC ERRORS OF DOUBLE STARS POSITIONS IN THE BELGRADE CATALOGUE*, Bull. Acad. Serbe Sci. Arts **35**, pp. 69-80.

The comparison of the Belgrade Catalogue of Double Stars (BCDS) with the Preliminary Compilation of DS-programme star positions (PCDS) and the catalogues of double stars Kiev, Kharkov, Odessa, Moscow 1, Moscow 2 and Kazan, was performed in right ascension, declination, magnitude and spectral type. Existence of $\Delta\alpha$ and $\Delta\delta$ type systematic errors for all star types and in all catalogues is indicated. This depends on the quality of the determined right ascensions and declinations derived from observations of stars at some observatories.

Sadžakov S., Dačić M. and Cvetković Z., 1994, *THE ACCURACY ESTIMATE FOR STAR POSITIONS IN THE VICINITY OF RADIO SOURCES IN ZONE $-30°$ TO $+60°$ OBTAINED WITH LMC IN BELGRADE*, Bull. Astron. Belgrade **149**, pp. 1-7.

With the Large Meridian Circle of the Belgrade Observatory we carried out in the period 1982–1987 visual measurements by using the relative method of the coordinates of 290 stars from 78 areas of the sky situated in the vicinity of radio sources. The results of the comparison of the Belgrade Catalogue with four others as well as the systematic errors of the types $\Delta\alpha$, $\Delta\delta$ are presented.

Dačić M., Sadžakov S. and Cvetković Z., 1995, *DETERMINATION OF STELLAR POSITIONS IN THE VICINITY OF RADIO SOURCES*, Publ. Obs. Astron. Belgrade **48**, pp. 77-85.

As a consequence of high precision of long-baseline radio interferometry and the possibility of observation of extragalactic radio sources, radio-astrometry has quickly developed in recent years. The need to link the existing and future optical observations with radio-interferometric work is evident. The Astronomical Observatory in Belgrade contributes to the international campaign with the objective to establish an unified reference system, by observations of stars whose positions can help to link optical and radio-interferometric work.

Sadžakov S. and Cvetković Z., 1995, *INTERNATIONAL PROGRAMS OF MERIDIAN OBSERVATION OF STARS*, Publ. Obs. Astron. Belgrade **48**, pp. 117-125.

This is a review of new international programs of meridian observation of stars, performed at various observatories throughout the world. The results can be used for the establishment of an inertial reference system which will be used in astronomy and related sciences.

Sadžakov S., Cvetković Z. and Dačić M., 1995, *INTERNATIONAL SPECIAL PROGRAMMES OF MERIDIAN OBSERVATIONS OF REFERENCE AND PROGRAMME STARS*, Publ. Obs. Astron. Belgrade **49**, pp. 195-199.

The new methods in astrometry have aided the development of fundamental research in atrometry. At many observatories in the world the compilations of star catalogues containing a large number of stars proposed by the IAU are in progress.

The accuracy of the determined star positions and proper motions is expected to increase due to the applications of VLBI, Hipparcos satellite, as well as of the automatic meridian circles.

Sadžakov S., Cvetković Z. and Dačić M., 1995, *INFLUENCE OF THE SPECTRAL TYPE OF A STAR ON THE DETERMINATION OF ITS DECLINATION*, Annals of Shanghai Observatory **16**, pp. 84-88.

The comparison of declinations from the Preliminary Compilation of DS-Programme Star Positions (PCDS) with those contained in the catalogues observed with meridian circles of several northern observatories shows differences depending on the spectral type of stars involved. Stars of types earlier than G are displaced towards the zenith of the observer, stars of later type are shifted away. The constant of refraction change depending on the star colour indicated.

Sadžakov S., Dačić M. and Cvetković Z., 1995, *THE ACCURACY ESTIMATE FOR STAR POSITIONS IN THE VICINITY OF RADIO SOURCES*, Abstracts 2nd Astron. Conf. Hellenic Astronomical Society, Thessaloniki, Greece, pp. 41.

With the Large Meridian Circle of the Belgrade Observatory we carried out in the period 1982–1987 visual measurements by using the relative method of the coordinates of 290 stars from 78 areas of the sky situated in the vicinity of radio sources. The results of the comparison of the Belgrade Catalogue with four others as well as the systematic errors of the types $\Delta\alpha$, $\Delta\delta$ are presented.

4. 1. 2. Observations of the Sun and planets
4. 1. 2. Посматрање Сунца и планета

Sadžakov S. and Dačić M., 1991, *ORIENTATION OF THE COORDINATE SYSTEM OF THE FUNDAMENTAL CATALOGUE FK5 OBTAINED FROM THE MERIDIAN OBSERVATIONS OF PLANETS*, Proceedings 1-st General Confer. Balkan Phys. Union, Thessaloniki, Greece, pp. 532-534.

Observations of the Sun and planets (Mercury, Venus, Mars) are described. We present the error estimate including both the systematic error and the random one. The correction of the equator, equinox, inclination, longitude and radii of the planets are presented, too.

Sadžakov S. and Dačić M., 1991, *ORIENTATION OF THE COORDINATE SYSTEM OF THE FUNDAMENTAL CATALOGUE FK5 OBTAINED FROM THE MERIDIAN OBSERVATIONS OF PLANETS*, Abstracts 1-st General Confer. Balkan Phys. Union, Thessaloniki, Greece, pp. 7-49 (one page).

The authors present their results obtained in a 15-year cycle of observations of the Sun, Mercury, Venus and Mars aimed at determining a fundamental coordinate system of high accuracy.

The following elements are determined : $\Delta\delta_o$ – the declination correction, ΔA, $\Delta\lambda$, $\Delta\varepsilon$, ΔM_o, Δe – the orientation elements describing the planetary orbits, $\Delta M_o'$, $\Delta e'$ – concerning the Earth's orbit, Δa – semiaxis-major correction of planetary orbits, Δp, Δq, Δr – the corrections related to those of the orbit-node longitude $\Delta\Omega$, of the orbit's inclination to the ecliptic Δi and of the angular distance of the perigee from the node $\Delta\omega$.

Sadžakov S., Dačić M. and Cvetković Z., 1991, *OBSERVATIONS OF THE SUN AND INNER PLANETS WITH THE LARGE MERIDIAN CIRCLE IN BELGRADE*, Bull. Obs. Astron. Belgrade **143**, pp. 21-27.

A description is given of the equipment and the procedure of the observations, along with the mean (O-C) values of the right ascensions and declinations, according to the years, and computed corrections of the orbital elements. It is inferred that the quality of the observations is satisfactory.

Dačić M., Sadžakov S. and Cvetković Z., 1992, *RESULTS OF OBSERVATIONS OF THE SUN, MERCURY, VENUS AND MARS FROM BELGRADE*, Bull. Astron. Belgrade **145**, pp. 115-123.

In this paper we present the results $(O-C)_\alpha$ and $(O-C)_\delta$ obtained during the period 1989–1990 in Belgrade from diurnal observations of the Sun, Mercury, Venus and Mars with the Large Meridian Circle "ASKANIA" d=190 mm, f=2578 mm.

Dačić M., Sadžakov S. and Cvetković Z., 1992, *RESULTS OF OBSERVATIONS OF THE SUN AND INNER PLANETS MADE AT THE BELGRADE OBSERVA-TORY*, Bull. Astron. Belgrade **146**, pp. 65-67.

In this paper we present the results $(O-C)_\alpha$, $(O-C)_\delta$ and related data obtained during 1991 at Belgrade Observatory from diurnal observations of the Sun, Mercury, Venus and Mars with the Large Meridian Circle.

Sadžakov S. and Dačić M., 1992, *THE ORIENTATION OF THE FK5 COORDI-NATE SYSTEM FROM THE BELGRADE MERIDIAN OBSERVATIONS OF THE SUN AND PLANETS*, Bull. Acad. Serbe Sci. Arts **18**, pp. 33-38.

Observations of the Sun and the planets Mercury, Venus and Mars are described. We present the error estimates, including both the systematic error and the random one. The corrections of the equator, equinox, inclination, longitude and radii of the planets are presented, too.

Sadžakov S., Dačić M. and Cvetković Z., 1992, *OBSERVATIONS OF SOLAR-SYS-TEM BODIES WITH THE BELGRADE MERIDIAN CIRCLE*, Astron. Astro-phys. Suppl. Ser. **92**, pp. 605-607.

Observations of the Sun and planets (Mercury, Venus, Mars) are described. The error estimate including both the systematic error and the random one is presented, as well.

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Dačić M., Sadžakov S. and Cvetković Z., 1993, *RESULTS OF OBSERVATIONS OF THE SUN AND INNER PLANETS MADE AT THE BELGRADE OBSERVATORY*, Bull. Astron. Belgrade **147**, pp. 83-86.

In this paper we present the results $(O-C)_\alpha$, $(O-C)_\delta$ and related data obtained during 1991 at Belgrade Observatory from diurnal observations of the Sun, Mercury, Venus and Mars with the Large Meridian Circle. (Addendum to the article published in Bull. Astron. Belgrade **146**, (1992).)

Sadžakov S., Dačić M. and Cvetković Z., 1993, *THE ORIENTATION OF THE FK5 COORDINATE SYSTEM FROM THE MERIDIAN OBSERVATIONS OF THE SUN AND PLANETS*, Publ. Obs. Astron. Belgrade **44**, pp. 23-26.

In this paper the elements of orientation of the fundamental system and the procedure for their calculation are presented. On the basis of the observation of the Sun, Mercury and Venus computed are the corrections ΔA and $\Delta\delta_o$.

Dačić M., Sadžakov S. and Cvetković Z., 1994, *RESULTS OF OBSERVATIONS OF THE SUN AND PLANETS WITH THE BELGRADE LARGE MERIDIAN CIRCLE*, Bull. Astron. Belgrade **149**, pp. 21-26.

In this paper we present the results $(O-C)_\alpha$, $(O-C)_\delta$ and related data obtained during the period 1992-1993 in Belgrade from diurnal observations of the Sun, Mercury, Venus and Mars with the Large Meridian Circle.

Dačić M., Sdažakov S. and Cvetković Z., 1995, *OBSERVATIONS OF THE SUN AND PLANETS WITH THE BELGRADE LARGE MERIDIAN CIRCLE*, Bull. Astron. Belgrade **151**, pp. 81-84.

The results of the observations of the Sun, Mercury, Venus and Mars made with the Large Meridian Circle of the Belgrade Observatory in 1994 are presented.

Sadžakov S., Dačić M., Cvetković Z. and Tolchel'nikova – Murri S. A., 1995, *EQUATOR AND EQUINOX CORRECTIONS FROM THE SUN AND PLANET OBSERVATIONS MADE AT THE BELGRADE OBSERVATORY*, Bull. Astron. Belgrade **152**, pp. 95-97.

Some particulars concerning the observations of the Sun and the planets Mercury, Venus and Mars, made at the Belgrade Observatory, as well as the accuracy estimates of the observations and the corrections to the equator and the equinox positions are presented.

4.2. Large Vertical Circle : Determination of absolute declinations of stars and planets

4.2. Велики вертикални круг : Одређивање апсолутних деклинација звезда и планета

Grujić R., Teleki G., Jovanović B., 1991, *DECLINATION VARIATIONS FOR ZE-NITH STARS*, Astrophysics & Space Science, **177**, pp. 373-376

The variations of the declinations of 36 Belgrade zenith stars from BZS1$_{70}$ Catalogue published in *Astronomy & Astrophysics*, **177**, 313-316 (1987) are examined by spectral analysis. The prospect is to evaluate multiples of Chandler period of which the most prominent for all stars is the double one.

Mijatov, M., Teleki, G., Bozhichkovich, D. Trajkovska, V., 1991, *CATALOGUE OF DECLINATIONS OF 307 BRIGHT STARS IN THE ZONE +65° - +90° (BCAD)*, Bull.Obs.Astron.Belgrade, 143, 1-20.

Catalogue of declinations of 307 bright stars in the zone +65° - +90° (BCAD)for the equinoxes B1950.0 and J2000.0 and epoch of observation is presented.The declinations were observed with the Vertical Circle of the Belgrade Observatory by absolute method from 1976 to 1980.All stars were observed at both culminations.

The mean error of a single zenith distance observation is $\varepsilon_z^2 = (0\overset{''}{.}42)^2 + (0\overset{''}{.}23 tanz)^2$ and the mean error of the catalogue declinations is $\varepsilon_\delta = \pm 0\overset{''}{.}13$.

The mean epoch of observation is 1978.62.

The mean systematic differences with respect to the fundamental catalogues FK4 and FK5 are : $BCAD - FK4 = -0\overset{''}{.}01$ and $BCAD - FK5 = +0\overset{''}{.}05$.

The systematic differences $\Delta\delta_\alpha$ and $\Delta\delta_\delta$ with respect to these catalogues are also given.The system of Catalogue BCAD is close to the FK5 system.

Mijatov, M., Teleki, G.,Bozhichkovich, D., Trajkovska, V., 1991, *BELGRADE ABSO-LUTE DECLINATION CATALOGUE*, Proceedings of the 1st General Conference of the Balkan Physical Union, September 26-28, 1991, Thessaloniki, Greece, Vol. I, 472-474.

In this paper the characteristics the Belgrade Absolute Declinations Catalogue of 307 bright stars in the zone +65° - +90° (BCAD) are presented.

Mijatov M., Pakvor I., Trajkovska V., Sekulović V., 1992, *SYSTEMATIC ERRORS OF SOME PARAMETERS WHICH HAVE BEEN USED IN THE TREATMENT OF BELGRADE CATALOGUE OF ABSOLUTE DECLINATIONS (BCAD)*, Bull. Astron. Belgrade, 145, 125-130.

The systematic errors of the latitude, corrections of the refraction and flexure – values which have been applied in the treatment of BCAD, are given in this paper.They have been obtained by comparison of BCAD and FK5. It was found out that the mean systematic errors are $+0\overset{''}{.}14$, $-0\overset{''}{.}02$, and $+0\overset{''}{.}14$ respectively for the mentioned parameters and that there exists significant seasonal variations of the refraction corrections in winter and flexure in autumn and winter.

Mijatov M., Tajkovska V., Bozhichkovich D., Sekulović V., 1992, *SYSTEMATIC ERRORS OF $\Delta\delta_\alpha$, $\Delta\delta_\delta$, $\Delta\delta_m$ TYPE OF THE BELGRADE ABSOLUTE DECLINATION CATALOGUE* Bull. Astron. Belgrade, 146, 47-51.

In this paper are presented the systematic differences $\Delta\delta_\alpha$, $\Delta\delta_\delta$ and $\Delta\delta_m$ of the Belgrade Absolute Declination Catalogue (BCAD) with respect to the fundamental catalogues FK4, FK5 and GC.It is found that prominent changes in $\Delta\delta_\delta$ occur within the zones of 2° in declination, that $\Delta\delta_\alpha$ possesses changes of a seasonal character particularly emphasized during autumn and winter and that the magnitude dependence $\Delta\delta_m$ is not negligible.The present systematic differences appear as a consequence of the systematic-error influences not estimated here.These systematic errors are due to the inadequately determined circle corrections, flexure, refraction and to an insufficient fading of stellar brightness.

Trajkovska V., Mijatov, M., 1993, *INFLUENCE OF UNACCOUNTED EFFECTS OF FLEXURE AND REFRACTION ON THE VALUES $O - C$ FOR OUTER PLANETS DETERMINED WITH THE BELGRADE VERTICAL CIRCLE*, Publ. Obs. Astron. Belgrade, 44, 27-28.

In this paper we show that the values $O - C$ for outer planets determined with the Belgrade Vertical Circle have to be corrected for remaining effects of flexure and refraction.The method for determination of corrections is given.

Trajkovska V., Mijatov, M., 1993, *ANALYSIS OF THE SYSTEMATIC EFFECTS AFFECTING ($O - C$) DETERMINATION OF THE OUTER PLANETS OBSERVED WITH THE BELGRADE VERTICAL CIRCLE*, Bull. Astron. Belgrade, 148, 11-16.

In this paper we show that the method used in the ($O - C$) calculation for the outer planets cannot entirely eliminate the systematic influences : time factor, temperature, flexure and refraction.The corrected ($O - C$) values for these influences as well as for the ($E - W$) effect are given.

Trajkovska V., Mijatov M.., 1995, *A METHOD OF DETERMINATION OF UNACCOUNTED EFFECTS AFFECTING THE DECLINATION ($O - C$) VALUES FOR THE PLANETS*, B' HELLENIC ASTRONOMICAL CONFERENCE, Thessaloniki 29 June - 1 July 1995, (Programme and Abstracts), 45.

For the ($O - C$) calculations of the planets unaccounted effects are negligible only when the coordinates of the planets are very close to the mean coordinates of the observed stars.Since this condition is very difficult to fulfil in practice the $(O - C)^s$ are determined with systematic errors whose values depend on to what degree this condition is satisfied. We present the method which entirely eliminates unaccounted systematic influences on the $(O - C)^s$ values : time factor, temperature, flexure and refraction.This method was applied to the observations of the outer planets with the Belgrade Vertical Circle in the period 1984 - 1985. The corrections of the ($O - C$) obtained with this method are not negligible and must be taken into account.

4.3. Large Transit Instrument : Determination of absolute right ascensions

4.3. Велики пасажни инструмент : Одређивање апсолутних ректасцензија звезда

Izmailov R.S., Litkevich N.G., Sadžakova S.N., Simonenko V.D., Suchkova T.I., Tolchel'nikova–Murri S.A. and Turenko V.I., 1991, *THE COMPARISON OF THE ACCURACY OF THE DETERMINATION OF RIGHT ASCENSION BY MEANS OF TRANSIT INSTRUMENTS OF DIFFERENT TYPES*, Bull. Obs. Astron. Belgrade **144**, pp. 61-63.

A special series of observations of the groups of stars performed in Pulkovo, Chile, Kharkov and Belgrade were used to compare the mean errors of the right ascension by means of the method eliminating the influence of the errors of the source catalogue. The results show the advantage of the small transit instruments over transit circles of the classical type.

5. EARTH ROTATION
5. ЗЕМЉИНА РОТАЦИЈА

5.1. Small Transit Instrument : Time determination
5.1. Мали пасажни инструмент : Астрономско одређивање времена

Jovanović B., Djurović L., Jovanović M., 1993, *HOMOGENEOUS SYSTEM UT$_{BLI}$ FOR 1964 – 1986*, Publ. Obs. Astron. Belgrade, **45**, pp. 1-205. (in serbian)

Homogeneous results of universal time determinations derived from the observations by Transit Instrument of Belgrade Astronomical Observatory (BLI) for the interval 1964–1986 are presented. They were prepared in accordance with IERS standards [7] and listed in Table 1.

In additon, using the smoothed values of monthly averaged UT1$_{BLI}$ – UT1$_{BIH}$ from Table 2, an analysis on variation of local system UT1$_{BLI}$ is carried out (Fig. 1, 2, 3), and also, systematic deviations after adopted BIH model are shown in Table 3. Undoubtedly, there exists a significant 11–14 year perodic change of UT1$_{BLI}$ system.

5.2. Zenith Telescope : Latitude determination
5.2. Зенит телескоп : Одређивање географске ширине

Sadžakov S., 1991, *A MULTIDISCIPLINARY STUDY OF THE VARIATIONS IN THE MEAN GEOGRAPHIC LATITUDES OF BELGRADE*, Proceedings 1-st General Confer. Balkan Phys. Union, Thessaloniki, Greece, pp. 529-531.

Our research will give a valuable contribution to the examination of the relationship between the seizmic phenomena and the latitude variations being undoubtedly very important for the city of Belgrade and its surroundings. Such a study is the first of this kind in our country.

Sadžakov S., 1991, *A MULTIDISCIPLINARY STUDY OF THE VARIATIONS IN THE MEAN GEOGRAPHIC LATITUDES OF BELGRADE*, Abstracts 1-st General Confer. Balkan Phys. Union, Thessaloniki, Greece, pp. 7-48 (one page).

The subject is the importance of multidisciplinary studies of Central Serbia in whose northern part Belgrade is situated. This is an area menaced by earthquakes.

The investigations include the following of manifestations of some phenomena already noticed which show a relationship with the dynamics of the consolidated part of the Earth's outer mantle on this part of the terrestrial surface. These are the astronomical followings and studies of variations in the geographic latitudes on the part of the meridian Warsaw-Belgrade and the seismical and seismotectonic followings and studies of the region between Belgrade and the river of Zapadna Morava, i.e. the seismogeological, geomagnetic, gravimetric and geodetic studies of an extended Belgrade area.

Sadžakov S. and Grujić R., 1991, *MULTIDISCIPLINARY STUDY OF THE VARI- ATIONS IN THE MEAN GEOGRAPHIC LATITUDES OF BELGRADE*, Bull. Obs. Astron. Belgrade **143**, pp. 77-79.

Our research will give a valuable contribution to the examinations of the relation- ship between the seizmic phenomena and the latitude variations being undoubtedly very important for the city of Belgrade and its surroundings. Such a study is the first of this kind in our country.

Grujić R., Sadžakov S. and Petrović M., 1992, *THE RESULTS OF THE RESEARCH CONCERNING THE ORIGIN OF VARIATIONS IN THE MEAN GEOGRA- PHIC LATITUDE OF BELGRADE*, Bull. Astron. Belgrade **145**, pp. 131-136.

The authors present the basic data concerning the study of the mean geographic latitude and seismical activity of Belgrade for the period 1964–1985, as well as the corresponding results.

Grujić R., Djokić M., Djokić N., Djurović L., Damljanović G., 1992, *OBSERVATIONS À LA LUNETTE ZENITHALE (DE 110 mm) DU SERVICE DE LATITUDE DE L'OBSERVATOIRE DE BELGRADE EN 1989, 1990*, Bull. Astron. Belgrade **145**, pp. 187–191.

On présente les valeurs de latitude ansi que quelques données météorologiques prises au cours d'observations.

Grujić R., Djokić M., Djokić N., Djurović L., Damljanović G., 1992, *OBSERVATIONS À LA LUNETTE ZENITHALE (DE 110 mm) DU SERVICE DE LATITUDE DE L'OBSERVATOIRE DE BELGRADE EN 1991*, Bull. Astron. Belgrade **146**, pp. 127–129.

On présente les valeurs de latitude ansi que quelques données météorologiques prises au cours d'observations.

Grujić R., Djokić M., Djokić N., Djurović L., Damljanović G., 1993, *OBSERVATIONS À LA LUNETTE ZENITHALE (DE 110 mm) DU SERVICE DE LATITUDE DE L'OBSERVATOIRE DE BELGRADE EN 1992*, Bull. Astron. Belgrade **147**, pp. 65–67.

On présente les valeurs de latitude ansi que quelques données météorologiques prises au cours d'observations.

Damljanović G., 1994, *RE-REDUCTION OF BELGRADE ZENITH-TELESCOPE OBSERVATIONS*, Proceedings 5 Rosiski simpozium Time and space metrology, pp. 76-80.

We made new reduction of the Belgrade zenith-telescope observations in the FK5 reference frame. The new reduction use the observations made in the period 1949.0- 1986.0 . They are now in a computer-readable form. We used Positions and Proper

Motions (PPM) Star Catalogue. Some results of re-reduction of the New Belgrade Latitude Programme, the observations made in the period 1960.0-1986.0, are presented.

Damljanović G., 1994, *ON THE SYSTEMATIC ERRORS OF DECLINATIONS AND PROPER MOTIONS FROM THE BELGRADE ZENITH–TELESCOPE OBSERVATIONS IN THE PERIOD 1960–1985*, Bull. Astron. Belgrade **150**, pp. 29–35.

We prepared the results of the observations with Belgrade ZT made in the period 1960–1985 in a computer–readable form in order to make their new reduction in the FK5 reference frame. Positions and proper motions of our stars were taken from PPM Star Catalogue. The results of determination of the systematic errors of declinations and proper motions od subgroups and Talcott's pairs in that period are presented.

Grujić R., Djurović L., Damljanović G., 1994, *OBSERVATIONS Á LA LUNETTE ZENITHALE (DE 110 mm) DU SERVICE DE LATITUDE DE L'OBSERVATO-IRE DE BELGRADE EN 1993*, Bull. Astron. Belgrade **149**, pp. 91–93.

On présente les valeurs de latitude ansi que quelques données météorologiques prises au cours d'observations.

Damljanović G., 1995, *ON THE SYSTEMATIC ERRORS OF DECLINATIONS AND PROPER MOTIONS FROM THE BELGRADE ZENITH–TELESCOPE OBSERVATIONS IN THE PERIOD 1949-1960*, Abstracts 2nd Hellenic Astronomical Conference, pp. 9.

Our investigation presented here is in accordance with the task of Commission 19 of the International Astronomical Union, "Rotation of the Earth". The Working Group on Earth Rotation in the HIPPARCOS reference frame - WG ERHRF was formed at the XXI IAU General Assembly, Buenos Aires 1991, to collect the data and create a central data bank of past optical astrometric observations. We prepared the results of the observations with Belgrade ZT made in the period 1949-1960 in a computer-readable form in order to make their new reduction in the FK5 reference frame. The results of determination of systematic errors of declinations and proper motions of groups and Talcott's pairs in that period are presented.

Damljanović G., 1995, *THE HIPPACOS MISSION AND THE RE-REDUCTION OF BELGRADE ZENITH–TELESCOPE OBSERVATIONS*, Book of Abstracts IAU Symposium **172**, pp. 70.

We prepared the results of the observations made with Belgrade ZT in the period 1949-1985 in a computer-readable form in order to make the reduction in the FK5 reference frame. After the XXI IAU General Assembly, Buenos Aires 1991, our investigation was in accordance with the task of Commission 19 of the IAU Rotation of the Earth. The Working Group on Earth Rotation in the HIPPARCOS reference frame - WG ERHRF was formed to collect data of past optical astrometric observations. Some results of our re-reduction are presented here.

Damljanović G., 1995, *SOME RESULTS FROM THE RE-REDUCTION OF THE BELGRADE ZENITH-TELESCOPE OBSERVATIONS*, Book of Abstracts JOURNÉES 1995 "Systemes de Référence Spatio–Temporels", "EARTH ROTATION, REFERENCE SYSTEMS IN GEODYNAMICS AND SOLAR SYSTEM", pp. 22.

At the beginning of 1990 we started the preparation of the Belgrade ZT observations, performed in the period 1949-1985, in a computer-readable form. After one year, at the XXI IAU General Assembly held in Buenos Aires in 1991, the Commission 19 of the International Astronomical Union, "Rotation of the Earth", formed the Working Group on Earth Rotation in the HIPPARCOS Reference Frame-WG ERHRF to collect the past optical observations and to recalculate them in this reference system. The WG ERHRF set up a list of the best observations performed in the past. The Belgrade Observatory is on that list with the observations in the period 1949-1990 obtained with ZT. Our investigations are in accordance with it. We prepared the new reduction in the FK5 reference frame and used the PPM Star Catalogue because the HIPPARCOS catalogue had not been finished yet. All the changes in our re-reduction are in accordance with the MERIT standards. The new IAU(1976) coordinate system (as defined by FK5) and astronomical constants, the IAU(1980) nutation model, and the new dynamical reference system (JPL DE200/LE200 ephemeris) are used. The FORTRAN program for refraction used for computation of "Refraction Tables of Pulkovo Observatory" was applied (V ed., 1985). The instrument constants are corrected and numerous systematic errors are taken into account. After this re-reduction, the mean error of the instantaneous latitude from one Talcott pair becomes less than before. Some basic results of our re-reduction are presented here.

Damljanović G., 1995, *ON THE SYSTEMATIC ERRORS OF DECLINATIONS AND PROPER MOTIONS FROM THE BELGRADE ZENITH-TELESCOPE OBSERVATIONS IN THE PERIOD 1949–1960*, Bull. Astron. Belgrade **152**, pp. 71–77.

New reduction was carried out (in the FK5 reference frame) of the Belgrade ZT observations made in the period 1949–1960. The PPM Star Catalogue was used for the positions and proper motions of our stars. The systematic errors of declinations and proper motions od groups and Talcott's pairs in that period are presented.

Damljanović G., Djurović L., 1995, *OBSERVATIONS Á LA LUNETTE ZENITHALE (DE 110 mm) DU SERVICE DE LATITUDE DE L'OBSERVATOIRE DE BELGRADE EN 1994*, Bull. Astron. Belgrade **151**, pp. 131–134.

On présente les valeurs de latitude ansi que quelques données météorologiques prises au cours d'observations.

Damljanović G., Pejović N., 1995, *THE HIPPARCOS MISSION AND THE BELGRADE ZENITH-TELESCOPE OBSERVATIONS*, Publ. Obs. Astron. Belgrade **49**, pp. 127-130.

At the beginning of 1990 we started collecting our past observations made with Belgrade ZT and making a new reduction in the FK5 reference frame. After the XXI

IAU General Assembly, Buenos Aires 1991, our investigation was made in accordance with the task of Commission 19 of the International Astronomical Union, "Rotation of the Earth", which formed the Working Group on Earth Rotation in the HIPPARCOS reference frame - WG ERHRF to collect the data and create a central data bank of past optical astrometric observations. We cooperate and some results are presented here.

Sadžakov S., Damljanović G., Ninković S., 1995, *MULTIDISCIPLINARY STUDIES OF THE VARIATIONS IN THE BELGRADE MEAN LATITUDE*, Publ. Obs. Astron. Belgrade **49**, pp. 201-205.

The topic concerns the importance of the studies of the variations in the Belgrade mean latitude and their connection with the seismical activity of the soil on which the instrument is mounted.

6. EARTH'S ATMOSPHERE
6. ЗЕМЉИНА АТМОСФЕРА

6.1. The quality of the atmosphere
6.1. Квалитет атмосфере

Vince I., Kubičela A., Dimitrijević M. S., 1993, *JEDNA POLARIMETRIJSKA ME-TODA MERENJA RELATIVNE ZAMUĆENOSTI ZEMLJINE ATMOSFERE*, II Simpozijum Hemija i zaštita životne sredine, Vrnjačka Banja pp. 47-48.

By measuring some properties of the scattered solar radiation one can obtain a measure of the atmosphere's turbidity. One possible approach is to measure the linear optical polarisation of the clear's sky radiation. On the basis of these facts, a portable instrument with light - dependent resistors as radiation sensors for day - sky polarization measurements was designed and constructed.

Vince I., Kubičela A., Dimitrijević M. S., 1994, *POLARIMETRIC METHOD TO MEASURE THE RELATIVE TURBIDITY OF THE EARTH'S ATMOSPHERE*, J.Serb.Chem.Soc. **59** pp. 781-785.

On the basis of the known theoretical and empirical facts about optical polarisation of clear sky a method for measurement of relative atmospheric turbidity has been developed. A portable instrument with light - dependent resistors as radiation sensors for day - sky polarization measurements was designed and constructed. Applicability and efficiency of the proposed method has been estimated and proposed for long series and large - scale monitoring of atmospheric turbidity.

7. PLANETARY SYSTEM
7. ПЛАНЕТНИ СИСТЕМ

7.1. Origin and dynamics of the Earth – Moon system
7.1. Порекло и динамика система Земља — Месец

Knežević Z., and Milani A., 1995, *AN ANALYTICAL PERTURBATION THEORY FOR THE LOW LUNAR POLAR ORBITER*, Publ. Obs. Astron. Belgrade **49**, 19–39.

Knežević Z., and Milani A., 1995, *ON THE CONVERGENCE OF ANALYTICAL THEORIES FOR LOW SATELLITES*, In : Dynamics, Ephemerides and Astrometry in the Solar System. IAU Symposium 172 Book of Abstracts, 73. (abstract)

Knežević Z., and Milani A., 1995, *PERTURBATION THEORY FOR THE LOW SATELLITES : AN APPLICATION*, Bull. Astron. Belgrade **152**, 35–42.

Milani, A., and Knežević Z., 1995, *SELENOCENTRIC PROPER ELEMENTS : A TOOL FOR LUNAR SATELLITE MISSION ANALYSIS, Final Report of a study conducted for ESA*, ESTEC, Noordwijk.

Protitch-Benishek V., and Protitch M., 1995, *UN COMMENTAIRE CONCERNANT L'ACCELERATION SECULAIRE DE LA LUNE*, Symposium 172 – Dynamique, Ephemerides et Astrometrie du Systeme Solaire, pp. 62-63, Paris.

Protitch-Benishek V., and Protitch M., 1995, *SECULAR ACCELERATION IN THE MOON'S MOTION : A REAL AND APPARENT PHENOMENA*, Simpozium Metrologye vremeni i prostranstva, pp. 376-379, Moskva.

7.2. Astrometric aspects of eclipses, transits and occultations
7.2. Астрометријски аспекти помрачења, пролаза и окултација

Kubičela A., Arsenijević J., and Protitch-Benishek V, 1991, *OCCULTATION OF 28 Sgr BY TITAN ON 1989 JULY 3rd*, Bull. Obs. Astron. Belgrade **143**, 59.

The results of the photoelectric recording of the eclipse of Jovian satelite Europa on April 3, 1991 are presented. This event gave us the opportunity to obtain not only the light curve of the phenomenon, but also the Europa's radius.

Arsenijević J., and Protić-Benišek V, 1993, *ECLIPSE OF JUPITER SATELLITE IO BY EUROPA ON APRIL 3, 1991 OBSERVED AT BELGRADE OBSERVATORY*, Bull. Astron. Belgrade **147**, 41.

This article presents the results of the photometric, photographic and visual recordings of the occultation of 28 Sgr by Titan, made by the authors at Belgrade Astronomical Observatory on July 3rd, 1989.

Kubičela A., 1993, *FIRST BELGRADE VIDEOGRAPHIC OBSERVATION OF A LUNAR OCCULTATION*, Bull. Astron. Belgrade 148, 57-59.

A VHS-C camcorder was used to record an occultation of Antares by the Moon. In repeated visual reobservations of the phenomenon with a tenfold "extension" of the time-scale a good internal timing accuracy has been achived.

Protitch-Benishek V., and Protitch M, 1994, *DATA REVISION OF BABYLONIAN AND SOME ARABIAN LUNAR AND SOLAR ECLIPSE OBSERVATIONS USED IN NEWCOMB'S RESEARCHES*, IAU General Assembly JD7. Astronomy Posters Abstracts, 215.

7.3. Asteroids
7.3. Астероиди

Debehogne H., Protitch-Benishek V., and Olević D., 1991, *294 PHOTOGRAPHIC POSITIONS OF MINOR PLANETS OBTAINED WITH THE GPO TELESCOPE OF ESO-LA SILLA*, Bull. Obs. Astron. Belgrade **143**, 63.

Knežević Z., 1991, *ASTEROID LONG-PERIODIC PERTURBATIONS : DERIVATION OF PROPER ELEMENTS AND ASSESSMENT OF THEIR ACCURACY*, Astron. Astrophys. **241**, 267–288.

Knežević Z., Milani A., Farinella P., Froeschlè Ch., and Froeschlè Cl., 1991, *SECULAR RESONANCES FROM 2 TO 50 AU.* Icarus **93**, 316–330.

Debehogne H., Protitch-Benishek V., and Olević D., 1992, *LES OBSERVATIONS ET LES ORBITES ELIPTIQUES DES PETITES PLANETES DECOUVERTES A LA SILLA-ESO*, Bull. Astron. Belgrade **145**, 163.

Debehogne H., and Protitch-Benishek V., 1992, *PRECISE ASTROMETRIC POSITIONS OF 16 MINOR PLANETS OBTAINED BY GPO TELESCOPE OF ESO-LA SILLA IN 1988*, Bull. Astron. Belgrade **145**, 169.

Debehogne H., and Protitch-Benishek V., 1992, *POSITIONS AND ORBITS OF THREE MINOR PLANETS DISCOVERED AT THE ESO-LA SILLA IN 1989*, Bull. Astron. Belgrade **146**, 121.

Froeschlè Ch., Farinella P., Froeschlè Cl., Knežević Z., and Milani A., 1992, *THE LOCATIONS OF SECULAR RESONANCES AND THE EVOLUTION OF SMALL SOLAR SYSTEM BODIES*, In : Chaos, Resonance, and Collective Dynamical Phenomena in the Solar System (S. Ferraz- Melo, Ed.), pp. 123–132.

Knežević Z., 1992, *AN EFFICIENT ALGORITHM FOR COMPUTATION OF PLANETARY SHORT-PERIODIC PERTURBATIONS*, Bull. Acad. Serbe Sci. Arts **104**, 39–46.

Knežević Z., and Milani A., 1992, *PROPER ELEMENTS FOR 20000 ASTEROIDS*, Bull. Amer. Astron. Soc. **24**, 1042. (abstract)

Knežević Z., and Milani A., 1992, *ASTEROID PROPER ELEMENTS AND SECULAR RESONANCES*, In, Asteroids, Comets, Meteors 1991, (A.E. Harris and E. Bowell, Eds.), pp. 305–308, LPI, Houston.

Kuzmanoski M., and Knežević Z., 1992, *CLOSE ENCOUNTERS WITH LARGE ASTEROIDS IN THE NEXT 50 YEARS*, Bull. Amer. Astron. Soc. **24**, 942. (abstract)

Milani A., Farinella P., and Knežević Z., 1992, *ON THE SEARCH FOR ASTEROID FAMILIES*, In : Interrelations Between Physics and Dynamics for Minor Bodies in the Solar System (D. Benest and Cl. Froeschlè, Eds.), pp. 85–132.

Milani A., and Knežević Z., 1992, *ASTEROID PROPER ELEMENTS AND SECULAR RESONANCES*, Icarus **98**, 211–232.

Debehogne H., Protitch-Benishek V., and Olević D., 1993, *183 PHOTOGRAPHIC POSITIONS OF NINE MINOR PLANETS OBTAINED AT LA SILLA IN FEBRUARY 1986*, Bull. Astron. Belgrade **147**, 69.

Knežević, Z. 1993, *MINOR PLANET SHORT-PERIODIC PERTURBATIONS, THE INDIRECT PART OF THE DISTURBING FUNCTION*, Celestial Mechanics **55**, 387–404.

Knežević Z., 1993, *"GENERIC TERM" TECHNIQUE IN COMPUTATION OF ASTEROID PERTURBATIONS*, Publ. Obs. Astron. Belgrade **44**, 19–21.

Knežević Z. and Milani A., 1993 *ASTEROID PROPER ELEMENTS : A BIG PICTURE*, LPI Contrib. **810**, 158. (abstract)

Kuzmanoski M., and Knežević Z., 1993, *CLOSE ENCOUNTERS WITH LARGE ASTEROIDS IN THE NEXT 50 YEARS*, Icarus, **103**, 93–103.

Kuzmanoski M., and Knežević Z., 1993, *PERTURBATIONS OF (1) CERES ON (3643) 1978 UN$_2$*, LPI Contrib. **810**, 172. (abstract)

Debehogne H., and Protich-Benishek V., 1994, *POSITIONS AND ORBITS OF FOUR MINOR PLANETS DISCOVERED AT THE ESO - LA SILLA IN 1988*, Bull. Astron. Belgrade **149**, 103-108.

Knežević Z., 1994, *ASTEROID PROPER ELEMENTS : PAST AND PRESENT*, In : Seventy-Five Years of Hirayama Asteroid Families : The Role of Collisions in the Solar System History, (Y. Kozai, R.P. Binzel and T. Hirayama, Eds.), ASP Conf. Ser. **63**, pp. 129–139.

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Knežević Z., 1994, *DETERMINATION OF ASTEROID MASSES*, In : *IC Meteoroids Abstracts. Astron. Inst. Slovak Acad. Sci.*, **34**. (abstract)

Knežević Z., 1994, *ASTEROID LONG PERIODIC PERTURBATIONS : GENERIC TERM REPRESENTATION OF THE DETERMINING FUNCTION*, *Planet. Space Sci.* **42**, 15–19.

Knežević Z., and Ćatović Z., 1994, *ON THE ACCURACY OF LAPLACE AND LEVERRIER COEFFICIENTS*, Bull. Acad. Serbe Sci. Arts **107** (Sci. math. *N°* 19), 1–17.

Knežević, Z. and Milani A., 1994. *ASTEROID PROPER ELEMENTS : THE BIG PICTURE*, In : Asteroids, Comets, Meteors 1993 (A. Milani, M. Di Martino, and A. Cellino, Eds.), Kluwer Acad. Publ., Dordrecht, pp. 143–158.

Kuzmanoski M., and Knežević Z., 1994, *ASTEROID CLOSE ENCOUNTERS AND MUTUAL PERTURBATIONS*, Planet. Space Sci. **42**, 297–299.

Milani A., Bowell E., Knežević Z., Lemaitre A., Morbidelli A., and Muinonen K., 1994, *A COMPOSITE CATALOGUE OF ASTEROID PROPER ELEMENTS* In : Asteroids, Comets, Meteors 1993 (A. Milani, M. Di Martino and A. Cellino, Eds.), Kluwer Acad. Publ., Dordrecht, pp. 467–470.

Milani A., and Knežević Z., 1994, *ASTEROID PROPER ELEMENTS AND THE DYNAMICAL STRUCTURE OF THE ASTEROID MAIN BELT*, Icarus **107**, 219–254.

Debehogne H., and Protich-Benishek V., 1995, *PRECISE ASTRONOMIC POSITIONS OF 36 MINOR PLANETS OBSERVED BY GRO TELESCOPE OF ESO – LA SILLA IN 1988*, Bull. Astron. Belgrade **151**, 141-164.

Knežević Z., 1995, *SOPSTVENI ELEMENTI MALIH PLANETA*, In : Savremena istraživanja u astronomiji. Publ. Obs. Astron. Belgrade **48**, 7–30.

Knežević Z., Carpino M. and Kuzmanoski M., 1995, *ASTEROID MASS DETERMINATION*, (1) Ceres. In : Dynamics, Ephemerides and Astrometry in the Solar System. IAU Symposium 172 Book of Abstracts, 18. (abstract)

Knežević Z., Froeschlé Ch., Lemaitre A., Milani A., and Morbidelli A., 1995. *COMPARISON BETWEEN TWO THEORIES OF ASTEROID PROPER ELEMENTS*, Astron. Astrophys. **293**, 605–612.

7.4. Comets
7.4. Комете

Popović L. Č., Kubičela A., Arsenijević J., Jevremović D. and Vince I.,, 1995, *BELGRADE OBSERVATIONS OF JUPITER DURING THE PERIOD OF ITS COLLIDING WITH SL-9 COMET* , Bull. Astron. Belgrade **151**, p.p. 85-94.

In this paper we present the results of CCD observations of the perturbations in Jupiter's atmosphere caused by the impact of fragments of the SL-9 on this planet. The appearance and evolution of "dark spots" in Jupiter's atmosphere were recorded in V and R spectral region.

Popović L. Č. Kubičela A., Arsenijević J. Jevremović D. & Vince I., 1995, *THE IMPACT OF SL9 FRAGMENTS ON JUPITER*, 2nd Hellenic astronomical conference, Thessaloniki, p. 40.

At the Belgrade Astronomical Observatory "dark spots" created after the impact G fragment of SL-9 comet with Jupiter were observed. The observations were done by CCD imaging camera during and after the impact time in the visual and the red spectral regions. Here we present some detailes about the developement of the G impact perturbation.

Popović L. Č. Kubičela A., Arsenijević J. Jevremović D. & Vince I., 1995, *BELGRADE OBSERVATIONS OF SL9 IMPACT ON JUPITER*, 1st Hungarian – Yugoslav Astronomical Conference, Publ. Obs. Astron. Belgrade **49**, 187-190

The preliminary results of observations of the impact SL9 with Jupiter are presents.

Protitch-Benishek V., and Olević D., 1995, *RESULTS OF THE HALLEY AND GIACOBINI-ZINNER COMETS OBSERVATIONS AT THE BELGRADE OBSERVATORY*, Bull. Astron. Belgrade **151**, 95-99.

8. SUN
8. СУНЦЕ

Kršlajnin V., Erkapić S. and Vince I., 1991, *ON PRESSURE BROADENING AND LINE BISECTORS IN SUNSPOTS*, 1st General Conference of the Balkan Physical Union (ed. K. M. Paraskevopoulos), Hellenic Physical Society, Thessaloniki, 457-459.

Taking into account hydrogen- and electron-impact broadening as major pressure broadening mehanisms, we synthetised profiles of 96 moderate and weak FeI lines in solar photophere amd sunspot umbra, and found umbra/photosphere ratios of line formation effective optical depths and of pressure shifts.

Kršljanin V., Erkapić S., and Vince I., 1991, *ON PRESSURE BROADENING AND LINE BISECTROS IN SUNSPOTS*, in lst General Conference of the Balkan Physical Union, September 26-28, 1991, Thessaloniki, Greece, Abstracts, p (7)-12.

Kršljanin V., Vince I., and Erkapić S., 1991, FeI LINE *ASYMMETRIES AND SHIFTS CAUSED BY PRESSURE BROADENING*, in Lecture Notes in Physics 380, The Sun and Cool Stars : Activity, Magnetism, Dynamos,(eds. I. Touminen, D. Moss and G. Rüdiger) Proc. IAU Colloquium 130, Spinger-Verlag, Berlin, Heidelberg New York, London, Paris, Tokyo, Hong Kong, Barcelona, Budapest, p. 277-278.

In order to test the validity of the usual neglect of pressure line shifts in investigations of Fe I line asymmetries and shifts, we calculated synthetic line bisectors and shifts of 96 moderate and weak photospheric lines, taking into account both hydrogen- and electron-impact shifts and neglecting the velocity fields. Absolute pressure line shifts obtained are less than or appr. equal to 50 m/s and the largest relative shifts along the bisectors are about 40 m/s. We found pronounced dependences of both shifts and bisectors on the energy of the upper level in transitions and on the transition array.

Ribes E., Vince I., and Pierre M., and Ferreira E., 1991, *SOLAR ROTATION OVER SOLAR CYCLE 21*, in Lecture Notes in Physics 380, The Sun and Cool Stars : Activity, Magnetism, Dynamos,(eds. I Touminen, D. Moss and G. Rüdiger) Proc. IAU Colloquium 130, Spinger-Verlag, Berlin, Heidelberg New York, London, Paris, Tokyo, Hong Kong, Barcelona, Budapest, p. 241-245.

The rotation rate of sunspots from 1977 to 1983 has been measured. It has been found that the solar rotation averaged over seven year record is similar to the grand average differential rotation over the period 1921-1982 and that the rotation rate change from year to year. The presence of a time-dependent pattern of azimuthal

rolls inferred from the meridional circulation pattern of sunspots offers a qualitative explanation of the observed rotation rates.

Skuljan J., Erkapić S., Vince I., and Kubičela A., 1992, *THE DATA PROCESSING IN SOLAR SPECTROPHOTOMETRY*, Bull. Astron. Belgrade **145**, 157-162.

An interactive software package especially developed for solar spectrophotometry at the Belgrade Astronomical Observatory is described. The procedure includes the flat field reduction, correction of the X-scale, normalization to the continuum level and evaluation of equivalent widths.

Skuljan J., Karabin M., Vince I., and Kubičela A., 1992, *SOLAR ACTIVITY IN-FLUENCE ON EQUIVALENT WIDTHS OF SOME PHOTOSPHERIC LINES*, Bull. Astron. Belgrade **145**, 1-7.

Changes of equivalent widths for then selected spectral lines were evaluated. Observations from August 1987 till May 1990 have been processed and the obtained results are presented.

Sotirovski P., Boyer R., Hiei E., Vince I., 1992, *SPECTRAL ANALYSIS OF A WHITE-LIGHT FLARE*, Astron. Astrophys. **262**, 597-607.

A white-light flare fenomenon was observed on 26 Septeber 1963 at the Crimean Astrophysical Observatory. Using an echelle spectrograph the flare spectra from 3500 $\mathring{A}$ to 6700 $\mathring{A}$ were obtained with dispersion of 0.56 to 0.30 $\mathring{A}$/mm. The flare lasted from 6 : 38 UT to 9 : 24 UT, with the maximum at 7 : 21 UT and located N15, W75. Twenty spectra were recorded during the flare. Our analysis concerns only 7 time sequences which were chosen according to the quality of the spectra. The line profiles and the halfwidths of the Balmer series from H_α to H_{14} were measured in order to obtain electron density by using Stark broadening, and the continuum intensity as a function of wavelength is studied in order to deduce the emission mechanism.

Vince I., 1992, *A NAP MINT CSILLAG; EGYES FRAUNHOFER-VONALAK EKVIVALENS SZÉLESSÉGÉNEK IDŐBELI VÁLTOZÁSA*, Magyarok szerepe a világ természettudományos és műszaki haladásában. III. Tudományos találkozó (eds. Fodor O., Füzeseri A., Stefkóné Vermes J.), Országos műszaki információs központ és könyvtár, p. 284-285.

The changes of measured equivalent widths of ten selected solar spectral lines from the minimum to the maximum of solar cycle 21 were analysed. Our results confirm that equivalent widths of some spectral lines change, while others do not show significant changes with solar activity.

Vince I. : 1992, *A LIMB-EFFEKTUS KUTATÁSÁNAK EGY ÉVTIZEDE*, Létünk **4-5**, 324–334.

A review of solar limb-effect investigation has been given. 66

modulation of the internal structure of the Sun can be manifested in photosphere, among others, as change in photospheric line profiles. In order to test and develop a reliable solar model among other data we need as well the data on profiles and behaviour of subphotospheric and photospheric spectral lines. In this contribution, the work on Belgrade Observatory concerning Solar spectral line observations and theoretical Stark broadening calculations for photospheric and subphotospheric spectral lines will be reviewed.

Erkapić S. and Vince I., 1994, *INFLUENCE OF ELECTRON DENSITY GRADIENT CHANGES ON SOLAR SPECTRAL LINE PROFILE PARAMETERS*, in 17th Summer school and International Symposium on the Physics of Ionized Gases (eds. B. Marinković and Z. Petrović), 326–329.

In this paper we examine, theoretically, the influence of electron density gradient changes on 27 spectral line profiles.

Mihajlov A. A., Dimitrijević M. S., Ignjatović Lj., Djurić Z., 1994, *SPECTRAL CO-EFFICIENTS OF EMISSION AND ABSORPTION DUE TO ION-ATOM RADIATION COLLISIONS IN THE SOLAR ATMOSPHERE*, Astron. Astrophys. Suppl. Series **103** pp. 57-66.

Spectral coefficients of spontaneous emission and absorption (for $300nm ¡ \lambda¡ 900nm$ range) due to ion-atom radiation processes $H^+ + H(1s) \rightarrow H_2 ({}^1\Sigma_g)$ and $H^+ + H(1s) \rightarrow H(1s) + H^+$ are presented. Calculations have been performed within semiclassical approach for standard solar photosphera and chromosphera model. Obtained results demonstrate the dominat role of considered processes for emission and absorption continuous spectra formation in the particular region of Solar photosphera and chromosphera.

Vince I., 1994, *SOLAR PHYSICS IN YUGOSLAVIA*, JOSO Annual report 1994 (ed. M. Saniga), 74–75.

A report on solar research in Yugoslavia has been given.

Erkapić D., Vince I., 1995, *ON THE AVERAGE OPTICAL DEPTHS OF FORMA-TION OF SOME FRAUNHOFER LINES*, Bull. Astron. Belgrade **151**, 13–16.

Average optical depths of the line depression formation in the center of the solar disk for 18 selected Fraunhofer lines have been calculated for six solar atmosphere models given by Vernazza *et al.*, (1981). Some regularities in the behaviour of the average optical depths vs. central residual intensities of the line profiles and lower excitation potential have been examined.

Erkapić D., Vince I., 1995, *INFLUENCE OF PHOTOSPHERIC PARAMETERS ON SOLAR SPECTRAL LINE PARAMETERS*, (Proc. of the first Hungarian-Yugoslav astronomical conference, eds. Vince I., Dimitrijević and Balázs L.) Publ. Obs. Astron. Belgrade **49**, 159–162.

Spectral line profiles for 31 solar spectral lines from the Belgrade observational program have been sinthesized previously. We gave a short review on the sensitivity of those spectral lines examining the behaviour of some line profile parameters (equivalent width, central residual flux, full half-width), induced by independent variations of temperature, gas pressure and electron density gradient in the atmosphere model. The results displayed as gradients of line profile parameters have shown high sensitivity of spectral lines to the temperature and a negligible sensitivity to the pressure and electron density changes.

Erkapić S. and Vince I., 1995, *MICROTURBULENCE SENSITIVITY OF SOME SOLAR SPECTRAL LINES*, 2nd Hellenic astronomical conference, Thessaloniki, p. 12.

9. STARS
9. ЗВЕЗДЕ

9.1. Double and Multiple Star Systems
9.1. Двојни и вишеструки звездани системи

Djurašević G., 1991, *INVESTIGATION OF ACTIVE CLOSE BINARIES BASED ON PHOTOMETRIC MEASUREMENTS*, Publ. Obs. Astron. Belgrade No. 42, 1-215 (in Serbian).

The paper is devoted to the actual problematics in the determination of orbital and physical parameters of active close binaries (CB) on the basis of the interpretation of photometric observations. One solves the problem in two stages : by obtaining a synthetic light curve in the case when the parameters of the corresponding CB model are given a priori (direct problem) and by determining the parameters of the given model for which the best fit between the synthetic light curve and the observations is achieved (inverse problem).

The theory and observations of CB offer a wide spectrum of possibilities to "model" light curves, but the complications arising in the model make the solving of the direct problem, and especially that of the inverse one, very difficult. However, in the analysis of the asymmetric, deformed, light curves of active CB improving the existing models and developing new ones becomes inevitable. Therefore, the present author develops in this paper relatively complicated, physically based, intraditional models enabling a successful interpretation of photometric observations of active CB with spots on their components, of classical CB, as well as of those containing an accretion disc and which are in an evolutionary phase characterised by an intensive matter exchange between the components. An original method for solving the inverse problem, i.e. for light-curve interpretation, is proposed and realised. The present author also develops algorithms enabling estimating the differential-rotation parameters for stars members of RS CVn-type CB.

On the basis of the algorithms proposed here the author undertakes the analysis of the observational material for several active CB.

The present paper is aimed at extending models of active-CB-light curve synthesis which take into account the observed light-curve characteristics (asymmetry, depressions, "bumps" etc). This enables the developing of an adequate method of their interpretation and the determination of the orbital and physical parameters of the system. As a starting point, one presents in the present paper the essential characteristics of asymmetric, deformed, active CB-light curves, as well as the characteristics of the system components. One also presents a brief discussion concerning some of the light-curve-interpretation models and methods existing actually. This time one indicates the weak points and limitations in the CB models and, also, in the inverse-problem methods. The system models and the light-curve-synthesis methods are enriched by new, original, contributions.

Djurašević G., 1991, *AN ANALYSIS OF CLOSE BINARIES (CB) BY USING THE INVERSE-PROBLEM METHOD*, 1st General Conference of the Balkan Physical Union (ABSTRACTS), Thessaloniki, 7-11.

The paper considers the possibility of determining the parameters of CB based on a light-curve analysis. Models comprising the clasical CB, systems with spots on their components (RS CVn type) and systems containing an accretion disc, are done. They make possible a light-curve synthesis for the model parameters given *a priori*. An efficient method for the purpose of solving the inverse problem is extended. This is realised by modifyng the Marquardt algorithm which combines the best properties of the gradient method with those of the one of differential corrections.

The models for aimed at obtaining a synthetic light curve are based on the Roche geometry of the components and on a Planckian character of radiation. Spots (dark or hot) may be present on the components. This is reflected in the form of the synthetic light curve.

The two light curves, the observed and the synthetic one resulted from the model, enable the inverse problem to be solved, i.e. the real system parameters to be found. The reliability of the method parameters to be found. The reliability of the method is tested in such a way that as the obseved light curve the synthetic one resulted from a model for the parameters given *a priori* is used. The next step is to look for a solution starting from arbitrary initial parameters. The inverse-problem method has proved itself in all cases as efficient and reliable.

In the paper the fundaments of the model and the inverse-problem method are presented. The results of analyses for a few active CB with spots on their components and systems of W Ser type with an accretion disc surrounding the primary are presented, as well.

The method and the CB models extended in the present paper do an efficient way to the determination of physical and orbital parameters of eclipse active CB.

Djurašević G., 1991, *AN ANALYSIS OF CLOSE BINARIES (CB) BY USING THE INVERSE-PROBLEM METHOD*, 1ST General Conference of the Balkan Physical Union (ed. K. M. Paraskevopoulos), Hellenic Physical Society, Thessaloniki, 454-456.

The paper is devoted to the actual problematics in the determination of orbital and physical parameters of active close binaries (CB) on the basis of the interpretation of photometric observations. One solves the problem in two stages : by obtaining a synthetic light curve in the case when the parameters of the corresponding CB model are given *a priori* (direct problem) and by determining the parameters of the given model for which the best fit between the synthetic light curve and the obsevations is achived (inverse problem).

Popović G. M., 1991, *OBSERVATIONAL ASPECT OF THE THREE-BODY PROBLEM*, Astrophysics and Space Science, **177**, pp. 365 – 368.

Distinguishes three phases in the history of triple-star system research. The necessity of obtaining some crucial observational data on these system is also pointed out.

An insight into the observational material concerning triple star system of the hierarhical type and some special properties of this group on the basis of observational data are presented, as well.

Popović G. M., 1991, *TRIPLE STAR SYSTEMS NEARER THAN 200 pc*, Bull. Obs. Astron. Belgrade, **144**, pp. 13 – 38.

A survey of 783 triple star systems is presented. All stars listed belong to the IDS Catalogue and are nearer than 200 pc. In addition to the system identification the survey includes Sp_A, π_A and m_A main component, as well as the designation (multiple) of the apparent component configuration in the system. The data concerning the real relationship among the components (dynamical state) are also included; existence of orbits among the components, or a tendency for any orbital motion, is also specified. In order to examine the relationship between this survey on one side and the Leningrad Triple-Star- System Programme and Gliese's Nearby-Star Catalogue on the other side, suitable designations are brought in the survey. As a final step a short recapitulation of the survey data is done.

Popović G. M., 1991, *MICROMETRIC MEASUREMENTS OF DOUBLE STARS (Series 45)*, Bull. Obs. Astron. Belgrade, **144**, pp. 39 – 45.

The author presents the mean values of micrometer measurements for 149 systems (176 pairs) of double and multiple stars performed with the rafractor Zeiss 65/1055 cm of Belgrade Astronomical Observatory. A total of 325 measurements is averaged.

Zulević D.J., 1991, *MICROMETRIC MEASUREMENTS OF DOUBLE STARS (Series 46)*, Bull. Obs. Astron. Belgrade **144**, 47.

Zulević D. J., 1991, *ORBITES NOUVELLES* UAI Commission des etoiles doubles, Circ. Inf. **114**.

Djurašević, G., 1992, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS I. A Model of Active CB with Spots on the Components*, Astrophysics and Space Science, 196, 241-265.

This is the first in a series of papers devoted to the actual problematics in the determination of orbital and physical parameters of active CB on the basis of the interpretation of photometric observations. One solves the problem in two stges : by obtaing a synthetic light curve in the case when the parameters of the coresponding CB model are given *a ptiori* (direct problem) and by determining the parameters of the given model for which the best fit between the synthetic light curve and the observations is achieved (inverse problem) (see Djurašević, 1991).

In the first article of the series one presents the basic of the model developed for the synthesis of asymetric, deformed, light curves of active CB with spots on their components. The modeling of the CB systems is based on the principles originated in the Wilson and Devinney (1971; hereafter referred to as WD) model for the synthesis of a light curve generalised to include also the case of a nonsynchronous rotation of

the components. The shapes of the components correspond to the equipotentials in the Roche model so that the critical Roche limits can be filled up to an arbitrary degree.

In a spherical-coordinate system the surface of the components are divided into a large number of elementary cells whose intensity and angular radiation distribution are determined by the star temperature, limb darkening, gravitational darkening, and by the effect of reflection in the system.

The active regions are approximated with circular spots. The presence of spots (dark or hot) enables to explain the asymmetry and depressions on the light curves of active CB.

The model enables to be also intepreted the light curves of classic CB (without spots).

Djurašević, G., 1992, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS II. Active CB with Accretion Discs*, Astrophysics and Space Science, 196, 267-282.

For the purpose of analysing light curves of active CB with an accretion disc being at the evolutional phase of an intensive matter exchange between the components a model for light-curve synthesis has been realized where the attention is given to systems like W Ser not sufficiently examined yet with regard that in them the accretion disc is formed around an ordinary star. In the paper one uses the elements presented in the first paper of this series. The model can successfully describe the essential characteristics of the observed light curves due to existence of an accretion disc and a hot spot, as well as those originated in the temperature distribution along the disc radius. The system components are considered in the framework of the non-synchronous Roche model and the accretion disc of a constant thickness lies in the orbital plane around the star capturing the matter of the neighbouring component.

The primary surrounded by the disc is situated relatively well within the Roche oval and its rotation can be significantly nonsynchronous. Near the Lagrange equilibrium point L_1 flows from the secondary (which files the Roche limit) the gas stream 'nourishing' the disc. In the zone where the stream touches the lateral side of the disc a hot spot is formed.

The proposed model enables estimating of the basic orbital and physical parameters of active type W Ser CB (Djurašević, 1991) on the basis of photometric measurements by applying the inverse-problem method.

Djurašević G., 1992, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS III. The Inverse-Problem Method - an Interpretation of CB Light Curves*, Astrophysics and Space Science, 197, 17-34.

In order to enable a successful application of the realised CB models (presented in the two former articles of the series) in the anaysis of the observed light curves, an efficient method unifying the best properties of the gradient method and of the differential-corrections one into a single algorithm (Djurašević, 1991) is proposed. This method is realised by modifyng the Marquardt (1963) algorithm. The inverse

problem is solved in an iterative cycle of corrections to the model elements based on a nonlinear least-square method.

The interpretation of photometric observations is based on the choice of optimal model parameters yielding the best agreement between an observed light curve and the corresponding synthetic one. Some of these parameters can be determined *a priori* in an independent way, while the others are found by solving the inverse problem.

The programmes for analysing light curves find the optimal system parameters rapidly, reliably and correctly. The corresponding programme support enables an evident graphic presentation of the results.

Zulević D. J., 1992, *REVISED ORBITAL ELEMENTS OF BINARY STARS ADS 13777*, Bull. Astron. Belgrade **146**, 57.

Zulević D. J., 1992, *NEW ORBITS OF BINARY STARS ADS 1473 AND ADS 1992* Bull. Astron. Belgrade **146**, 53.

Zulević D. J., 1992, *ORBITS OF TWO INTERFEROMETRIC AND ONE VISUAL BINARY STARS*, Bull. Astron. Belgrade **146**, 61.

Zulević D. J., 1992, *ORBITAL ELEMENTS OF TWO DOUBLE STARS*, Bull. Astron. Belgrade **145**, 103.

Zulević D. J., 1992, *ORBITES NOUVELLES WDS 01512N2439*, UAI Commission des etoiles doubles, Circ. Inf. **117**.

Zulević D. J., 1992, *ORBITES NOUVELLES WDS 02383N4564*, UAI Commission des etoiles doubles, Circ. Inf. **117**.

Zulević D. J., 1992, *ORBITES NOUVELLES WDS 03283N6015*, UAI Commission des etoiles doubles, Circ. Inf. **118**.

Zulević D. J., 1992, *ORBITES NOUVELLES WDS 2253561137*, UAI Commission des etoiles doubles, Circ. Inf. **118**.

Djurašević, G., 1993, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS IV. An Interpretation of CB Light Curve AG Vir by using the Inverse-Problem Method*, Astrophysics and Space Science, 206, 119-127.

The paper is devoted to the actual problematics in the determination of orbital and physical parameters of active CB on the basis of the interpretation of photometric observations. One solves the problem in two stages : by obtaining a synthetic light curve in the case when the parameters of the corresponding CB model are given a priori (direct problem) and by determining the parameters of the given model for which the best fit between the synthetic light curve and the observations is achieved

(inverse problem). In this paper, the above procedure is applied to a particular case of CB AG Vir.

Djurašević, G., 1993, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS V. An Interpretation of CB Light Curve RX Cas by using the Inverse-Problem Method,* Astrophysics and Space Science, 206, 129-144.

The author considers the current problematics in the determination of the orbital and physical parameters for active close binaries (CB) of W Ser type based on the interpretation of photometric observations. In the particular case one analyses the light curves of CB RX Cas in the framework of the accretion-disc model explained in the second paper of this series (Djurašević, 1992a). The change of the light curves with that of the system's physical-activity phase is analysed and the orbital and physical parameters of the system are determined for the maximum, minimum and the transition regime of the physical activity by applying the inverse-problem method described in the third paper of the series (Djurašević, 1992b). In the paper the graphical illustration of the obtained solutions is also given.

Djurašević, G., 1993, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS VI. An Interpretation of CB Light Curves WZ Cep and FT Lupi by using the Inverse-Problem Method,* Astrophysics and Space Science, 206, 145-159.

The paper is devoted to the actual problematics in the determination of orbital and physical parameters of active CB on the basis of the interpretation of photometric observations. One solves the problem in two stages : by obtaining a synthetic light curve in the case when the parameters of the corresponding CB model (Djurašević, 1992a) are given a priori (direct problem) and by determining the parameters of the given model for which the best fit between the synthetic light curve and the observations is achieved (inverse problem) (Djurašević, 1992b). In this paper, the above procedure is applied to a particular case of an interpretation of CB light curves WZ Cep and FT Lupi.

Djurašević, G., 1993, *AN ANALYSIS OF CLOSE BINARIES (CB) BASED ON PHOTOMETRIC MEASUREMENTS VII. An Interpretation of CB Light Curves AU Ser and RV Corvi by using the Inverse-Problem Method,* Astrophysics and Space Science, 206, 207-218.

The paper is devoted to the actual problematics in the determination of orbital and physical parameters of active CB on the basis of the interpretation of photometric observations. One solves the problem in two stages : by obtaining a synthetic light curve in the case when the parameters of the corresponding CB model (Djurašević, 1992a) are given a priori (direct problem) and by determining the parameters of the given model for which the best fit between the synthetic light curve and the observations is achieved (inverse problem) (Djurašević, 1992b). In this paper, the

corresponding absorption coefficients in the infrared and visible spectral range, proposed in the mentioned article, is applicable not only in the case of (1a) and (1b) processess but for a more numerous class of atomic systems. The absorption coefficients $K_\omega^{(ab)}$ for H_2^+ and He_2^+ case as a function of λ and T for conditions in white dwarf atmospheres are presented in this contribution. Our conclusion is that the processes 1a and 1b as well as 2a and 2b must be treated together when the process 1a or 2a are taken into account since their contributions are comparable. Moreover, the process 1b (2b) becomes more significant towards the infrared part of the spectrum. The total absorption coefficient shows a weak dependence on λ and T except in the region of low temperatures and towards the UV part of the spectrum, where a significant increase of $K_\omega^{(ab)}$ exists.

Mihajlov A. A., Dimitrijević M. S., 1992, *RADIATIVE CHARGE EXCHANGE AND RADIATIVE ION-ATOM RECOMBINATION AS A SOURCE OF CONTINUAL E-M RADIATION FROM ASTROPHYSICAL PLASMA* IAU Symp. 155, Planetary Nebulae, Abstract Booklet p. III-51.

Contributions of the radiatiative charge exchange and radiative association processes at symmetrical ion-atom collisions to low temperature gas plasmas continuous spectra have been considered and semiclassical expressions for differential cross sections for the photon spontaneous emission during ion-atom collisions as well as the general expressions for emission spectral coefficients have been given. Also, the special cases of hydrogen and helium plasma have been studied in detail. Moreover, wavelength and temperature ranges where ion-atom radiative processes cotribute significantly to continuous EM plasma spectra have been determined.

Mihajlov A. A., Dimitrijević M. S., 1992, *ION-ATOM COLLISIONS AND ELECTRON RECOMBINATION IN ASTROPHYSICAL HYDROGEN PLASMA*, IAU Coll. 138, Peculiar versus Normal Phenomena in A-type and Related Stars, Abstracts of invited and contributed papers, Trieste 1 page.

Besides the interaction between diatomic molecular ions and colliding atom - atomic ion complexes with radiation in plasma, it is obviously actual and the problem of their interaction with free electrons. Recently has been presented and applied to hydrogen case a quasiclassical method for the calculation of total and partial recombination rate coefficients for the following processes (Mihajlov et al. 1992) :

$$A_2^+ + e \rightarrow A + A^*(n)$$

$$A + A^+ + e \rightarrow A + A^*(n) or A^*(n) + A$$
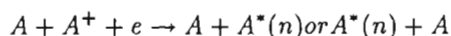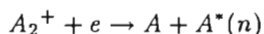
These are important recombination channels in weakly ionised stellar plasmas, for temperatures T ≤ 11000 K

In this contribution we present an approximate method, derived from previous one for the case n $\gg$ 1. In the case of hydrogen, this method agrees within several percents with previous one for n2¿110 and converges very quckly. The method is based

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on tables with results of more sophysticated calculations for a particular n (n = 10 in the present case), which are a starting point for a simple interpolation to higher n cases.

Mihajlov A. A., Dimitrijević M. S., 1992, *INFLUENCE OF ION-ATOM COLLI-SIONS ON THE ABSORPTION OF RADIATION IN WHITE DWARFS*, Astron.Astrophys. **256** pp. 305-308.

In order to provide the relevant absorption coefficients for the interpretation of the continuum absorption spectra in a number of white dwarfs with helium dominated atmospheres, the processes
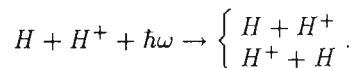
$$He_2^+ + \hbar\omega \rightarrow He + He^+$$

and

$$He + He^+ + \hbar\omega \rightarrow \begin{cases} He + He^+ \\ He^+ + He \end{cases}$$
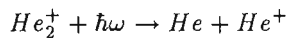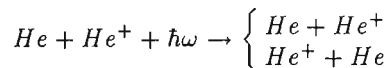
have been considered together. We present also the absorption coefficients for the conditions of DA white dwarf atmospheres calculated by taking into account together the processes

$$H_2^+ + \hbar\omega \rightarrow H + H^+$$

and

$$H + H^+ + \hbar\omega \rightarrow \begin{cases} H + H^+ \\ H^+ + H \end{cases}.$$
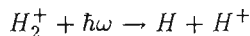
Dimitrijević M. S., 1993, *STARK BROADENING OF Pt II LINES IN CHEMI-CALLY PECULIAR STARS*, Astrophys.Lett. and Communications **28** pp. 381-383.

The need for a very extensive list of line broadening data is particularly stimulated by spectroscopy from space. In such a manner an extensive amount of spectroscopic information over large spectral regions of all kind of celestial objects has been and will be collected, stimulating the spectral-line-shape research.

Lines of Pt II have been discovered in Hg Mn stars by Dworetsky. An analysis of few strong Pt II transitions which are also observed in IUE spectra of stars had shown "that Pt is, like Hg, among the most overabundant elements in the atmospheres of Hg Mn stars". Dworetsky et al. (1984) selected also the four Pt II lines which might be used for astrophysical applications. Moreover, they determined the corresponding theoretical gf values. The aim of this contribution is to investigate Stark broadening of these Pt II lines and to provide the corresponding Stark widths.

Consequently, by using the modified semiempirical approach, Stark widths of 1777.1 $\overset{\circ}{A}$; 2245.518 $\overset{\circ}{A}$; 1781.858 $\overset{\circ}{A}$ and 2144.244$\overset{\circ}{A}$ Pt II lines, observed in Hg Mn stars have been calculated.

Dimitrijević M. S. & Popović L. Č., 1993, *ON STARK BROADENING OF HEAVY ELEMENT LINES IN A - TYPE STAR SPECTRA : Bi II LINES*, ASP Conference Series **44**, eds. M. M. Dworetsky, F. Casteili and R. Faraggiana, pp. 165 – 168, Trieste, Italy.

We report here results of Bi II spectral lines Stark broadening research within the MSE. The strong absorption Bi II lines observed in Hg-Mn star atmospheres have been investigated as well as the influnece of the departure from LS coupling and the correct knowledge of ionization potential. The observed results have been compared with othe estimations and with experimental results.

Kršljanin V., Dimitrijević M. S., 1993, *STARK SHIFTS OF C IV LINES IN THE SPECTRUM OF PG 1159-035*, X Nac.Konf.Astron. Jugoslavije, Beograd, Publ. Obs. Astron. Belgrade **44** pp. 45-48.

Using the semiclassical results for electron- and proton - impact shifts as well as a NLTE model atmosphere, we have calculated total Stark shifts (due to collisions with electrons and He^{2+}, C^{4+}, O^{6+}, H^+ ions, estimating the ionic contribution within the adiabatic approximation) of the cores of C IV lines from 62 multiplets in the spectrum of the carbon rich, very hot, pulsating pre White Dwarf PG 1159-035 (log g = 7; T_{eff} = 140,000 K; C/He = 0.7, H/He = 0.21), prototype of its class. Obtained shifts vary for six orders of magnitude, reaching 80 km/s for 6f - 7g multiplet.

Mihajlov A. A., Dimitrijević M. S., 1993, *THE INFLUENCE OF ION-ATOM RADIATIVE COLLISIONS TO THE OPACITY IN HELIUM RICH DB WHITE DWARFS*, Int.Conf.on Chemmically peculiat and magnetic stars on and close to upper main sequence, Stara Lesna p. 3.

We investigate the influence to the continuous optical spectrum of the helium rich DB white dwarf atmosphere of radiative processes due to $He^+(1s) - He(1s^2)$ collisions. We show that these ion-atom radiative collision processes are of importance at certain layers of the investigated white dwarf atmosphere, and the corresponding contributions to the optical depth and continuous opacity are not negligible.

A. A. Mihajlov, Dimitrijević M. S., Ignjatović Lj. M., 1993, *ION-ATOM RADIATIVE COLLISIONS AND CONTINUOUS OPTICAL SPECTRA IN HELIUM REACH DB WHITE DWARF ATMOSPHERE*, XVI Symp.Phys.Ioniz.Gases, Beograd pp. 365-368.

The influence of the processes of radiative charge transfer and photoassociation during $He^+ + He$ collisional processes, as well as the process of the photodissociation of He_2^+ molecular ion, on the phormation of continuous spectrum of the DB white dwarf atmospheres in function of T_{eff}, and $\log g$ (gravities)d 8, is studied within the wavelenght range $\lambda = 200 - 800$ nm. It is shown that the contribution of these processes relative to other relevant radiative processes is particularly important for $T_{eff} \leq 16000$ K, and increases with the decrease of T_{eff}. Moreover, it is found that the influence of the considered $He^+ + He$ radiative processes is particularly pronounced in the UV range.

Popović L. Č., Dimitrijević M. S. & Vince I., 1993, *SPECTRUM OF CP STARS : STARK WIDTH OF HEAVY ION LINES*, Publ. Obs. Astron. Belgrade **44**, pp. 55 – 58.

We present here the results of our investigation of Stark braoadening for a number of astrophysically important heavy ion lines in order to provide the corresponding Stark broadening data needed for astrophysical purposes.

Vince I., Popović L. & Dimitrijević M. S., 1993, *STARK BROADENING OF HEAVY ION SPECTRAL LINES IN SPECTRA OF CP STARS*, 25th Meeting and Workshop of the Europen Working Group on CP Stars, Szombathely, Hungary.

Dimitrijević M. S., 1994, *STARK BROADENING OF STELLAR Pt II LINES*, in Pulsastion, Rotation and mass loss in early-type stars, eds. L.A.Balona, H.F.Henrichs, J.M. Le Contel, Kluwer, Dordrecht, Boston, London pp. 337-338.

An analysis of few strong Pt II transitions which are also observed in IUE spectra of stars had shown (Dworetsky et al., 1984) "that Pt is, like Hg, among the most overabundant elements in the atmospheres of Hg Mn stars, with enhancements of the order of 10^4 to 10^5 over the solar system abundances".Dworetsky et al. (1984) selected also the four Pt II lines which might be used for astrophysical applications. Moreover, they determined the corresponding theoretical gf values. The aim of this contribution is to investigate Stark broadening of these Pt II lines and to provide the corresponding Stark widths.

In the case of more complex atoms or multiply charged ions the lack of the accurate atomic data needed for more sophisticated calculations, decreases the reliability of the semiclassical results. In such cases approximate methods might be very interesting. Good possibilities provides e.g. the modified semiempirical method (Dimitrijević and Konjević, 1980) used here for these calculations. Our results for four Pt II lines selected by Dworetsky et al. (1984) as the most interesting ones from the astrophysical point of view, have been calculated here. The influence of the oscillator strength values on the Stark broadening parameters has been analyzed here as well.

Jevremović D. and Vince I., 1994, *FeII EMISSION LINES IN IUE SPECTRA OF COOL SUPERGIANT μ CEPHEI*, in 17th Summer school and International Symposium on the Physics of Ionized Gases (eds. B. Marinković and Z. Petrović), 319–322.

Jevremović D., Vince I., 1994, *MgII h AND k LINES IN THE IUE SPECTRA OF THE COOL DUSTY SUPERGIANT μ CEP*, Bull. Astron. Belgrade **150**, 41–46.

Our results of investigation of MgII h and k lines in the IUE high resolutin spectra of the cool dusty supergiant μ Cep have been presented. We obtained the profile parameters and found the total chromospheric radiative loss.

Mihajlov A. A., Dimitrijević M. S., Ignjatović Lj. M., 1994, *ION ATOM COLLISIONS AND ELECTRON RECOMBINATION IN ASTROPHYSICAL HYDROGEN PLASMA*, XVII Symp.Phys.Ioniz.Gases, Beograd pp. 346-349.

Arsenijević J., Marković – Kršljanin S., Jankov S., Kršljanin V., and Popović L. Č., 1993, *LINEAR OPTICAL POLARIZATION OF THE STAR BU Tau*, Publ. Obs. Astron. Belgrade **44**, 77.

The intrinsic linear optical polarization percentage and position angle durin the period 1986–1992 are presented. These data are the result of Belgrade polarimteric study of Be stars. Polarization percentage have a general decreasing trend starting with the value 0.57% and finishing with the value 0.32% . The position angle varied in a range between 58° and 71° without any general trend.

Arsenijević J., Marković – Kršljanin S., Kršljanin and Jankov S., 1993, *LINEAR OPTICAL POLARIZATION DURING THREE SHELL PHASES OF THE STAR o AND*, Proc. of the 16th SPIG (Ed. M.Milosavljević), 361. Obs.

The optical polarization of the star o And, measured in Belgrade Observatory, during the period 1974-1992 is presented. The data clearly display the changes of both polarization parameters, percentage and position angle. The changes globaly correlate with the three shell phases, with the H-alfa emission. The observed polarization percentage reaches maxima of 0.66, 0.52 and 0.48 percents in the years 1975, 1983 and 1988 respectively. Low values, under 0.2position angle varies between the values 54 and 137 degrees having tendency to be higher during the periods of high polarization percentage.

Arsenijević J., Marković–Kršljanin S., Kubičela A., Jankov S., 1994, *COMMON PROPERTIES OF SOME Be STARS OPTICAL POLARIZATION PARAME-TERS*, In : Pulsation, rotation and mass loss in early-type stars (L.A. Balona, H.F. Henrichs, and J.M. Le Contel, Eds.), Kluwer Acad. Publ., Dordrecht/Boston/London, 236–237.

The long-term changes of the intrinsic polarization percentage are evident in the stars o. γ and 88 Her (during the period of time 1974-1992), κ (1979-1992) and BU Tau (1986-1992). The amplitude of the polarization percentage variations are not more than a half of the percent. The changes of the position angles are within an interval of about 30 degrees.

Arsenijević J., Marković-Kršlajnin S., Vince I., Jankov S., 1995, *SOME CHARAC-TERISTICS OF INTRINSIC POLARIZATION OF Be STAR κ DRA*, (Proc. of the first Hungarian–Yugoslav astronomical conference, eds. Vince I., Dimitrijević and Balázs L.) Publ. Obs. Astron. Belgrade **49**, 73–76.

The intrinsic polarization parameters of κ Dra in V-color measured at Belgrade Observatory during the 14 years period (1979–1992) are presented. The changes of polarization percentage are discussed with the data of V-color photometry and H_α emission line equivalent widths.

10. STAR CLUSTERS AND GALAXIES

10. ЗВЕЗДАНА ЈАТА И ГАЛАКСИЈЕ

Brosche P., Tucholke H.-J., Klemola A. R., Ninković S., Geffert M. and Doerenkamp P., 1991, *SPACE MOTIONS OF GLOBULAR CLUSTERS NGC 362 AND NGC 6218 (M12)*, Astron. J. **102**, pp. 2022-2027.

We measured the absolute proper motions of NGC 6218 ($M12$) against distant galaxies and of NGC 362 against stars of the Small Magellanic Cloud (typical accuracy $\pm 0 \overset{"}{.} 13 cent^{-1}$). The results are combined with those of the two studied clusters NGC 4147 and NGC 5466. A variety of parameters is determined within the approximation of a simple galactic potential, including the description of the last transits of the clusters through the main plane of the Galaxy. The path of the orbits in a meridional section (based on a more refined potential) is provided for the last 10^{10} yr. We would like to draw attention to orbits with north-south asymmetry, as exemplified by the tube orbit of NGC 4147.

Mullari A. A., Nechitailov Yu. V., Ninković S. and Orlov V. V., 1991, *PROPERTIES OF STAR FLOWS IN DYNAMICAL MODELS OF GALAXY*, Abstracts IAU Symposium 149, "The Stellar Populations of Galaxies", Angra dos Reis, Brazil, pp. 23.

Using the computer simulations we have studied the stellar orbits in two models of our Galaxy : the Kutuzov-Osipkov model (1989) and the Allen-Martos model (1986). We compare the orbits of stars being the probable members of the stars flows versus the orbits of stars outside the moving clusters. Some general properties of typical orbits are discussed. The contours of orbits and folds are outlined. We estimate a measure of ergodity for the various types of orbits.

Ninković S., 1991, *ANALYSIS OF THE EQUIPOTENTIAL SURFACES OF CORO-NAE OF SPIRAL GALAXIES*, Bull. Obs. Astron. Belgrade **143**, pp. 49-51.

Assuming a spheroidal corona with an analogous density function as in Ninković, 1988, the author analyses the resulting equipotential surfaces. They are found to be spheroids. The obtained results are applied to our Galaxy by estimating the distance to the galactic plane above (below) the Sun where the potential is one half of that at the Sun. This distance is found to be equal a few tens of kpc. Therefore, at the present level of information one cannot reject the possibility that the galactic corona is flattened significantly.

Ninković S., 1991, *A STUDY OF THE VELOCITY DISTRIBUTION FOR A PAR-TICULAR CASE OF THE SPHERICAL SYMMETRY*, Bull. Obs. Astron. Belgrade **144**, pp. 1-3.

Ninković S., 1992, *ON THE LOCAL VELOCITY DISPERSIONS*, IAU Symposium 149 Proc. "The Stellar Populations of Galaxies", eds. B. Barbuy and A. Renzini, Kluwer Academic Publishers, Dordrecht, pp. 463-464.

The ratio of the local velocity dispersions for the stars of the galactic disc is studied. It is inferred that the involving of the local asymmetric-drift value can help to a better understanding of the relationship between the local properties of the galactic gravitation field and the ratio of the dispersions of the planar velocity components.

Ninković S., 1992, *ON THE TOTAL KINETIC ENERGY OF OUR GALAXY WITH THE CONTRIBUTION OF THE POPULATIONS*, IAU Symposium 149 Proc. "The Stellar Populations of Galaxies", eds. B. Barbuy and A. Renzini, Kluwer Academic Publishers, Dordrecht, pp. 465-466.

The total kinetic energy of the Galaxy is estimated through the corresponding potential energy by means of the virial theorem. The contribution of each galactic population is considered. It is found that this contribution is rather equal in the specific kinetic energy; otherwise the contribution in the kinetic energy of a given population is followed by the corrresponding one in the total mass. It is inevitable to include the contribution of the dark corona in such a calculation though its nature is rather hypothetical. This population might even exceed the others in the contribution to the specific kinetic energy due to the, usually, very large volume assumed for the dark corona of a typical spiral galaxy.

Ninković S. and Filipović M., 1992, *AN EXAMINATION OF THE MOTION IN AN ACCELERATED FIELD*, Proc. 1st General Conference Balkan Physical Union, Vol. I, ed. K. M. Paraskevopoulos, Hellenic Physical Society, Thessaloniki Branch, pp. 469-471.

We study a special case of a spherically symmetric stellar system moving around the centre of its parent system also possessing the spherical symmetry. The orbits of both the test particle with respect to the satellite system and of the latter one with respect to the parent system are rectilinear. A tentative conclusion may be that test particles with apocentric distances even exceeding the critical radius could survive.

Нинкович С. и Петровская И. В., 1992, *ОБ ОЦЕНКЕ МАССЫ И СПЛЮСНУТОСТИ КОРОНЫ ТУМАННОСТИ АНДРОМЕДЫ*, Астрономический журнал, 69, pp. 926-933.

Оценивается масса Туманности Андромеды (M 31), причем нижний предел получается по кривой вращения, а верхний предел - по движениям ее спутников. Результаты неплохо согласуются между собой, а если принять сплюснутость короны, согласие улучшается.

Petrovskaya I. V. and Ninković S., 1992, *THE CONTRIBUTION OF THE BULGE TO THE GALACTIC ROTATION CURVE*, Abstracts IAU Symposium 153, "Galactic Bulges", Gent, Belgium, pp. 29.

Assuming a suitable model for the galactic thin disc and by adding the contribution of the bulge we construct a rotation curve for the inner Galaxy which should be compared to the observational one. Among the variety of models for the bulge proposed by us at the moment as the most perspective appears one containing a dense central core and a "halo". The total mass of this bulge is concentrated within a cutoff radius of about 5 *kpc*.

Chernin A. D., Ninković S. and Ćatović Z., 1993, *STUDIES OF THE SATELLITE MOTION IN THE LOCAL GROUP*, Mathematical Methods in Studying the Structure and Dynamics of Gravitating Systems, Program and Abstracts, Kosalma-Petrozavodsk, Russia, pp. 37.

The motion of a satellite of the Milky Way in the conditions of Andromeda Nebula approaching along a straight line is studied. The effects of the changes in the basic orbit (without the presence of Andromeda) around the Milky-Way centre are assessed.

Ninković S., 1993, *SOME APPLICATIONS OF AGEKYAN'S CRITERION*, Mathematical Methods in Studying the Structure and Dynamics of Gravitating Systems, Program and Abstracts, Kosalma-Petrozavodsk, Russia, pp. 35.

The application of Agekyan's criterion for the purpose of discriminating the multiple stars from the open clusters is studied.

Ninković S. and Ćatović Z., 1993, *A NUMERICAL N-BODY EXPERIMENT SIMULATING AN OPEN CLUSTER*, Mathematical Methods in Studying the Structure and Dynamics of Gravitating Systems, Program and Abstracts, Kosalma-Petrozavodsk, Russia, pp. 36.

The authors give a description of their algorithm used for the purpose of studying an imaginary open cluster consisting of 100 stars.

Ninković S. and Ćatović Z., 1993, *ON THE CHOICE OF THE INITIAL CONDITIONS IN AN N-BODY EXPERIMENT*, Publ. Obs. Astron. Belgrade, Proc. National Conference Yug. Astronomers, **44**, pp. 85-87.

The authors discuss the choice of the initial conditions in their numerical experiment concerning a simulation of a hypothetical open cluster containing 100 stars (mass points) based on the N-body approach.

Petrovskaya I. V. and Ninković S., 1993, *THE CONTRIBUTION OF THE GALACTIC BULGE TO THE GALACTIC ROTATION CURVE*, IAU Symposium 153 Proc. "Galactic Bulges", eds. H. Dejonghe and H. J. Habing, Kluwer Academic Publishers, Dordrecht, pp. 353-354.

The authors study the contribution of the galactic bulge to the rotation curve of the Galaxy in various mass models. Since the bulge is usually thought to be in the central region, the central parts are of interest where an additional subsystem is introduced by the authors, namely a dense central core. The purpose is to explain the sharp peak

near the centre found on the rotation curves of spiral galaxies. The mass of the bulge, not including the core, is about 15 $GM_\odot$.

Atanacković–Vukmanović O., Popović L. Č., Vince I. & Kubičela A., 1994, *CONTRIBUTION OF GRVITATIONAL REDSHIFT TO SPECTRAL LINE PROFILES OF AGN : THE CASE OF VOIGT PROFILE*, Bull. Astron. Belgrade **150**, pp. 1–6.

In this paperr we analyze the influence of gravitational redshift on the spectral line profiles of AGN when the radiative transfer effects are taken into account. Assuming Voigt profile function for H_β line the importance of this effect is illustrated through several examples of different optical thickness of the emission region situated at various distances from the massive nucleus.

Mullari A. A., Nechitailov, Yu. V., Ninković S. and Orlov V. V., 1994, *THE ORBITS OF MOVING CLUSTERS IN THE GALACTIC DYNAMICAL MODELS*, Astroph. Space Sci., **218**, pp. 1-11.

The orbits of nine moving star clusters distinguished by Agekian and Orlov (1984) are studied in the rotationally symmetric field of the Galaxy. The three galactic models are considered : the potentials of Sala (1987), Allen and Martos (1986), Kutuzov and Osipkov (1989). In the first model applied to a local galactic region in the solar circle vicinity, the orbit of each star is periodic in the meridional plane. The presence of two streams of the moving clusters is assumed. The superclusters of Sirius and Hyades are connected with these streams. For the two latter global galactic models, the orbits of principal stars in the moving clusters, as well as the ones of the stars which are probable non-members of clusters are calculated. A typical lifetime of the moving clusters in the galactic field is estimated.

Ninković S., 1994, *ON THE CIRCULAR VELOCITY IN THE ANDROMEDA GALAXY*, Astroph. Space Sci., **215**, pp. 1-9.

By analysing a sample of 158 globular clusters belonging to the galaxy M 31 or Andromeda Nebula (AN) in the framework of a spherically symmetric model with constant circular velocity a value of $260 \pm 40 kms^{-1}$ for this quantity is obtained. It is also found that the number density of AN globulars roughly decreases as the cube of the distance to the centre with a cutoff radius of about 40 kpc. The implied AN mass within this cutoff is about 0.6 $TM_\odot$ ($1 \ TM_\odot = 10^{12} M_\odot$). Bearing in mind the model limitations this mass is rather an upper limit. The present results suggest 1.5 as a probable value for the mass ratio of AN to the Milky Way unless their massive dark coronae are significantly different in size.

The velocity distribution of AN globulars seems to be close to isotropic.

Ninković S., 1994, *ON THE POTENTIAL ENERGY OF SPHERICALLY SYMMETRIC STELLAR SYSTEMS*, Bull. Astron. Belgrade, **150**, pp. 7-10.

The case of spherically symmetric, self-consistent, stellar systems, whose total mass is contained within a finite radius, is considered. A general formula for their potential

energy, where the latter is expressed in terms of the total-mass square, limiting radius and a dimensionless coefficient depending on the general density slope, is given. Though the increase of this dimensionless coefficient follows the increasing in another dimensionless quantity (ratio limiting radius to half-mass one), the ratio of the two, for the case of the realistic models examined in the present paper, remains almost constant, usually about 0.4-0.5 depending on the given model.

Ninković S., 1994, *AN ESTIMATE OF THE DARK MATTER CONTENT IN THE GALAXY*, Abstracts of Poster Papers XXIInd IAU General Assembly, den Haag, the Netherlands, Abs. No S 164.E.43, pp. 49.

The total mass of the dark matter in the Milky Way, as well as its rate in the Milky-Way total mass, are estimated by combining the limits imposed by the condition that the Local Group is probably bound and the constraints to the local escape velocity. The dark-matter rate in the Milky-Wy total mass might exceed even 90%.

Ninković S., 1994, *A SYSTEM OF GALACTIC CONSTANTS BASED ON STELLAR DYNAMICS*, Abstracts of Poster Papers XXIInd IAU General Assembly, den Haag, the Netherlands, Abs. No S 169.H.84, pp. 172.

Assuming that the Galaxy is in a steady state characterised with axial symmetry as a working hypothesis a system of galactic constants based dynamically is proposed. This system contains ten independent constants. The current knowledge concerning the amounts and relationship among them is discussed as well.

Popović L. Č., Vince I. & Kubičela A., 1994, *INFLUENCE OF THE GRAVITATIONAL FIELD ON THE SHAPE OF SPECTRAL LINES IN SPECTRA OF SEYFERT GALAXIES AND QUASARS*, in Multi − wavelength continuum emission of AGN, p.456 (eds. T.J.-L. Courvoisier and A. Blecha), Kluwer Academic Publishers, Dordrecht − Boston − London.

An idea about possibility of change of spectral line shapes in a strong gravitational field have been presented.

Popović L. Č., Vince I., Kubičela A., Atanacković–Vukmanović O. & Samurović S., 1994, *CONTRIBUTION OF GRAVITATIONAL REDSHIFT TO SPECTRAL LINE PROFILES OF AGN : THE CASE OF LORENTZIAN PROFILE*, Bull. Astron. Belgrade **149**, p. 9.

In this paper we analyse the influence of gravitational redshift on the spectral line profiles of homogeneous, static and optically thin region near massive AGN (Seyfert galaxies and quasars). The correction function (Φ) that determines the degree of spectral line profile distorsion produced by gravitational field has been investigated.

Chernin A. D., Ninković S. and Ćatović Z., 1995, *STUDIES OF THE SATELLITE MOTIONS IN THE LOCAL GROUP*, Astron. Astrophys. Trans., **7**, pp. 111.

The motion of a satellite represented as a test particle in the field of the Milky Way and Andromeda Nebula, where the motion of the latter two is rectilinear, is studied.

The authors look for the changes in the satellite's orbit compared to the case of the Milky Way alone for a variety of initial conditions.

Нинковић С., 1995, *ЗВЕЗДАНИ СИСТЕМИ*, Publ. Obs. Astron. Belgrade, **48**, pp. 87-100.

Дат је један преглед садашњег стања истраживања на пољу звезшдане астрономије намењен, пре свега, студентима као читалачкој публици. Звездана астрономија се дефинише као општа наука о звезданим системима, али без укључивања космологије (проучавање васионе као целине). Констатује се да проблематика ни из далека није исцрпљена, као и да постоје услови за развој звездане астрономије код нас.

Ninković S., 1995, *THE MILKY WAY LOCAL DYNAMICS*, Publ. Obs. Astron. Belgrade, **49**, pp. 7-13.

The dynamics of our own Galaxy (the Milky Way) in the solar neighbourhood is analysed. It is emphasized that in the framework of the classical approach, which involves the steady state and axial symmetry, the main research directions are the determination of the dynamical constants and the explanation of the local kinematics. In spite of this it seems that the classical approach is not sufficient to explain the entire variety of the observed phenomena. Some of them (vertex deviation, velocity-dispersion increasing with age, etc) in the present author's opinion require its generalisation towards a triaxial symmetry and a nonsteady state.

Ninković S., 1995, *ON THE VALUE OF AGEKYAN'S FACTOR IN STELLAR SYSTEMS*, Bull. Astron. Belgrade, **151**, pp. 1-5.

The behaviour of Agekyan's factor - the quantity $\frac{<m^{3/2}>}{<m>^{3/2}}$ appearing in the formula of Agekyan's criterion for estimating the importance of irregular, resp. regular forces, in stellar systems - is studied. It is found that in the case of a mass distribution of stars expected on the basis of stellar statistics the value of this quantity tends to be about 2. In general, the value of Agekyan's factor exceeds one, increasing gradually with N (number of stars in a stellar system) towards 2 expected for N high enough. According to Agekyan's criterion with taking into account the present results a classification of gravitationally bound stellar systems consisting of stars based on stellar dynamics is proposed.

Ninković S., 1995, *SOME APPLICATIONS OF AGEKYAN'S CRITERION*, Astron. Astrophys. Trans., **7**, pp. 195-196.

The well-known formula of Agekyan's criterion yielding the role of regular, i. e. regular forces in stellar systems is analysed. A special attention is paid to the factor depending on the mass distribution within the system. A preliminary conclusion is reached that for N (total number of stars in stellar system) about 5 the ratio characterising the role of the regular, i. e. irregular forces, mentioned above, attains one.

Ninković S., 1995, *ON THE POTENTIAL ENERGY OF SPHERICALLY SYMMET-RIC STELLAR SYSTEMS*, Abstracts of "Structure and Evolution of Stellar Systems", Petrozavodsk, Russia, pp. 65.

A general formula for expressing the potential energy of spherically symmetric stellar systems is found. In it the latter one is given through the square of the total mass, the limiting radius and a dimensionless coefficient. The ratio of this dimensionless coefficient to another dimensionless quantity - the ratio of the limiting radius to the half-mass one - remains almost constant (0.4-0.5) for the case of some realistic models examined here.

Ninković S. and Ćatović Z., 1995, *A NUMERICAL EXPERIMENT SIMULATING AN OPEN CLUSTER*, Astron. Astrophys. Trans., **7**, pp. 237-238.

A numerical experiment based on N-body problem comprising 100 point masses (an imaginary open cluster) is briefly described. Agekyan's factor for this case is calculated. The algorithm is described. The numerical stability is monitored by calculating the values of the first integrals (energy, angular momentum and that of mass centre). The increase in the virial coefficient is examined.

Ninković S., Cubarsi R. and Sanz J., 1995, *DISCUSSION OF HYPOTHESES AND DYNAMIC MODELS FOR STELLAR SYSTEMS*, Abstracts of "Structure and Evolution of Stellar Systems", Petrozavodsk, Russia, pp. 19.

The authors present an overview of some relationships between the hypotheses like axial symmetry, symmetry plane, normal velocity distribution for stellar populations, etc and some possible observational facts, such as vertex deviation, general asymmetry of the velocity distribution, existence of radial different movement, etc.

Ninković S., Petrovskaya I. V. and Nikiforov I. I., 1995, *THE ROTATION CURVE AND MULTICOMPONENT MODEL OF THE GALAXY*, Abstracts of "Structure and Evolution of Stellar Systems", Petrozavodsk, Russia, pp. 38.

The Milky-Way rotation curve obtained recently by Nikiforov and Petrovskaya is studied. We propose a multicomponent (usually three - bulge, disc and corona) model of the Milky Way for the purpose of explaining it. The bulge is almost spherically symmetric (slightly flattened), the disc is exponential and truncated and the corona is spherical.

Ninković S. and Trajkovska V., 1995, *ON THE VALUE OF AGEKYAN'S FACTOR IN REAL DOUBLE STARS*, Abstracts B' Hellenic Astronomical Conference, Thessaloniki, Greece, pp. 32.

Agekyan's factor - a dimensionless quantity depending on the mass distribution within stellar system - is analysed for a sample containing 104 double stars. The obtained mean value is compared to the theoretical prediction of Ninkovic (who found 1.07).

Popović G. M., 1995, *STELLAR PROPER MOTIONS IN THE PROCEDURE OF DETECTION OF THE RADIANT STAR CLUSTERS*, Astronomical and Astrophysical Transactions, **7**, pp. 135 – 137.

Following a suggestion put forward by T. A. Agekyan a method was evolved for the detection of radiant star clusters using star proper motions. Presented are the fundamentals of the method.

Popović G. M., Ninković S., Pavlović R., 1995, *A KINEMATICAL APPROACH TO THE SEPARATION OF MOVING-CLUSTER MEMBERS*, Structure and Evolution of Stellar Systems (Abstracts of Conference), Petrozavodsk, pp. 31

The nine moving star clusters discovered by Agekyan and Orlov are analysed by applying two methods. In the first one we calculate the heliocentric-velocity directions for the cluster stars and in the second one the great circles of their proper motions are analysed. Though a satisfactory agreement is found, it is possible to eliminate on the basis of the second approach some stars as cluster members.

Popović G. M., Ninković S., Pavlović R., 1995, *AN ANALYSIS OF NINE MOVING-CLUSTERS*, Bull. Astron. Belgrade, **152**, pp. 59 – 63.

The nine moving star clusters discovered by Agekyan and Orlov are analysed by applying two methods. In the first one we calculated the velocity directions for the cluster stars relative to the Sun and in the second one the circles of their proper motions are analysed. Though a satisfactory agreement is found, it is possible to eliminate on the basis of the second approach some stars as cluster members.

Popović L. Č., Vince I., Atanacković – Vukmanović O. and Kubičela A., 1995, *CONTRIBUTION OF GRAVITATIONAL REDSHIFT TO SPECTRAL LINE PROFILES OF SEYFERT GALAXIES AND QUASARS*, Astron. Astrophys. **293**, pp. 309-314.

In the present work we analyse the influence of gravitational field on the profile of spectral lines. For kinematically very composite regions near nuclei of Seyfert galaxies and quasars both th optically thin and optically thick cases have been considered. We suppose that the line profile without gravitational field influence (undisturbed profile) is a Voigt one.

Irrespective of any other (mostly Doppler) influence the gravitational one yields shifted and asymmetric, and under the assumption of optically thin region, broadened spectral lines. The blue wing of the deformed spectral line is lower, while the red on is higher than in th undisturbed line profile. In the case of optically thin region we have discussed the shape of spectral lines for different wavelength ranges.

Popović L. Č., Jevremović D., Vince I. T. Milovanov, 1995, L_α *LINE IN THE MKN335 SEYFERT 1 GALAXY*, (Proc. of The first Yugoslav conference on spectral line shapes, eds. Dimitrijević and L. Č Popović) Publ. Obs. Astron. Belgrade **50**, 107–110.

The analysis of the L_α emission line profile of Mkn 335 Seyfert 1 galaxy is presented. The line profile shows a prominent blue asymmetry (A=0.18). For description of this asymmetry a model with outflow emission gas and gravitational redshift effect in Broad Line Region (BLR) are applied.

11. THEORETICAL ASTROPHYSICS AND PLASMA PHYSICS

11. ТЕОРИЈСКА АСТРОФИЗИКА И ФИЗИКА ПЛАЗМЕ

11.1. Radiative transfer
11.1. Пренос зрачења

Atanacković –Vukmanović O., 1991, *CONTRIBUTION TO THE SOLUTION OF THE RADIATIVE TRANSFER PROBLEM IN STELLAR ATMOSPHERES*, PhD Thesis, Faculty of Mathematics, University of Belgrade

In the thesis a new fast-convergent iterative method is developed to solve the NLTE line formation problem in stellar atmospheres. The method is based on the introduction of proper iteration factors, defined as the ratios of the radiation field intensity moments, in a simple iterative procedure. The formal solution of the RT equation used for the computation of the iteration factors and the solution of the moment equations closed by these factors is performed in turn. Several families of the factors are defined and their convergence properties are studied and discussed. Due to the quasi-invariant properties of the factors, the exact solution is achieved in a few iterations even under extreme NLTE conditions. A very high rate of convergence is provided by the explicit introduction of the basic physical properties of the problem in the definition of the iteration factors, i.e. by the best mathematical simulation of the radiation transport process. This simple method, requiring only small computational costs and efforts, is a powerful tool for the treatment of more complexe astrophysical problems in which radiative transfer is coupled with other physical phenomena.

Atanacković –Vukmanović O., Simonneau, E., 1991, *ITERATION FACTORS METHOD IN THE SOLUTION OF THE NLTE LINE TRANSFER PROBLEM*, Proc. of the 1st General Conf. of the Balkan Physical Union, 138–140.

Simonneau E., Atanacković -Vukmanović O., 1991, *ITERATION FACTORS IN THE SOLUTION OF THE NLTE LINE TRANSFER PROBLEM* , in "Stellar atmospheres : Beyond classical models", eds. L. Crivellari et al., Kluwer Academic Publishers, 105–110.

A simple and efficient mixed iteration procedure that uses iteration factors to solve the non-LTE line transfer problem is presented. By suitable choice of quasi-invariant iteration factors, the exact solution is reached within only a few iterations even under physical conditions very far from LTE.

Atanacković –Vukmanović O., Simonneau, E., 1993, *THE USE OF ITERATION FACTORS IN THE LINE FORMATION PROBLEM WITH SPATIAL VARIATIONS IN PROFILE FUNCTION*, Publ. Obs. Astron. Belgrade 44, 41–44. [Proc. of the X National Conference of Yugoslav Astronomers]

In a previously published paper a simple and fast-convergent method using iteration factors is developed to solve two-level-atom line transfer problem in a constant property medium. In this paper a spatial variation of the profile function is taken into account and a new iteration factors family is considered.

Atanacković – Vukmanović O., Simonneau, E., 1994, *THE USE OF ITERATION FACTORS IN THE SOLUTION OF THE NLTE LINE TRANSFER PROBLEM – I. TWO-LEVEL ATOM*, J. Quant. Spectrosc. Radiat. Transfer, Vol. **51**, No.3, 525–543.

From the original idea of the monochromatic variable Eddington factors and through a critical revision of the straightforward Λ iteration scheme we have developed an improved iterative method to solve the line formation problem. The study deals with the computational aspects of the method when applied to the solution of the two-level-atom line transfer problem. At each iteration step, angle and frequency averaged depth-dependent factors defined as the ratios of the relevant intensity moments are computed from the current values of the radiation field. These factors are then used to close the system of the radiative transfer equation moments. Due to the quasi-invariance of the factors, the exact solution of the system is achieved within only a few iterations, even under physical conditions very far from LTE.

Atanacković–Vukmanović O., Simonneau, E., 1995, *ON SOME ITERATION FACTORS FAMILIES IN SOLUTION OF LINE TRANSFER PROBLEM WITH DEPTH-DEPENDENT PROFILE FUNCTION*, Publ. Obs. Astron. Belgrade **49**, 77–80. [The First Hungarian–Yugoslav Astronomical Conference, Baja]

Atanacković –Vukmanović O., Simonneau, E., 1995, *SOLUTION OF THE LINE FORMATION PROBLEM BY THE USE OF ITERATION FACTORS*, Publ. Obs. Astron. Belgrade **50**, 7, (abstract), Proc. of The First Yugoslav Conference on Spectral Line Shapes, Krivaja)

11.2. Spectral line shapes in astrophysics and plasma physics
11.2. Профили спектралних линија у астрофизици и физици плазме

Dimitrijević M. S., and Sahal-Bréchot S., 1989, *TABLES FOR HeI LINES STARK BROADENING PARAMETERS*, Bull.Obs.Astron.Belgrade **141**, pp. 57-86.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 79 He I multiplets as a function of temperature (T = 10000 K - 200000 K) and perturber density (N = 10^{14} - 10^{19} cm^{-3}).

Dimitrijević M. S., and Atanacković-Vukmanović O., 1990, *PLASMA SCREENING EFFECTS ON STARK BROADENING OF ION LINES AT THE ADIABATIC LIMIT*, Annales de Physique, Coll. No 3, Suppl. au No 3, **15**, pp. 76-80.

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The plasma screening effects on the Stark broadening parameters of ion lines at the adiabatic limit are shown by the use of both Coulomb cut-off and Debye - Hückel screening model potentials.

Dimitrijević M. S., and Ben Nessib N., 1990, *SIMPLE CONVERGENT FORMULA FOR ESTIMATING STARK WIDTHS OF NEUTRAL ATOM LINES*, American Institute of Physics Conference Proceedings **216**, pp. 605- 606.

A simple analytical expression for estimating Stark widths of neutral atom lines has been derived from a convergent theory that avoids the computation of the minimum impact parameter. The formula obtained was applied to He I lines. The obtained results have been compared to other calculations.

Dimitrijević M. S., and Peach G., 1990, *AN EXAMINATION OF REGULARITIES IN NEUTRAL ATOM BROADENING*, American Institute of Physics Conference Proceedings **216**, pp. 170- 171.

Regularities and similarities in the widths of spectral lines perturbed by neutral atoms have been studied in order to find out if they are apparent to such a degree that they can be used to obtain data by interpolation and hence provide a tool for the critical evaluation of new experimental results. The principal results on the clearly indentified regularities will be published soon.

Dimitrijević M. S., Peach G., 1990, *REGULARITIES AND SIMILARITIES ON THE WIDTHS OF SPECTRAL LINES PERTURBED BY NEUTRAL ATOMS*, Astron.Astrophys. **236**, pp. 261-267.

Regularities and similarities in the widths of spectral lines perturbed by neutral atoms have been studied in order to find out if they are apparent to such a degree that they can be used to obtain data by interpolation and hence provide a tool for the critical evaluation of new experimental results. Consideration of the structure of the emitting or absorbing atom indicates that similarities should exist for lines within a multiplet or supermultiplet. Line widths should also have a regular behaviour along a spectral series, for corresponding transitions in homologous emitters, and for iso-electronic sequences. The dependence of line widths on perturber properties such as polarisability has also been examined. Critically selected experiments on non - resonant broadening of spectral lines have been examined and exceptions from expected regularities are discussed.

Dimitrijević M. S., Sahal-Bréchot S., 1990, *STARK BROADENING OF NA (I) LINES WITH THE PRINCIPAL QUANTUM NUMBER OF THE UPPER STATE BETWEEN 6 AND 10.*, J.Quant.Spectrosc.Radiat.Transfer **44**, pp. 421-431.

A semiclassical approach for the Stark broadening of spectral lines, has bee used for the calculation of electron—, proton—, and He II—impact line widths and shifts for 46 Na I multiplets with the principal quantum number of the upper state between 6 and 10. Calculations have been performed as a function of temperature (T = 2500

K - 80000 K) at an perturber density of $N = 10^{13}$ cm^{-3}). The results have been used to investigate Stark broadening parameter regularities within spectral series.

Dimitrijević M. S., Sahal-Bréchot S., 1990, *STARK BROADENING OF K I LINES*, Bull.Obs.Astron.Belgrade **142**, pp. 29-57.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 51 K I multiplets as a function of temperature (T = 2500 K - 80000 K) and perturber density ($N = 10^{13}$ - 10^{18} cm^{-3}).

Dimitrijević M. S., Sahal-Bréchot S., 1990, *TABLES FOR Na I LINES STARK BROADENING PARAMETERS*, Bull.Obs.Astron.Belgrade **142**, pp. 59-77.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 61 Na I multiplets as a function of temperature (T = 10000 K - 200000 K) and perturber density ($N = 10^{14}$ - 10^{19} cm^{-3}).

Dimitrijević M. S., and Sahal-Bréchot S., 1990, *LINE PROFILE PARAMETERS FOR Li-LIKE IONS*, Annales de Physique, Coll.No 3, Suppl. au No 3, **15**, pp. 77-80.

Using a semiclassical perturbational approach in the impact approximation, Stark broadening parameters along the lithium isoelectronic sequence have been calculated. The obtained results have been compared with quantum mechanical calculations and with available experimental results.

Djurović S., Konjević N., and Dimitrijević M. S., 1990, *PLASMA BROADENING OF Br I AND II LINES FROM ($^1D_2$) np LEVELS*, American Institute of Physics Conference Proceedings **216**. (Spectral Line Shapes Vol. 6), pp. 65-66.

Systematic experimental and theoretical study of Stark broadening of Br I and II lines from ($^1D_2$)np levels has been performed.

Dimitrijević M. S., 1991, *ON THE APPROXIMATE METHODS FOR STARK BROADENING CALCULATIONS*, in Evolution of stars : The photospheric abundance connection, eds. G.Michaud, A.Tutukov, M.Bergevin. Universite de Montreal pp. 5-6.

Approximate methods for Stark broadening of non hydrogenic spectral lines, have been reviewed and discussed.

Dimitrijević, M. S., 1991, *LINE SHAPES INVESTIGATIONS IN YUGOSLAVIA II (1985-1989) (Bibliography and Citation Index)*, Publ. Obs. Astron. Belgrade **41** pp. 1-129.

First part of the publication contains review and analysis of the results of spectral line shapes investigations in Yugoslavia in the period 1985 - 1989. In the second part,

and quadratic Stark effects in a perturbed system. Our approach should be especially useful at relatively high plasma densities and at the adiabatic limit.

Purić, J., Ćuk, M., Dimitrijević M. S., and Lesage A., 1991, *SIMPLE ESTIMATES OF STARK BROADENING PARAMETERS ON THE BASIS OF REGULARITIES AND SYSTEMATIC TRENDS ALONG THE PERIODIC TABLE*, XX Int.Conf.Phen.Ioniz.Gases, Pisa pp. 1451-1452.

An approach, based on the found systematic trends in Stark broadening parameters, has been developed in a series of articles, in the case of neutral atoms and single charged ion resonances and offresonances. Similar regularities were found for the isoelectronic sequences; for the isonuclear sequences (the same type of transition within several stages of ionization of a particular emitter); and for the same type of transition within homologous group of atoms or ions. In the present work, we apply this approach to doubly and triply charged ion resonant and offresonant spectral lines.

Finally, we might conclude that, the approach described in the contribution, might be used for the predictions of missing Stark broadening data in the case of singly, doubly and triply charged ions.

Purić J., Ćuk M., Dimitrijević M. S., and Lesage A., 1991, *REGULARITIES OF STARK PARAMETERS ALONG THE PERIODIC TABLE*, Astrophysical Journal **382**, pp. 353-357.

Stark widths and shifts dependence on the upper level ionization potential of the corresponding transitions have been investigated on the basis of the semi-classical and semi-empirical data . The simple formulas obtained from that dependence can be used to predict the Stark broadening and shift parameters of resonance n_os - n_op and n_os - $(n_o + 1)$p (n_o for ground level) and offresonance $((n_o + 1)$s - $(n_o + 1)$p) lines of neutral atoms and ions (up to several stages of the ionization).

The predicted data are compared with the known experimental and theoretical values. The agreement is found to be within the quoted experimental and theoretical uncertainties. All data are given at the electron density $N = 10^{17} cm^{-3}$ and different electron temperatures T (for neutral atoms and singly charged ions T = 10,000 K, 20,000 K, 40,000 K and 80,000 K; for doubly and multiply charged ions T = 20,000 K, 40,000 K, 80,000 K and 160,000 K).,

Dimitrijević M. S., 1992, *STARK-BROADENING PARAMETERS OF IONIZED MERCURY SPECTRAL LINES OF ASTROPHYSICAL INTEREST*, J. Quant. Spectrosc. Radiat. Transfer **47**, pp. 315-318.

Stark broadening data for some Hg II lines are of importance for investigation of stellar spectra. E.g. $6s^2$ ^{2}D - $6p^2P^o$ 3983.95Å Hg II line is a strong and characteristic feature in the spectre of most of the Mn stars and in some magnetic Ap stars. This line is used e.g. for the Hg abundance determination in the atmosphera of γ Her. The significance of the resonance $6s^2$S - $6p^2P^o$ Hg II line for the Hg stellar abundance determination has been pointed out by Dworetsky. By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-

impact line widths and shifts for 7 Hg II lines. Here we present and discuss the results for ionized mercury lines, along with a comparison with the experimental data.

Dimitrijević M. S., 1992, *STARK BROADENING DATA FOR STELLAR PLASMA INVESTIGATION*, Newsletter on Analysis of Astronomical Spectra (Daresbury Laboratory) **17**, pp. 1-8.

Here is presented a review of semiclassical calculations of Stark broadening parameters and comparison of different semiclassical procedures is discussed, as well as the agreement with critically selected experimental data and more sophysticated, close coupling calculations. Approximate methods for the calculations of Stark broadening parameters, useful especially in such astrophysical problems where large scale calculations and analyses must be performed and where a good average accuracy is expected, have also been discussed.

Dimitrijević M. S. , 1992, *INFLUENCE OF DIFFERENT COLLISIONAL PROCESSES ON THE STARK BROADENING WITHIN SPECTRAL SERIES : THE O VI CASE*, Bull. Astron. Belgrade **146** pp. 115-119.

Using a semiclassical perturbation approach, behaviour of Stark broadening parameters within spectral series has been investigated on the O VI case. The behaviour of inelastic, elastic and strong collision contribution to line widths within a spectral series has been studied also.

Dimitrijević M. S., Ben Nessib N., Ben Lakhdar Z., 1992, *SIMPLE CONVERGENT FORMULA FOR ESTIMATING STARK WIDTHS AND SHIFTS FOR NEUTRAL AND IONIC LINES*, 11 Int.Conf.Spectral Line Shapes, Carry le Rouet pp. A 36(1-2)

Formula for estimating Stark widths and shifts of ionized atom lines has been derived from a convergent theory that avoids the computation of the minimum impact parameter.

Dimitrijević M. S., Ben Nessib N., Ben Lakhdar Z., 1992, *SIMPLE CONVERGENT FORMULA FOR ESTIMATING STARK WIDTHS AND SHIFTS FOR NEUTRAL AND IONIC LINES*, 11 Int.Conf.Spectral Line Shapes, Carry le Rouet pp. A 36(1-2)

Formula for estimating Stark widths and shifts of ionized atom lines has been derived from a convergent theory that avoids the computation of the minimum impact parameter.

Dimitrijević M. S., Djurić Z., Mihajlov A. A., Popović M. M., 1992, *STARK BROADENING OF Al III LINES IN THE ARC OF ELECTRODYNAMIC MACROPARTICLE ACCELERATOR* Proc. X Int.Conf. on Gas Discharges and their applications, Swansea 1992, ed. W.T.Williams, Univ.College of Swansea, Swansea pp. 726-727.

The arc plasma created in the electrodynamic macroparticle accelerator (rail gun) is an interesting example of a cool and very dense plasma. Moreover, the diagnostic of such a plasma is very difficult. In order to provide a possibility for the plasma diagnostic we have calculated within a semiclassical perturbation approach Stark broadening parameters of Al III lines, for conditions of interest for such plasma research.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETERS FOR SPECTRAL LINES OF MULTICHARGED IONS IN STELLAR ATMOSPHERES : C IV, N V, O VI LINES AND REGULARITIES WITHIN AN ISOELECTRONIC SEQUENCE*, In The Atmospheres of Early-Type Stars, Eds. U.Heber, C.S.Jeffery, Lect.Notes in Physics **401** pp. 368-370.

Stark broadening of C IV, N V and O VI lines has been considered within the semiclassical perturbation approach. The obtained results were used to investigate the behaviour of Stark broadening parameters within the isoelectronic sequence in order to examine the use of such behaviour for the interpolation of new data of interest for the stellar plasma investigations.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETERS*, IAU Coll 137, Inside the stars, Commun.Asteroseimsology **43** p. 3/1.

Stark broadening of Be II, Ca II, Sc III and Ti IV lines has been analyzed and discussed.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF SINGLY IONIZED CALCIUM LINES*, 11 Int.Conf.Spectral Line Shapes, Carry le Rouet pp. A 37(1-2)

By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II multiplets. Here, we discuss the results for Ca II, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF C IV LINES OF LARGE PRINCIPAL QUANTUM NUMBER : REGULARITIES WITHIN SPECTRAL SERIES*, 11 Int.Conf.Spectral Line Shapes, Carry le Rouet pp. A 38(1-2)

Here, we present and discuss the results of Stark broadening parameters calculation for C IV transitions with large principal quantum number, along with a discussion of the Stark broadening parameter regularities within spectral series .

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETERS OF C IV LINES FOR STELLAR PLASMA RESEARCH*, IAU Symp. 155, Planetary Nebulae, Abstract booklet p. II-30.

In order to complete available C IV Stark broadening data, we present and discuss here Stark broadening parameters for 69 C IV multiplets of large principal quantum

number, calculated using semiclassical perturbation approach, along with a discussion of the Stark broadening parameter regularities within spectral series .

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETER TABLES FOR Be II LINES OF ASTROPHYSICAL INTEREST*, Bull. Astron. Belgrade **145** pp. 65-81.

Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 30 Be II multiplets.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST*, Bull. Astron. Belgrade **145** pp. 81-99.

Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II multiplets. The resulting data have been compared with existing experimental values.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. Sc III AND Ti IV LINES*, Astron.Astrophys.Suppl.Series **95**, pp. 121-123.

The knowledge of multicharged ion Stark broadening parameters is of interest in astrophysics owing to the recent development of research on the physics of the stellar interiors, as well as for the investigation of hot star atmospheres. E.g. Rogerson and Ewell (1985) have been found 7 Ti IV lines in τ Sco spectrum., This paper is the fifth of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions. The first four were concerned with C IV , Si IV, O VI and N V lines. By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 10 Sc III and 10 Ti IV multiplets. Here we present and discuss the results for Sc III and Ti IV, along with a discussion of the Stark broadening parameter regularities within an isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. IV. N V LINES.*, Astron.Astrophys.Suppl.Series **95** pp. 109-120.

Stark broadening of multicharged ion spectral lines has a new interest to Astrophysics owing to the recent development of research on the physics of the stellar interiors (Seaton, 1987). Moreover, the knowledge of N V Stark broadening parameters is useful also for the astrophysical plasma diagnostic and for the investigation of hot dense plasmas in laboratory, due to its presence as an impurity in many laboratory plasma sources.

This paper is the fourth of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions. By using the semiclassical - perturbation formalism we have calculated electron-, proton-, and ionized helium-impact

line widths and shifts for 30 N V multiplets. Here we present and discuss the results for N V, along with a comparison with experimental data.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF Be II SPECTRAL LINES*, J.Quant.Spectrosc.Radiat.Transfer **48** pp. 397-403.

Besides the interest for plasma spectroscopy, the Be II Stark-broadening parameters are important to astrophysicists since the surface content (abundance) of light elements, especially Li and Be, involves problems correlated with nucleogenesis, mixing between the atmosphere and the interior, and stellar structure and evolution. Moreover, Be II profiles are of importance for opacity calculations as well. By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 30 Be II multiplets. Here, we present and discuss the results for Be II, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *ASYMPTOTIC BEHAVIOUR OF THE A AND a FUNCTIONS FOR IONIZED EMITTERS IN SEMICLASSICAL STARK-BROADENING THEORY*, J.Quant.Spectrosc.Radiat.Transfer **48** pp. 349-351.

The asymptotic behaviour of the characteristic A and a functions has been studied in semiclassical Stark - broadening theory for ionized emitters (attractive hyperbolic paths). The approximate expressions for the particular asymptotic cases are presented.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETER TABLES FOR Rb I LINES* Bull. Astron. Belgrade **146** pp. 97-104.

Using a semiclassical approach, we have calculated electron-, proton-, and ionized argon-impact line widths and shifts for 28 Rb I multiplets. The resulting data have been compared with existing experimental and theoretical values.

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETER TABLES FOR LARGE QUANTUM NUMBER C IV UV LINES OF INTEREST FOR EXTREME ULTRAVIOLET EXPLORER MISSION* Bull. Astron. Belgrade **146** pp. 105-114.

The Extreme Ultraviolet Explorer (EUVE) mission will provide the all sky survey in the $\lambda = 70 - 700$ Å range by four EUV telescopes in the Earth orbit (Bowyer and Malina, 1990). Moreover, the primary goal of the Far Ultraviolet Spectroscopy Explorer (FUSE) mission which is being developed by NASA is to obtain high resolution spectra with unprecedented sensitivity in the wavelength range 912 - 1250 Å (Soneborn, 1991). Consequently, one of the principal aims of this paper is to complete available C IV Stark broadening data with the lines of large principal quantum number. By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 69 C IV multiplets of large principal quantum number.

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Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETER TABLES FOR Be I LINES OF ASTROPHYSICAL INTEREST* Bull. Astron. Belgrade **146** pp. 73-81.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 19 Be I multiplets as a function of temperature (T = 3000 K - 50000 K) and perturber density (N = 10^{16} - 10^{19} cm^{-3}).

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING PARAMETER TABLES FOR Al I LINES OF ASTROPHYSICAL INTEREST* Bull. Astron. Belgrade **146** pp. 83-95.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 25 Al I multiplets as a function of temperature (T = 3000 K - 50000 K) and perturber density (N = 10^{13} - 10^{14} cm^{-3} and N = 10^{16} - 10^{18} cm^{-3}).

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. VI. C IV LINES OF LARGE PRINCIPAL QUANTUM NUMBER*, Astron. Astrophys. Suppl. Series **96** pp. 613-624.

Stark broadening data for 39 C IV multiplets (Dimitrijević and Sahal-Bréchot (1991) have been published recently. Our tables however are not sufficiently complete for the investigation of PG 1159 stars (Werner, Heber, Hunger, 1991; Werner and Heber, 1991). The PG 1159 stars are hot hydrogen deficient pre-white dwarfs with effective temperature 100.000 - 140.000 K and peculiar chemical composition. Carbon and helium are the dominant constituents (C/He = 0.5) (Werner, Heber, Hunger, 1991). Due to the high surface gravity (log g = 7) Stark broadening is an important line broadening mechanism and Stark broadening data are needed for NLTE model atmosphere analysis (Werner, Heber, Hunger, 1991) and other stellar plasma investigations. In this class of stars a number of large principal quantum number C IV lines not included in our previous analysis has been observed recently (Werner, Heber, Hunger, 1991; Werner and Heber, 1991). Consequently, one of the principal aims of this paper is to complete available C IV Stark broadening data with the lines of large principal quantum number. This paper is the sixth of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions. The first five were concerned with C IV , Si IV, O VI, N V Sc III and Ti IV lines. By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 69 C IV multiplets of large principal quantum number. Here, we present and discuss the results for C IV multiplets of large principal quantum number, along with a discussion of the Stark broadening parameter regularities within spectral series .

Dimitrijević M. S., Sahal-Bréchot S., 1992, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. III. O VI LINES*, Astron.Astrophys.Suppl.Series **93** pp. 359-371.

Stark broadening data for O VI lines are useful for the investigation of hot star atmospheres, like the atmospheres of PG1159 type stars or some hot white dwarfs. Such data are as well of interest for the investigation and modelling of laboratory plasma.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 30 O VI multiplets as a function of temperature (T = 100000 K - 1500000 K) and perturber density (N = 10^{17} - 10^{21} cm^{-3}). The obtained comprehensive set of data has been used for the investigation of Stark broadening parameter regularitioes within spectral series.

Dimitrijević M. S., Todorović K. N., 1992, *AN INVESTIGATION OF THE SIMPLE FORMULAE FOR STARK WIDTH AND SHIFT CALCULATION OF NEUTRAL ATOM LINES* Proc. 1 st Gen.Conf.Balkan Physical Union, ed. K.M. Paraskevopoulos, Hellenic Physical Society, Thessaloniki, Vol. 1, pp. 158-160.

Whenever line broadening data for a large number of lines are required, and the high precision of every particular result is not so important, simple approximative formulae with good average accuracy may be very useful. For the astrophysical purposes, of particular interest might be the symplified semiclassical approach.

Using this approach, we have calculated Stark broadening widths and shifts for 42 neutral helium multiplets, in order to obtain an extensive data set for the investigation of possibilities and applicability of the mentioned approach. The obtained results have been compared with the more sophysticated semiclassical calculatious, as well as with the more simple approximate formula. We performed also an analysis of the influence of the number of perturbing levels used in the calculation, as well as the analysis of the applicability and accuracy of this approach in function of the increase of the principal quantum number for the upper level of the transition, within a spectral series. The number of perturbing levels included in the calculations may become particularly critical in the case of the shift where even the sign may be changed if a more complete set of perturbing levels is used.

Results indicate that the analyzed approach may be very useful for simple calculations when only a good average accuracy is needed and the high precision of every particular result is not so important.

Konjević N., Dimitrijević M. S., 1992, *SIMPLE ESTIMATES FOR PLASMA BROADENING AND SHIFT OF NON- HYDROGENIC ION LINES* in Short Wavelength Lasers and their Applications Eds. V.V.Korobkin, M.Yu.Romanovsky, Nova Science Publ. Inc. New York, pp. 355-362.

For radiative transfer calculations of laser produced plasmas, electron - impact broadening parameters for a large number of spectral lines of various elements are required. In spite of the possibility of quantum mechanical and semiclassical theories to provide data of higher accuracy, they are often not suitable, since considerable computational efforts and knowledge of numerous atomic data are needed for Stark broadening parameter calculations for a large number of lines, as *e.g.* in the case of

radiative transfer, simple approximate approaches with good average accuracy are more apropriate.

This contribution deals with the modified semiempirical approach, which is tested several times and gives on average a satisfactory agreement with experimental data.

Popović L., Srećković A., and Djeniže S., 1992, *INFLUENCE OF THE ELECTRON TEMPERATURE DECAY ON THE STARK SHIFT MEASUREMENTS*, Proceeding of the 11th ICSLS, Carry Le Rouet (France), A25.

Correction of the method for experimental determination of Stark shifts is given, by taking into account a possible change of the electron temperature. The problem is analyzed on the bases of semiempirical and modified-semiempirical approaches

Dimitrijević M. S., 1993, *STARK-BROADENING PARAMETERS OF SPECTRAL LINES OF ASTROPHYSICAL INTEREST OF NEUTRAL PALLADIUM*, Astron.Astrophys.Suppl.Ser. **100** pp. 593-594.

Neutral palladium lines are present in solar spectrum where fifteen lines of this element have been identified. The developement of satellite astronomy providing high resolution spectrograms, gives possibility to determine palladium abundance in stellar atmospheres as well. Recently, Orlov and Shavrina have analyzed Pd I lines existing in stellar spectra and particularly 14 Pd I lines observed in the Procyon (α CMi) spectrum. They have shown that the only line suitable for determining palladium abundance in stellar atmospheres is Pd I $\lambda = 3242.70 \text{Å}$ line. Since α CMi is rather hot star with T = 6750 K and log g = 4.0, and since the all sky survay by the means of satellite astronomy should provide high resolution spectra for other hot stars with non negligible electron-impact influence on spectral line shapes (e.g. hot white dwarfs), it is of interest to provide corresponding Stark broadening data enabling to perform better determination of palladium abundance.

In order to provide such data we have calculated electron-, proton-, and ionized-helium-impact line widths and shifts for 3 Pd I multiplets by using the semiclassical-perturbation formalism.

We hope that the present results enable a better determination of palladium stellar abundances, especially in the case of white dwarfs and stars of A and B type.

Dimitrijević M. S., 1993, *CALCULATION OF STARK BROADENING PARAME-TERS FOR STELLAR PLASMA INVESTIGATION*, X Nac. Konf. Astron. Jugoslavije, Beograd, Publ.Obs.Astron.Belgrade **44** p. 127.

A review of research of Stark broadening parameters, needed for stellar plasma investigations has been presented.

Dimitrijević M. S., 1993, *STARK BROADENING DATA FOR STELLAR PLASMA RESEARCH*, Int.Conf.on Chemmically peculiar and magnetic stars on and close to upper main sequence, Stara Lesna p. 1.

Here is presented a review of semiclassical calculations of Stark broadening parameters and the comparison of different semiclassical procedures is discussed, as well

as the agreement with critically selected experimental data and more sophysticated, close coupling calculations. Approximate methods for the calculation of Stark broadening parameters, usefull especially in such astrophysical problems where large scale calculations and analyses must be performed and where only a good average accuracy is expected, have been discussed as well.

Dimitrijević M. S., 1993, *ELECTRON-IMPACT WIDTHS OF FOUR- AND FIVE-TIMES CHARGED ION LINES OF ASTROPHYSICAL IMPORTANCE*, Astron.Astrophys.Suppl.Ser. **100** pp. 237-241.

Important astrophysical applications of Stark broadening of multiply charged ion spectral lines are in the physics of stellar interiors (Seaton 1987). In subphotospheric layers, the modelling of energy transport requires radiative opacities and thus, certain atomic processes must be known with accuracy. At these high temperatures and densities, Stark broadening of strong multicharged ionic lines plays a non-negligible role in the calculation of the opacities, especially in the UV. Moreover, with the development of spectroscopy investigations from space, UV and extreme UV spectral line research has been further stimulated.

In order to provide such data for four- and five-times charged ions, comprehensive studies of electron-, proton- and ionized helium-impact broadening parameters for 30 N V and 30 O VI multiplets have been made recently, by using the semiclassical perturbation approach. In the case of C V, O V, P V and S VI lines, there exist sufficient atomic data for sophisticated semiclassical calculations for some or all astrophysically interesting lines. But, for other four- and five-times charged ions, the atomic data set is not sufficiently complete.

Whenever the semiclassical method is not applicable, e.g., due to the lack of reliable atomic data and the high precision of every particular result is not so important, but a good average accuracy for a large number of lines is required, the modified semiempirical method is useful.

The aim of this paper is to provide Stark broadening data of astrophysical interest for four- and five-times charged ion lines. In such a way, our intention is to complete such data, together with the published studies for N V and O VI lines and with studies of C V, O V, P V and S VI lines, which are in preparation. Consequently, in the case of C V and O V, data are presented here only for such cases for which atomic data set is not sufficient for semiclassical perturbation calculations. Since theoretical errors for shifts are considerably larger than for line widths, and since the astrophysical importance of multiply charged ion Stark widths is greater, only width calculations are presented in this article.

Consequently, Stark widths of astrophysically important spectral lines within 3 C V, 50 O V, 12 F V, 9 Ne V, 3 Al V, 6 Si V, 11 N VI, 28 F VI, 8 Ne VI, 7 Na VI, 15 Si VI, 6 P VI, and 1 Cl VI multiplets, have been calculated and presented here by using a modified semi-empirical approach.

Comparison of the present values with values calculated by using Eq. (526) in Griem (1974) have been performed, and the obtained agreement is satisfactory. In comparison with the experiment of Purić et al (1988) for two O V lines, both approaches give about two times smaller values.

Dimitrijević M. S., 1993, *STARK WIDTHS OF FOURTHLY AND FIFTHLY CHAR-GED ION LINES*, Astrophys.Lett. and Communications **28** pp. 385-388.

Stark widths of astrophysically important spectral lines within 1 C V, 29 O V, 10 F V, 6 Ne V, 2 Al V, 5 Si V, 4 N VI, 10 F VI, 6 Ne VI, 4 Na VI, 6 Si VI, and 5 P VI multiplets, have been calculated by using symplified semiclassical approach. The comparison of obtained results with existing theoretical and experimental data has been discussed as well.

Dimitrijević M. S., 1993, *STARK BROADENING OF Hg II LINES IN STELLAR ATMOSPHERES*, X Nac.Konf.Astron.Jugoslavije, Beograd, Publ. Obs. Astron. Belgrade **44** pp. 49-52.

Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 7 ionized mercury lines, observed in the spectra of Mn and magnetic stars as well as in laboratory plasmas.

Dimitrijević M. S., 1993, *STARK WIDTHS OF FOUR- AND FIVE-TIMES CHAR-GED ION LINES FOR ASTROPHYSICISTS*, X Nac.Konf.Astron.Jugoslavije, Beograd, Publ. Obs. Astron. Belgrade **44** pp. 65-67.

Stark line widths(FWHM) for 3 C V, 50 O V, 12 F V, 9 Ne V, 3 Al V, 6 Si V, 11 N VI, 28 F VI, 8 Ne VI, 7 Na VI, 15 Si VI, 6 P VI, and 1 Cl VI multiplet calculated using the modified semi-empirical approach (Dimitrijević and Konjević 1980) - (WMSE) will be published elsewhere. A sample of results is presented and discussed here. Data are presented for an electron density of 10^{17}cm^{-3} 10 and temperatures from 50,000 to 800,000 K. Data are linear with electron density, but at very high densities Debye screening should be considered. Moreover, for lines with very near perturbing levels broadening by inelastic proton collisions may be also important.
Comparison of the present values with values calculated by using Eq. (526) in Griem (1974) have been performed, and the obtained agreement is satisfactory. In comparison with the experiment of Purić et al (1988) for two O V lines, both approaches give about two times smaller values.

Dimitrijević M. S., 1993, *STARK WIDTHS OF ASTROPHYSICALLY IMPORTANT FOUR-AND FIVE- TIMES CHARGED ION LINES*, IAU Symp. 162, Pulsation, Rotation and Mass Loss in Early Type Stars, Antibes, Juan les Pins, Abstracts, 1 page without page number.

Stark widths of astrophysically important spectral lines within 1 C V, 29 O V, 10 F V, 6 Ne V, 2 Al V, 5 Si V, 4 N VI, 10 F VI, 6 Ne VI, 4 Na VI, 6 Si VI, and 5 P VI multiplets, have been calculated by using mthe modyfied semiempirical approach (Dimitrijević, Konjević, 1980) and symplified semiclassical approach (Griem, 1974). The comparison of obtained results with existing theoretical and experimental data will be discussed as well.

Dimitrijević M. S., 1993, *STARK BROADENING OF STELLAR Pt II LINES*, IAU Symp. 162, Pulsation, Rotation and Mass Loss in Early Type Stars, Antibes, Juan les Pins, Abstracts, 1 page without page number.

By using the modified semiempirical approach, Stark widths of 1777.1 Å; 2245.518 Å; 1781.858 Å and 2144.244Å Pt II lines, observed in Hg Mn stars have been calculated.

Dimitrijević M. S., Ben Nessib N., Ben Lakhdar Z., 1993, *SIMPLE CONVERGENT FORMULA FOR ESTIMATING STARK WIDTHS AND SHIFTS FOR NEUTRAL AND IONIC LINES*, in Spectral Line Shapes Vol. 7 (eds. R.Stamm and B.Talin), Nova Science Publ.Inc. pp. 533-535.

We extend our recently published formula for estimating Stark widths and shifts of neutral atom lines, derived from a convergent theory (that avoids the computation of the minimum impact parameter), to the case of charged emitters.

Dimitrijević M. S. & Popović L. Č., 1993, *STARK BROADENING OF Bi II LINES OF ASTROPHYSICAL INTEREST*, Astron. & Astrophys. Suppl. Ser. **101**, pp. 583-586.

We report here results of Bi II spectral line Stark broadening research within a modified semi-empirical approach. The strong absorption Bi II lines observed in Hg-Mn star atmospheres have been investigated, as well as other Bi II lines of importance for astrophysical and laboratory plasma. Stark width and shift data for 26 Bi II lines are presented as a function of temperature. The obtained results have been compared with experiments and with other estimations.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF Ca II SPECTRAL LINES*, J.Quant.Spectrosc.Radiat.Transfer **49** pp. 157-164.

Within the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II multiplets. Here, we discuss the results for Ca II, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING PARAMETER TABLES FOR Al III LINES*, Bull.Astron.Belgrade **147** pp. 35-40.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 13 Al III multiplets as a function of temperature (T = 10000 K - 500000 K) and perturber density (N = 10^{17} - 10^{19} cm^{-3}).

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. VIII. S VI LINES*, Astron.Astrophys.Suppl.Series **100** pp. 91-101.

This paper is the eighth of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions, and is the continuation of our efforts to provide Stark broadening data of interest for stellar opacities and stellar plasma investigations By using the semiclassical - perturbation formalism, we have calculated

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electron-, proton-, and He III -impact line widths and shifts for 21 S VI multiplets. Here, we present and discuss the results for S VI multiplets of interest for stellar plasma research. Moore (1950) e.g., gives a list of first five S VI multiplets in far UV to be of interest for astrophysics, and Seaton (1987) discuss the interest of Stark broadening data of spectral lines of multicharged ions for stellar opacities research.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. VII. Al III LINES*, Astron.Astrophys.Suppl.Series **99** pp. 585-589.

By using the semiclassical - perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 23 Al multiplets. Here, we present and discuss the results for Al III multiplets, which are of interest for interpretation and analysis of stellar spectra. Namely, Al III absorption lines are very strong in hot star atmospheres, where Stark broadening is the principal pressure broadening mechanisme. Moreover, results presented may be used for the diagnostic and modelling of an electrodynamic macro-particle accelerator arc plasma created by the evaporation of an Al-foil and for spectroscopy of laboratory plasma.

Dimitrijević M. S., S. Sahal-Bréchot 1993, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. IX. F VII LINES*, Astron.Astrophys.Suppl.Series **101** pp. 587-597.

By using the semiclassical - perturbation formalism, we have calculated electron-, proton-, and He III- impact line widths and shifts for 20 F VII multiplets. Obtained results for 3s S-3p P multiplet have been compared with existing experimental data (Glenzer et al 1992) and with other calculations (Glenzer et al 1992) by using different approximate approaches . We found the good agreement between experiment and semiclassical calculations as well as the reasonable agreement between different approximate approaches and more sophysticated semiclassical calculations.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING PARAMETER TABLES FOR Al XI AND Si XII LINES OF ASTROPHYSICAL INTEREST*, Bull.Astron.Belgrade **148** pp. 21-28.

Using a semiclassical approach, we have calculated electron−, proton−, and He III−impact line widths and shifts for 7 Al XI and 9 Si XII multiplets as a function of temperature and perturber density.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *LINE BROADENING DATA : STARK BROADENING OF Ca II Sc III AND Ti IV LINES*, in Inside the stars, IAU Colloquium 137, ASP Conference Series, **40** pp. 260-262.

The present paper concerns Ca II, Sc III and Ti IV lines from the kalium iso-electronic sequence. Beyond the interest for the stellar atmospheres investigation and the modellisation of stellar interiors, the knowledge of Ca II, Sc III and Ti IV Stark broadening parameters is important for a number of problems in astrophysics and

plasma physics. Particularly is important Ca II which is among the most abundant elements in stellar plasma after hydrogen and helium. In order to provide reliable data for the mentioned lines broadened by collisions with all important charged perturbers in stellar plasmas, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II, 10 Sc III and 10 Ti IV multiplets, using the semiclassical-perturbation formalism.

The obtained results were used to investigate the behaviour of Stark broadening parameters within the isoelectronic sequencee in order to examine the use of such behaviour for the interpolation of new data of interest for the stellar plasma investigations. Our analysis shows that a regular behaviour exist but the mutual relation of the corresponding Stark broadening parameters depends on temperature. Additional experimental and theoretical work for the investigated case is needed as well as the extension to the other members of K isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING PARAMETER TABLES FOR Ne VIII AND Na IX LINES OF ASTROPHYSICAL INTEREST*, Bull.Astron.Belgrade **148** pp. 29-42.

Using a semiclassical approach, we have calculated electron−, proton−, and He III−impact line widths and shifts for 20 Ne VIII and 8 Na IX multiplets as a function of temperature and perturber density.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING PARAMETER TABLES FOR Be I LINES OF ASTROPHYSICAL INTEREST*, Bull. Astron. Belgrade **148** pp. 65-69.

This is the addendum to the previous article concerned to the Stark broadening parameters of Be I lines. Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated electron−, proton−, and He II−impact line widths and shifts for 28 Be I multiplets as a function of temperature (T = 3000 K - 50000 K) at an perturber density of N = 10^{15} cm^{-3}.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING PARAMETERS FOR Be II SPECTRAL LINES*, X Nac.Konf.Astron.Jugoslavije,Beograd, Publ. Obs. Astron. Belgrade **44** pp. 59-63.

The Be II Stark-broadening parameters are important to astrophysicists since the surface content (abundance) of light elements, especially Li and Be, involves problems correlated with nucleogenesis, mixing between the atmosphere and the interior, and stellar structure and evolution. Such data are of importance for opacity calculations and laboratory plasma diagnostic as well. By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 30 Be II multiplets. Here, we discuss the results for Be II, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF S VI LINES*, X Nac.Konf.Astron.Jugoslavije, Beograd Publ.Obs.Astron.Belgrade **44** pp. 69-71.

Using a semiclassical approach, we have calculated electron-, proton-, and He III-impact line widths and shifts for 21 S VI multiplets, of interest for stellar opacities calculations.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF Be II SPECTRAL LINES : COMPARISON OF DIFFERENT THEORETICAL CALCULATIONS*, XVI Symp.Phys.Ioniz.Gases, Beograd pp. 181-184.

By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 30 Be II multiplets. Here, we discuss the results for Be II, along with a comparison with other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *ON THE STARK BROADENING OF SINGLY IONIZED CALCIUM SPECTRAL LINES*, XVI Symp.Phys.Ioniz.Gases, Beograd pp. 185-188.

Knowledge of reliable Ca II Stark-broadening parameters is of great importance for detailed investigation of stellar atmospheres, as well as for opacity research. Furthermore, Ca II lines are of particular interest for investigations of laboratory plasmas, since calcium is often present as an impurity. By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II multiplets. Here, we discuss the results for Ca II, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF FOURTHLY CHARGED NITROGEN SPECTRAL LINES*, XVI Symp.Phys.Ioniz.Gases, Beograd pp. 189-192.

Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 30 N V multiplets. The obtained data have been compared with the existing experimental values.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF SINGLY IONIZED CALCIUM LINES*, in Spectral Line Shapes Vol. 7 (eds. R.Stamm and B.Talin), Nova Science Publ.Inc. pp. 537-538.

Calcium is among the most abundant elements in stellar plasmas after hydrogen and helium. Particularly important for stellar spectral analysis are the well known resonance lines of Ca II, which are present in all spectra starting with B−type stars and reaching maximal intensity in stars of the K0 spectral type. Consequently, knowledge of reliable Ca II Stark−broadening parameters is of great importance for detailed investigation of stellar atmospheres, as well as for opacity research. Furthermore, Ca II lines are of particular interest for investigations of laboratory plasmas, since calcium is often present as an impurity. By using the semiclassical−perturbation formalism we have calculated electron−, proton−, and ionized helium−impact line widths and shifts for 28 Ca II multiplets.

We have found that for most of existing experiments the calculated widths fall within the error bars of both methods. Additional reliable experimental data for the 4s–4p Ca II widths, especially at lower temperatures, will be of interest.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF Al III LINES*, II DIAM (Dynamique des Ions, des Atomes et des Molecules), Bourges pp. 153-154.

Within the semiclassical-perturbation formalism, we have analyzed electron-, proton-, and ionized helium-impact broadening of doubly charged alluminium ion lines. Such results are of interest for interpretation and analysis of stellar spectra. Moreover, results presented may be used for the diagnostic and modelling of an electrodynamic macro-particle accelerator arc plasma created by the evaporation of an Al-foil and for spectroscopy of laboratory plasma.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF C IV LINES FOR STELLAR PLASMA RESEARCH*, in Planetary Nebulae (eds. R.Weinberger, A.Acker), Kluwer Acad.Publ., Dordrecht, Boston, London p. 94.

We have calculated recently, Stark broadening data for 39 C IV multiplets persuaded that we have provided data for practically all C IV lines important for stellar research. Our tables however are not sufficiently complete for the investigation of PG 1159 stars , which are hot hydrogen deficient pre–white dwarfs with effective temperature 100.000−140.000 and with C and He as dominant constituents (C/He = 0.5). Moreover, Stark broadening data in far and extreme ultraviolet, for lines originating from transitions between energy levels with large principal quantum number and low lying levels will become important for astrophysics in the near future due to the Extreme Ultraviolet Explorer (EUVE)and the Far Ultraviolet Spectroscopy Explorer (FUSE) missions. In order to complete available C IV Stark broadening data, we present and discuss here Stark broadening parameters for 69 C IV multiplets of large principal quantum number, calculated using semiclassical perturbation approach, along with a discussion of the Stark broadening parameter regularities within spectral series .

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF C IV LINES OF LARGE PRINCIPAL QUANTUM NUMBER : REGULARITIES WITHIN SPECTRAL SERIES*, in Spectral Line Shapes Vol. 7 (eds. R.Stamm and B.Talin), Nova Science Publ.Inc. pp. 539-540.

We have calculated recently, Stark broadening data for 39 C IV multiplets. Our tables however are not sufficiently complete for the investigation of PG 1159 stars. The PG 1159 stars are hot hydrogen deficient pre–white dwarfs with effective temperature $100,000 - 140,000K$ and carbon and helium as the dominant constituents $(C/He = 0.5)$. Due to the high surface gravity (log g= 7) Stark broadening is an important line broadening mechanism and Stark broadening data are needed for NLTE model atmosphere analysis and other stellar plasma investigations. Moreover, Stark broadening data in far and extreme ultraviolet, for lines originating from transitions between energy levels with large principal quantum number and low lying levels will

become important for astrophysics in the near future due to the Extreme Ultraviolet Explorer (EUVE) and the Far Ultraviolet Spectroscopy Explorer (FUSE) missions.

Here, we present and discuss the results for C IV multiplets of large principal quantum number, along with a discussion of the Stark broadening parameter regularities within spectral series .

The obtained set of results has been used for the analysis of systematic trends in spectral series. The electron full halfwidth and shift within $2p^2P^0 - ns^2S$ series are analyzed. By inspecting the energy separation between the upper level and the principal perturbings levels, we find that this separation decreases gradually within a spectral series. We obtain as a consequence, a gradual change of the Stark widths. The case of C IV $np^2P^0 - 9s^2S$ transitions, i.e. the case when the upper level does not changes has been analyzed as well. We can see that particularly in the case of shift the changes of Stark broadening parameters are relatively small, permitting the interpolation of new data or critical evaluation of mutual consistency of existing data.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *ON THE STARK BROADENING OF Al I SPECTRAL LINES*, 25th E.G.A.S. Conference Abstracts, Caen 1993, Europhys.Conf. Abstracts Vol. **17 D** pp. P2-067(1-2).

Stark broadening parameters of neutral aluminium lines are of interest for laboratory plasma diagnostics and they have been determined experimentaly several times.

By using the semiclassical - perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 22 Al I multiplets. Here, we discuss the results for Al I, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF F VII SPECTRAL LINES*, 25th E.G.A.S. Conference Abstracts, Caen 1993, Europhys.Conf. Abstracts Vol. **17 D** pp. P2-068(1-2).

In order to continue our investigation of Stark broadening behavior along the lithium isoelectronic sequence, we have calculated electron-, proton-, and He III-impact line widths and shifts for 20 F VII multiplets, by using the semiclassical-perturbation formalism. Here, the obtained results will be discussed and compared with the available experimental data and other theoretical calculations.

Dimitrijević M. S., Sahal-Bréchot S., 1993, *ON THE STARK BROADENING OF Be I SPECTRAL LINES*, IX Gen.Conf.European Phys.Soc. Trends in Physics, Firenze p. 122.

Beryllium Stark-broadening parameters are important to astrophysicists since the surface content (abundance) of light elements involves problems correlated with nucleogenesis, mixing between the atmosphere and the interior, and stellar structure and evolution. With the developpement of infrared and space astronomy, Stark broadening data for a large number of atom- and ion-spectral lines will be needed. We note that for lines originating from higher energy levels the importance of Stark broadening

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increases. Such data are useful as well for the diagnostic of laboratory plasmas and for plasma spectroscopy.

By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Be I multiplets and the resulting data have been compared with existing theoretical values. The agreement is within error limits of the semiclassical method except for transitions involving highly excited levels (2p-4s and 2p-4d) where our widths are smaller due to Debye screening effect not taken into account explicitely in previous calculations (but the corresponding correction is suggested).

Dimitrijević M. S., Sahal-Bréchot S., 1993, *STARK BROADENING OF F VII SPECTRAL LINES*, IX Gen.Conf.European Phys.Soc. Trends in Physics, Firenze p. 150.

Within the semiclassical-perturbation formalism, we have calculated electron-, proton-, and He III- impact line widths and shifts for 20 F VII multiplets. Obtained results for $3s^2S$-$3p^2P^o$ multiplet have been compared with existing experimental data (Glenzer et al 1992) and with other calculations (Glenzer et al 1992) by using different approximate approaches . We found the good agreement between experiment and semiclassical calculations as well as the reasonable agreement between different approximate approaches and more sophysticated semiclassical calculations.

Djeniže S., Popović L. Č., Labat J., Srećković A. & Platiša M., 1993, *STARK PARAMETERS OF SEVERAL B II, C II AND N III SPECTRAL LINES*, Contrib. Plasma Phys. **33**, pp. 193 – 199.

Stark shifts and widths of ionized boron, carbon and nitrogen spectral lines have been measured in a low – presure pulsed arc plasma and compared with calculated values based on the modified semiempirical approach.

Popović L. Č. & Dimitrijević M. S., 1993, *STARK BROADENING PARAMETERS OF SINGLY IONIZED IODINE LINES*, 25th E.G.A.S. CONFERENCE, eds. K. Bethge and G. Thomas, p. P2-066, Caen, France.

Stark broadening data for nine multipet transition of single ionized iodine are given.

Popović L. Č., Vince I. and Dimitrijević M. S., 1993, *STARK BROADENING OF Zn II AND Cd II LINES WITHIN THE MODIFIED SEMIEMPIRICAL APPROACH*, D. I. A. M. Deuxiéme colloque sur la dynamique des ions, des atoms et des molécules, Bourges, p.255.

Using the modified semi-empirical approach Stark broadening data for resonant lines of Zn II and Cd II were calculated. The calculated data have been compared with avaliable experimental data.

Popović L. Č. & Dimitrijević M. S., 1993, *ON THE INFLUENCE OF RADIATOR COMPLEXITY TO STARK BROADENING*, Abstracts of EPS 9 – trends in physics, p. 138., Firenze, Italy.

A disscusion about influence of radiator complexity to Stark broadening has been done. Difference in oscillator strength values produce change in calculated Strark widths within error bars of the modified semiempirical method, but in the case of shifts the accuracy of oscillator strengths may be very important.

Popović L. Č., Vince I. and Dimitrijević M. S., 1993, STARK BROADENING OF Zn II AND Cd II SPECTRAL LINES OF ASTROPHYSICAL INTEREST, Astron. Astrophys. Suppl. Ser. **102**, pp. 17-23.

Using a modified semi-empirical approach, Stark broadening parameters for 12 Zn II and 8 Cd II spectral lines have been calculated as a function of temperature. The results obtained have been compared with available experimental data. The influence of the oscillator strengths accuracy on Stark broadening parameter calculation has been investigated.

Skuljan Lj, 1993, *ŠTARKOVO POMERANJE SPEKTRALNIH LINIJA ArI i HeI*, magistarska teza, Univerzitet u Beogradu.

Skuljan Lj., Djeniže S., and Labat J, 1993, *STARK SHIFTS OF SEVERAL He I SPECTRAL LINES*, XVI Symp. Phys. Ioniz. Gases, (M. Milosavljević, ed.), Belgrade, 204.

Skuljan Lj., Djeniže S., and Labat J, 1993, *STARK SHIFTS OF Ar I SPECTRAL LINES*, Publ. Obs. Astron. Belgrade **44**, 53.

Skuljan Lj., Djeniže S., Labat J., and Bukvić S, 1993, *STARK WIDTHS AND SHIFTS OF NiII SPECTRAL LINES*, Proceedings of 21st ICPIG, Bochum.

Blagojević B., Popović M. V., Konjević N., Dimitrijević M. S., 1994, *STARK BROAD-ENING OF TRIPLY IONIZED OXYGEN LINES : THE TEMPERATURE DE-PENDENCE*, Phys.Rev. E, **50** pp. 2986-2990.

The Stark widths of the $3s^2S$ - $3p^2P^o$ and $3p^2P^o$ - $3d^2D$ transitions have been calculated and measured in the plasma of a pulsed arc. Electron densities in the range (2.1 - 6.4) x 10^{17} cm^{-3} were determined from the width of the He II P$_\alpha$ line while electron temperatures between 50800 and 131800 K are measured from the Boltzmann plot of O IV line intensities. Our experimental O IV Stark width agrees well with another experiment and with our semiclassical theoretical results in the whole temperature range.

Dimitrijević, M. S., 1994, *LINE SHAPES INVESTIGATIONS IN YUGOSLAVIA AND SERBIA III (1989-1993) (Bibiliography and Citation Index)*, Publ. Obs. Astron. Belgrade **47** pp. 1-184.

First part of the publication contains review and analysis of the results of spectral line shapes investigations in Yugoslavia and Serbia in the period 1989 - 1993. In the

second part, the bibliography of the contributions of yugoslav and serbian scientists is given, together with the citation index.

Dimitrijević M. S., 1994, *STARK WIDTHS OF ASTROPHYSICALLY IMPORTANT FOUR- AND FIVE- TIMES CHARGED IONS*, in Pulsastion, Rotation and mass loss in early-type stars, eds. L.A.Balona, H.F.Henrichs, J.M. Le Contel, Kluwer, Dordrecht, Boston, London pp. 335-336.

The aim of this contribution is to provide Stark broadening data of astrophysical interest for four- and five-times charged ion lines. In such a way, our intention is to complete such data, together with the published studies for N V and O VI lines and with studies of C V, O V, P V and S VI lines, which are in preparation. Since theoretical errors for shifts are considerably larger than for line widths, and since the astrophysical importance of multiply charged ion Stark widths is greater, only width calculations have been performed.

Stark widths of astrophysically important spectral lines within 1 C V, 29 O V, 10 F V, 6 Ne V, 2 Al V, 5 Si V, 4 N VI, 10 F VI, 6 Ne VI, 4 Na VI, 6 Si VI, and 5 P VI multiplets, have been calculated by using mthe modyfied semiempirical approach (Dimitrijević, Konjević, 1980) and symplified semiclassical approach (Griem, 1974). The comparison of obtained results with existing theoretical and experimental data will be discussed as well.

Dimitrijević M., 1994, *ON STARK BROADENING DATA FOR STELLAR PLAS-MA RESEARCH*, in Chemically peculiar and magnetic stars (eds.J. Zverko, J. Žiž-novsky) Astronomical Institute, Slovak Academy of Sciences, Tatranska Lomnica pp. 137-145.

Here is presented a review of semiclassical calculations of Stark broadening parameters and the comparison of different semiclassical procedures is discussed, as well as the agreement with critically selected experimental data and more sophysticated, close coupling calculations. Approximate methods for the calculation of Stark broadening parameters, usefull especially in such astrophysical problems where large scale calculations and analyses must be performed and where only a good average accuracy is expected, have been discussed as well.

Dimitrijević M. S., Djurić, Z., Mihajlov A. A., 1994, *STARK BROADENING OF Al III AND Cu IV LINES FOR DIAGNOSTIC OF THE RAIL GUN ARC PLASMA*, J.Phys.D : Appl.Phys. **27** pp. 247-252.

Stark broadening parameters of Al III lines of interest for diagnostic of an electrodynamic macroparticle accelerator (rail gun) arc plasma created by evaporation of an Al foil, have been calculated by using the semiclassical perturbation formalism. Stark widths of Cu IV lines, of interest for arc plasma created by Cu foil evaporation,have also been calculated by using the modified semiempirical method.

Results presented here, may be used for diagnostic and modelling of rail gun arc plasma on the basis of ion line profiles. Results are given for larger T-range than needed for rail gun arc plasma analysis, since they are of interest for other laboratory

and astrophysical plasmas as well. For all needed purposes data density in tables enables a good interpolation. Semiclassical data for Al III are of better accuracy than semiempirical data for Cu IV. Since within the semiclassical theory we take into account Debye screening, results for Al III are not linear with density (especially the shift) like semiempirical Cu IV data. Consequently, Al III results are presented as a function of density. Since the importance of the Stark shift usually decreases with the increases of the ionisation stage, and Cu IV shifts are not of importance for rail gun plasma diagnostic, they are not presented here.

We hope that the presented results will be of help for diagnostic, modelling and other investigations of rail gun arc plasma.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *INFLUENCE OF THE OSCILLATOR STRENGTHS ON THE STARK BROADENING OF Rb I LINES*, XII Int.Conf. on Spectral Line Shapes, Toronto pp. PB-5(1-2).

The influence of oscillator strength values to the neutral rubidium Stark broadening parameter values has been investigated. It has been found that the most important difference is for $5p^2P^o$ - $5d^2D$ transition.

Dimitrijević M. S., Sahal-Bréchot S. , 1994, *ON THE STARK BROADENING OF NEUTRAL RUBIDIUM SPECTRAL LINES*, XVII Symp.Phys.Ioniz.Gases, Beograd pp. 187-190

Stark-broadening parameters of Rb I are of interest for laboratory plasma investigation and diagnostic as well as for Solar and stellar spectroscopy. By using the semiclassicalperturbation formalism, we have calculated electron-, proton-, and ionized argon-impact line widths and shifts for 24 Rb I multiplets. Here, we discuss the results for Rb I, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF Al XI AND Si XII SPECTRAL LINES*, XVII Symp.Phys.Ioniz.Gases, Beograd pp. 205-207.

Stark broadening parameters for spectral lines for ions within the lithium isoelectronic sequence have particular importance for the investigation of regularities and systematic trends, due to its simplicity (one optical electron) for theorethical research. Results of such investigations are of interest for acquisition of new data by interpolation and for critical evaluation of existing experimental and theoretical data, particularly in astrophysics. The astrophysical importance of multiply charged ion lines is increasing due to the developpement of UV astronomy from space and owing to the development of researches on the physics of stellar interiors.

In order to investigate the behavior of Stark broadening parameters along an isoelectronic sequence as far as posible without the significant influence of relativistic effects, we have calculated electron—, proton—, and He III— impact line widths and shifts for 7 Al XI and 9 Si XII multiplets, by using the semiclassical-perturbation formalism. Discussion and analysis of the obtained results is presented as well.

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Dimitrijević M. S., Sahal-Bréchot S., 1994, *ON THE STARK BROADENING OF SPECTRAL LINES ALONG THE LITHIUM ISOELECTRONIC SEQUENCE : Ne VIII AND Na IX*, 26 EGAS Conference, Bellatera (Barcelona), Europhysics conference abstracts, 18 D pp. 344-345.

The development of UV astronomy from space as well as the development of researches on the physics of stellar interiors, increases the significance of multiply charged ion lines in astrophysics. By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 20 Ne VIII and 8 Na IX multiplets, in order to continue our research of multiply charged ion line Stark broadening parameters, with the special emphasis on the lithium isoelectronic sequence. Here, we present and discuss the obtained results. Moreover, the influence of the perturber charge on the ion broadening contribution has been investigated and discussed.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF Ne VIII LINES*, III DIAM (Colloque sur la Dynamique des Ions Atomes et Molecules), Albi p. P78.

By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 20 Ne VIII multiplets, in order to continue our research of multiply charged ion line Stark broadening parameters, with the special emphasis on the lithium isoelectronic sequence. Here, we present and discuss the obtained results, and also the comparison with experimental data (Glenzer et al. 1992) and other theoretical calculations (Glenzer et al. 1992; Seaton 1988) and estimates (Puria et al 1988).

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF Na IX SPECTRAL LINES*, VII Int.Conf. on the Physics of Highly Charged Ions, Book of Abstracts, eds. F.Aumayr, H.P.Winter, Vienna p. We60.

Using a semiclassical approach, we have calculated electron-, proton-, and He III-impact line widths and shifts for 8 Na IX multiplets. The influence of the perturber charge on the ion broadening contribution has been investigated and discussed.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *ON THE STARK BROADENING OF Si XII SPECTRAL LINES*, VII Int.Conf. on the Physics of Highly Charged Ions, Book of Abstracts, eds. F.Aumayr, H.P.Winter, Vienna p. We61.

Using a semiclassical approach, we have calculated electron-, proton-, and He III-impact line widths and shifts for 9 Si XII multiplets. Obtained results have been used for the study of the behavior of Stark broadening parameters within an isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *ON THE STARK BROADENING OF Na IX SPECTRAL LINES*, XXIInd General Assembly of the International Astronomical Union, Den Haag, Astronomy posters, Abstracts, H.van Woerden, ed. p. 255.

Within the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 8 Na IX multiplets, in order to continue our effort to provide to astrophysicists the needed multiply charged ion line Stark broadening parameters, with the special emphasis on the lithium isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *ON THE STARK BROADENING OF Al XI SPECTRAL LINES*, XXIInd General Assembly of the International Astronomical Union, Den Haag, Astronomy posters, Abstracts, H.van Woerden, ed. p. 255.

Using a semiclassical approach, we have calculated electron-, proton-, and He III-impact line widths and shifts for 7 Al XI multiplets. Obtained results have been used for the study of the behavior of Stark broadening parameters within an isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S. , 1994, *STARK BROADENING PARAMETER TABLES FOR MG I LINES OF INTEREST FOR SOLAR AND STELLAR SPECTRA RESEARCH. I* , Bull. Astron. Belgrade, **149** pp. 31-84 (Errata in Bull. Astron. Belgrade, **150**, (1994) p. 121).

Using a semiclassical approach, we have calculated electron–, proton–, and ionized argon–impact line widths and shifts for 267 Mg I multiplets as a function of temperature and perturber density.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING PARAMETER TABLES FOR O IV AND O V LINES OF ASTROPHYSICAL IMPORTANCE*, Bull. Astron. Belgrade, **150** pp. 95-108.

Using a semiclassical approach, we have calculated electron–, proton–, and He III–impact line widths and shifts for 5 O IV and 19 O V multiplets as a function of temperature and perturber density.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF Al I SPECTRAL LINES*, Physica Scripta **49** pp. 34-38.

Stark broadening parameters of neutral aluminium lines are of interest for laboratory plasma diagnostics and they have been determined experimentaly and theoretically several times. Astrophysical importance of Aluminium lines is due to its high cosmical abundance and its presence in the solar atmosphere and stellar spectra. Particularly important are Al I resonance lines 13944.5Å and 3961.5 Å which appear in A0 type stars (where Stark broadening is not negligible) and become more stronger with the temperature decrease. By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 22 Al I multiplets. Here, we present and discuss the results for Al I, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF Be I SPEC-TRAL LINES*, Astron.Astrophys.Suppl.Series **105** pp. 243-244.

As discussed in our previous article concerning Be II, beryllium Stark-broadening parameters are important to astrophysicists since the surface content (abundance) of light elements involves problems correlated with nucleogenesis, mixing between the atmosphere and the interior, and stellar structure and evolution. Moreover, due to developement of infrared astronomy from space, lines originating from higher energy levels, have an increasing interest. For such lines the importance of Stark broadening contribution increases with the increase of the relevant principal quantum number, since the optical electron becomes less influenced by the core and more sensitive to weak external electric fields. Consequently, for such lines Stark broadening might be of interest even for cooler star plasmas.

By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Be I multiplets. We present and discuss here, the results for Be I, along with a comparison with other semiclassical results. We see that the agreement is within error limits of the semiclassical method except for transitions involving highly excited levels (2p-4s and 2p-4d) where our widths are smaller due to Debye screening effect not taken into account explicitely by Griem (but the corresponding correction is suggested).

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. XI. Al XI AND Si XII*, Astron.Astrophys.Suppl.Series **105** pp. 245-246.

This paper is the eleventh of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions.In previous articles Stark broadening data for C IV, N V, O VI, F VII, Ne VIII and Na IX all belonging to the lithium isoelectronic sequence have been calculated.

Due to the simplicity (one optical electron), Stark broadening parameters for spectral lines for ions within this electronic sequence have particular importance for the investigation of regularities and systematic trends. Results of such investigations are of interest for asquisition of new data by interpolation and for critical evaluation of existing experimental and theoretical data, particularly in astrophysics. The astrophysical importance of multiply charged ion lines is increasing due to the developpement of UV astronomy from space and owing to the developpement of researches on the physics of stellar interiors.

In the case of Mg X, the reliable data on $4s^2S$ energy level are missing, so that we could not complete atomic data set needed for reliable semiclassical calculations.In order to investigate the behavior of Stark broadening parameters along an isoelectronic sequence as far as posible without the significant influence of relativistic effects,we have calculated electron-, proton-, and He III- impact line widths and shifts for 7 Al XI and 9 Si XII multiplets, by using the semiclassical-perturbation formalism. Here, we present and discuss the obtained results as well as the Stark broadening parameter behaviour within the lithium isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF Rb I SPEC-TRAL LINES*, Physica Scripta **49** pp. 661-665.

Neutral Rubidium Stark-broadening parameters are of interest for laboratory plasma spectroscopy and have been investigated several times. Moreover, rubidium lines have been observed in Solar and stellar spectra as well, and their Stark broadening parameters consequently are of interest to astrophysicists too.

By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized argon-impact line widths and shifts for 28 Rb I multiplets. Here, we present and discuss the results for Rb I, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1994, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. X. Ne VIII AND Na IX LINES*, Astron.Astrophys.Suppl.Series **107** pp. 349-351.

In order to investigate the behavior of Stark broadening parameters along the lithium isoelectronic sequence as far as posible, we have calculated electron-, proton-, and He III- impact line widths and shifts for 20 Ne VIII and 8 Na IX multiplets, by using the semiclassical-perturbation formalism. We present here as well, the discussion and analysis of obtained results together with the comparison with the existing experimental and theoretical data. Since data are not linear with perturber density (N), due to the Debye screening effect, which is often important at high densities of interest for subphotospheric layers, we will present here the data for N $=10^{16}$-10^{22}cm^{-3} and temperatures from 200,000 K up to 2,000,000 K.

Dimitrijević M. S., Sahal-Bréchot S. , 1994, *STARK BROADENING PARAMETER TABLES FOR MG I LINES OF INTEREST FOR SOLAR AND STELLAR SPECTRA RESEARCH. II*, Bull. Astron. Belgrade, **150** pp. 47-94.

Using a semiclassical approach for the Stark broadening of spectral lines, we have calculated ionized magnesium−, ionized silicon−, and ionized iron−impact line widths and shifts for 270 Mg I multiplets as a function of temperature (T = 2500 K - 50000 K) and perturber density (N = 10^{11} cm^{-3}).

Dimitrijević M. S., Sahal-Bréchot S., 1994, *INFLUENCE OF THE OSCILLATOR STRENGTHS ON THE STARK BROADENING OF Rb I LINES*, in Spectral Line Shapes 8, eds. A. D. May, J.R. Drummond, E. Oks, AIP Conf. Proc **328**, American Institute of Physics, New York, pp. 87-88.

In order to see the influence of oscillator strength values to the neutral rubidium Stark broadening parameter values, calculations have been firstly performed within the Bates - Damgaard approximation and than repeated with oscillator strengths calculated by using relativistic single- configuration Hartree-Fock method with allowance for core polarization (Migdalek and Baylis), and with oscillator strengths from Warner, where allowance for configuration mixing and for spin-orbit interaction has been One can conclude that the most important difference is for $5p^2P^o$ - $5d^2D$ transition.

Djeniže, S., Skuljan Lj., Labat J., Bukvić S., and Konjević R, 1994, *STARK WIDTHS AND SHIFTS OF SEVERAL NiI AND NiII SPECTRAL LINES*, Astron. Astrophys. Suppl. Ser. **105**, 115–118.

Konjević N., Blagojević B., Popović M. V., Dimitrijević M. S., 1994, *TEMPERATURE DEPENDENCE OF THE TRIPLY IONIZED OXYGEN STARK WIDTHS*, XII Int.Conf. on Spectral Line Shapes, Toronto pp. PA-2(1-2).

The aim of this paper is to supply the experimental and theoretical data for the widths of the prominent triply ionized oxygen lines in a large electron temperature range. The reported experimental results together with other experimental data will be used for testing of various theoretical calculations.

Konjević N., Blagojević B., Popović M. V., Dimitrijević M. S., 1994, *TEMPERATURE DEPENDENCE OF THE TRIPLY IONIZED OXYGEN STARK WIDTHS*, in Spectral Line Shapes 8, eds. A. D. May, J.R. Drummond, E. Oks, AIP Conf. Proc **328**, American Institute of Physics, New York, pp. 75-76.

Results of experimental and theoretical investigations of O IV 3s - 3p and 3p - 3d lines have been reported.

Поповић Л. Ч., 1994, *ШТАРКОВО ШИРЕЊЕ ЈОНА ТЕШКИХ ЕЛЕМЕНАТА У СПЕКТРИМА ТОПЛИХ ЗВЕЗДА*, Математички факултет (Докторска дисертација), Београд.

Popović L. Č., 1994, *STARK BROADENING OF HEAVY ION SPECTRAL LINES IN SPECTRA OF HOT STARS*, Publ. Obs. Astron. Belgrade 46, pp. 1-131

A large number of heavy ion spectral lines are present in spectra of hot ("normal" and CP) stars. Stark broadening is the dominant pressure broadening mechanism for stars with $T_{eff} \gtrsim 10000$ K. As one can see from Tables 1.1 and 1.2 in atmosphere of hot star (with electron density of $N = 10^{21} cm^{-3}$, and temperature of 10000 K) Stark widths of some Zn II, As II, Sb II, I II and Bi II spectral lines are even larger than widths due to the thermal Doppler effect. Stark broadening of lines originating from energy levels with high principal quantum numbers may be important even for cooler stars.

Due to the lack of reliable atomic data for Stark broadening calculation of heavy ion lines with complex spectra it is not always possible to apply a semiclassical approach. In this case one can provide Stark broadening data using approximative methods. One of such method is the modified semiempirical approach (MSE) developed by Dimitrijević & Konjević (1980) and Dimitrijević & Kršljanin (1986). In this work we investigate the applicability of this modified semi-empirical approach for Stark broadening parameter calculation of ions with complex spectra.

In order to test the MSE approach we have selected seven singly ionized emitters (Z$\geq$ 30) : Zn II, As II, Sb II, Cd II, I II, Br II and Bi II.

The selection was based on the following resons :

– that the spectral lines of considered ions are astrophysically important,

– that there exist the mesaured data for a number of considered lines,

– the selected ions have a complex spectra,

– that for considered ion lines it is impossible to calculate Stark broadening parameters with other more accurate methods, as, e.g., semiclassical method.

For the ions with complex spectra the MSE approach, in general case, gives equations (4.2.1ab), where the square of matrix element depend on the coupling approximation. Here we consider the LS, $j\ell$ and jj coupling approximations and the case of mixing configuration.

The influence of the coupling approximation is presented in Figs. 4.2.2 – 4.2.12. We can see that the obtained differences in Stark widths for different coupling approximations are within the error of the method. We can also see (Figs. 4.2.3 and 4.2.4 for Cd II resonance lines) that for the shift the accuracy of used coupling approximation could be very important. We can conclude that shifts are more sensitive to the coupling approximation accuracy than widths.

Obtained results for Stark broadening parameters for 99 lines of seven heavy ions are presented in Tables 5.2 – 5.10. For 31 spectral lines our results have been compared with available experimental data. Taking into account the complexity of the considered ion spectrum, we may conclude that our results satisfactory agree with experimental data for Stark widths. In the case of Stark shifts the comparison of the calculated and experimental data, from case to case, gives different agreement (see Tables 5.4, 5.7, 5.11). It has to be pointed out that for Stark shift there is less experimental data than for widths. So, we are not able to get definitive conclusion of MSE approach applicability for shift of complex ion lines, but we may conclude that Stark width calculation in MSE approach in this case gives satisfactory accuracy for astrophysical needness.

Popović L. Č. & Dimitrijević M. S., 1994, *STARK WIDTH OF Xe II SPECTRAL LINE*, in 26th E.G.A.S. Conference, p.93 (eds. R Pick and G. Thomas), Bellaterra (Barcelona).

Stark widths and shifts for several Xe II lines are presented. For calculation was used the modified semiempirical approach.

Popović L. Č. & Dimitrijević M. S., 1994, *STARK BROADENING OF As II SPECTRAL LINES*, in D.I.A.M., p P120, Albi, France.

Stark broadening data for six As II lines ($5s - 5p$ transition) are presented.

Popović L. Č. & Dimitrijević M. S., 1994, *THE MODIFIED SEMIEMPIRICAL APPROACH FOR COMPLEX ION LINES OF ASTROPHYSICAL INTEREST*, XXIInd GA IAU, p. 256, Twin Press, The Netherlands.

Skuljan Lj., and Djeniže S, 1994, *STARK BROADENING OF THE ArI SPECTRAL LINES*, XVII Symp. Phys. Ioniz. Gases (B. Marinković, and Z. Petrović, Eds.), Beograd, 1983–1984.

Blagojević B., Popović M. V., Konjević N., Dimitrijević M. S., 1995, *STARK BROAD-ENING OF THE FV $3s^2S$ - $3p^2P^o$ AND $3p^2P$ - $3d^2D^o$ TRANSITIONS*, Proc. of the First Hungarian-Yugoslav Astronomical Conference, Baja, eds. I. Vince, M.S. Dimitrijević, L. Balazs, Publ. Obs. Astron. Belgrade, **49** pp. 89-92.

The Stark widths of several fourthly ionized fluorine lines have been calculated and measured in the plasma of a pulsed arc. Electron density $2.54 \times 10^{17} cm^{-3}$ was determined from the width of the HeII P_α line while electron temperature of 89900 K is measured from the ratio of FV and FIV lines. Our experimental FV widths agree well with our semiclassical theoretical results. The results of another experiment for 3p-3d transition is in a good agreement with our theoretical and experimental data while the discrepancy for 3s-3p transition is rather large. The results of two simple theoretical methods for evaluation of Stark widths are in reasonable agreement with experiment.

Blagojević B., Popović M. V., Konjević N., Dimitrijević M. S., 1995, *STARK SHIFTS OF N III AND O IV LINES*, Proc. of the First Hungarian-Yugoslav Astronomical Conference, Baja, eds. I. Vince, M.S. Dimitrijević, L. Balazs, Publ. Obs. Astron. Belgrade, **49** pp. 93-96.

The Stark shifts of several lines belonging to analogous multiplets, $3s^2S$-$3p^2P^o$ and $3p^2P^o$-$3d^2D^2$, of doubly ionized nitrogen and triply ionized oxygen (boron isoelectronic sequence) have been calculated and measured in a plasma of a low pressure pulsed arc. Plasma electron densities are determined from the width of the HeII P_α line. Electron temperatures are measured from the ratios of NIV/NIII while temperatures in oxygen mixture are determined from relative intensities of IV lines. Experimental NIII Stark shifts are in reasonable agreement with our semiclassical calculations. In the case of OIV lines theory predicts shifts of the opposite sign. Possible causes of this discrepancy are discused.

Blagojević B., Popović M. V., Konjević N., Dimitrijević M. S., 1995, *ON THE STARK BROADENING AND SHIFT OF TRIPLY IONIZED OXYGEN LINES*, Proc. of the first Yug. Conf. on Spectral Line Shapes, Publ.Obs. Astron. Belgrade 50, pp. 31-34.

Using a semiclassical approach, we have calculated electron-, proton-, and He III-impact line widths and shifts for 19 O V multiplets. The obtained data have been discussed and analyzed.

Dimitrijević M. S., 1995, *O PARAMETRIMA ŠTARKOVOG ŠIRENJA SPEKTRAL-NIH LINIJA, POTREBNIM ZA ISTRAŽIVANJE ZVEZDANE I LABORATORI-JSKE PLAZME*, u Istraživanja u astronomiji I, O. Atanacković-Vukmanović, Dimitrijević M. S., eds., Publ.Obs.Astron.Belgrade 48, pp. 127-138.

A review of semiclassical calculations of Stark broadening is presented and comparison of different semiclassical procedures is discussed, as well as the agreement with critically selected experimental data and more sophysticated, close coupling calculations. Approximate methods for the calculations of Stark broadening parameters,

usefull especially in such astrophysical problems where large scale calculations and analyses must be performed and where a good average accuracy is expected, have also been discussed. The begining and development of line shapes investigations in Yugoslavia has been described as well.

Dimitrijević M. S., 1995, *ON THE IONIZED IRON LINES STARK BROADENING IN PLASMAS* , 17th Symp. om Plasma Physics and Technology, Prague 1995, Programme and Abstracts, p. 75.

Fe II lines are present in solar and stellar spectra and for their analysis or the calculations of synthetic spectra corresponding Stark broadening data are of importance. Stark broadening data for Fe II lines are of significance for laboratory plasma as well, since the iron is often present as impurity in various plasmas.

Within the semiclassical - perturbation formalism we have analyzed Stark broadening of singly-ionized iron a^6D - z^6P^o, a^6D - z^6D^o and a^6D - z^6F^o multiplets.

Dimitrijević M. S., 1995, *STARK BROADENING DATA FOR PLASMA DIAGNOSTICS*, 17th Symp. om Plasma Physics and Technology, Prague 1995, Proceedings, pp. 299-301.

The existing large scale calculations of Stark broadening parameters have been reviewed and discussed.

Dimitrijević M. S., 1995, *STARK BROADENING OF SINGLY-IONIZED IRON SPECTRAL LINES*, Astron.Astrophys.Suppl.Series **111** pp. 565-568.

The strongest Fe II lines correspond to 4s-4p and 3d-4p transitions in $3d^6nl$ and $3d^54snl$ configurations, covering some 1500 observed lines and accounting for the main part of the intensity of the Fe II spectrum. However, if one wishes to perform a more sophisticated calculations of the corresponding Stark broadening parameters needed in astrophysics and laboratory plasma diagnostics, it is not easy to collect the sufficiently complete energy level set and to avoid the additional difficulties due to configuration interaction and violation of the LS selection rules. The best situation is just with 4s-4p sextets, which Stark broadening parameters have been determined experimentally recently, where the sufficiently complet energy level set exists and there is not pronounced configuration interactions or critical violations of the LS selection rules, so that the semiclassical calculations may provide more reliable Stark broadening parameters.

By using the semiclassical - perturbation formalism we have calculated Stark broadening parameters for singly-ionized iron a^6D - z^6P^o, a^6D - z^6D^o and a^6D - z^6F^o multiplets. covering 34 lines within 2328.11-2632.108 Å range. The present theoretical full half-widths have been compared with experimental results as well as with the calculations performed by using the modified semiempirical approach and with simple theoretical estimates based on regularities and systematic trends.

Dimitrijević M. S., 1995, *A PROGRAMME TO PROVIDE STARK BROADENING DATA FOR STELLAR AND LABORATORY PLASMA INVESTIGATIONS* , Proc. of the first Yug. Conf. on Spectral Line Shapes, Publ.Obs. Astron. Belgrade **50** pp. 9.

Here is presented a review of available semiclassical calculations of Stark broadening parameters and comparison of different semiclassical procedures is discussed, as well as the agreement with critically selected experimental data and more sophysticated, close coupling calculations. The modified semiempirical approach, usefull especially in such astrophysical problems where large scale calculations and analyses must be performed and where a good average accuracy is expected, has also been discussed as well as his applications. We discuss as well the criteria used for selection of radiator spectra for analysis and the future development of the programme.

Dimitrijević M. S., 1995, *STARK WIDTHS AND SHIFTS OF Ni II SPECTRAL LINES*, Astron. Astrophys. Suppl. Series **114** pp. 171-173.

Spectral lines of ionized nickel are present in stellar spectra. For example, such lines have been found in the spectra of Gamma Geminorum and 7 Sextantis (Adelman and Philip 1992), stars of A0 V type, where the main pressure broadening mechanism is the Stark effect. Consequently, the corresponding Stark broadening parameters are of astrophysical interest.

The first experimental determination of Ni II Stark widths and shifts has been performed recently (Djeniže *et al* 1994). Obtained experimental widths have been compared with simple calculations (Djeniže *et al* 1994) by using low temperature limits of the semiempirical (Griem 1968) and the modified semiempirical (Dimitrijević & Konjević 1980, 1987) approaches. As a result, a surprisingly large discrepancy between experimental and theoretical values has been reported. Since the sufficiently complete set of atomic data for the considered Ni II lines exists, it is of interest to perform a more elaborate theoretical analysis within the frame of the semiclassical approach.

By using the semiclassical - perturbation formalism (Sahal-Bréchot 1969ab), we have calculated Stark broadening parameters for two lines withins Ni II a^4F - z^4G^o multiplet. Perturbers are electrons, protons and a singly charged perturber with the mass equal to 35 atomic mass units (a.u.).

By using low temperature limit of the the modified semiempirical approache, but with more accurate atomic data than in Djeniže *et al.* (1994) and with the ion broadening contribution included, we obtain 3.2 and 3.0 as ratios of measured and calculated values for Ni II 2264.5 Å and 2270.2 Å lines instead of 4.4 and 3.9. With the use of the non simplified version of the MSE approach (Dimitrijević & Konjević 1980), the corresponding ratios are 2.7 and 2.4, and for the ful semiclassical calculations 1.7 and 1.5, which is much better but still not satisfying.

Our results for the shift have the different sign from experimental ones. Since the considered lines are an 4s-4p transition with a far 4d perturbing level with smaller influence, it is logical that the shift is around zero or negative. In spite of the fact that the agreement between the theory and experiment is better if one uses the more

sophysticated semiclassical - perturbation approach, the differences are still such that a new experiment is of interest.

Dimitrijević M. S., 1995, *STARK BROADENING DATA FOR PLASMA DIAGNOS-TICS*, 17th Symp. om Plasma Physics and Technology, Prague 1995, Programme and Abstracts, p. 15.

Plasma spectroscopy depends on very extensive list of elements and line transitions with their atomic and line broadening parameters. The most sophysticated theoretical method for the calculation of a Stark broadened line profile is of course the quantum mechanical strong coupling approach. However, due to its complexity and numerical difficulties, only a small number of such calculations exist. In a lot of cases such as e.g. complex spectra, heavy elements or transitions between more excited energy levels, the more sophysticated quantum mechanical approach is very difficult or even practically impossible to use and, in such cases, the semiclassical approach remains the most efficient method for Stark broadening calculations.

The existing large scale calculations of Stark broadening parameters were performed by using three different computer codes, developed by (i) Jones, Benett and Griem, (ii) Sahal—Bréchot and (iii) Bassalo, Cattani and Walder.

All three methods have been compared with critically selected experimental data for 13 He I multiplets. The agreement between experimental and all three semiclassical calculations is within the limits of 20 percents, what is the predicted accuracy of the semiclassical method.

Dimitrijević M. S., 1995, *STARK BROADENING OF Ni II SPECTRAL LINES*, 5th EPS Conf. on Atomic and Molecular Physics, Edinburg, EPS Conf.Abstracts, **19A**, Part II p. 607.

The first experimental determination of Ni II Stark widths and shifts has been performed recently. By using the semiclassical - perturbation formalism we have calculated and analyzed Stark broadening parameters for two lines withins Ni II a^4F - z^4G^o multiplet.

Dimitrijević M. S., 1995, *ON THE IONIZED IRON LINES STARK BROADENING IN PLASMAS* , 17th Symp. om Plasma Physics and Technology, Prague 1995, Proceedings, pp. 302-304.

By using the semiclassical - perturbation formalism we have calculated Stark broadening parameters for singly-ionized iron a^6D - z^6P^o, a^6D - z^6D^o and a^6D - z^6F^o multiplets. covering 34 lines within 2328.11-2632.108 Å range, Perturbers are electrons and protons. The obtained results have been compared with available experimental and theoretical results.

Dimitrijević M. S., 1995, *ON THE IONIZED IRON LINES STARK BROADENING IN STELLAR SPECTRA*, Proc. of the First Hungarian-Yugoslav Astronomical Conference, Baja, eds. I. Vince, M.S. Dimitrijević, L. Balazs, Publ. Obs. Astron. Belgrade, **49** pp. 131-134.

The investigation of neutral and ionized iron is of great astrophysical importance due to its high abundance and its role in various processes in stellar plasma. Fe II lines are present in solar and stellar spectra and for their analysis or the calculations of synthetic spectra corresponding Stark broadening data are of importance.

The strongest Fe II lines correspond to 4s-4p and 3d-4p transitions in $3d^6nl$ and $3d^54snl$ configurations, covering some 1500 observed lines and accounting for the main part of the intensity of the Fe II spectrum. The best case for the reliable semiclassical calculation is just for 4s-4p sextets, measured by Purić et al. (1993), where the sufficiently complet energy level set exists and there is not pronounced configuration interactions or critical violations of the LS selection rules. We have calculated within the semiclassical - perturbation approach, Stark broadening parameters for singly-ionized iron a^6D - z^6P^o, a^6D - z^6D^o and a^6D - z^6F^o multiplets, comparing the obtained results with available experimental and simpler theoretical evaluations.

Dimitrijević M. S., 1995, *STARK BROADENING OF IONIZED NICKEL LINES*, Proc. of the first Yug. Conf. on Spectral Line Shapes, Publ.Obs. Astron. Belgrade **50** pp. 43-45.

Spectral lines of ionized nickel are present in stellar spectra. For example, such lines have been found in the spectra of Gamma Geminorum and 7 Sextantis, stars of A0 V type, where the main pressure broadening mechanism is the Stark effect. Consequently, the corresponding Stark broadening parameters are of astrophysical interest.

By using the semiclassical-perturbation formalism, we have calculated Stark broadening parameters for two lines withins Ni II a^4F - z^4G^o multiplet. Perturbers are electrons, protons and a singly charged perturber with the mass equal to 35 atomic mass units (a.u.). The present semiclassical full half-widths have been compared with experimental results (Djeniže *et al* 1994) as well as with results of present calculations by using the modified semiempirical approach (MSE-Dimitrijević & Konjević 1980) and its simplified version (SMSE-Dimitrijević & Konjević 1987).

Dimitrijević M. S., Sahal-Bréchot S., 1995, *ON THE STARK BROADENING OF Na IX SPECTRAL LINES*, in Astrophysical Applications of Powerful New Databases, eds. S.J. Adelman, W.L. Wiese, ASP Conference Series, **78**, pp. 169-173.

The development of UV astronomy from space as well as the development of researches on the physics of stellar interiors, increases the significance of multiply charged ion lines in astrophysics, as well as the corresponding Stark broadening data. By using the semiclassical - perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 8 Na IX multiplets, in order to continue our effort to provide to astrophysicists the needed multiply charged ion line Stark broadening parameters, with the special emphasis on the lithium isoelectronic sequence.

Moreover, the influence of the perturber charge on the ion broadening contribution has been investigated and discussed. Full half widths (W) and shifts (d) due to Na IX collisions with Na ions with the charge between 1 and 9 (Z = 2 - 10) are compared

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with the electron- and proton - impact widths and shifts. When the perturber charge increases, we have that the repulsive force between the emitter and the perturber increases as well. On the other hand, a perturber with higher charge has the stronger influence on the emitter than a perturber with smaller charge at the same distance. For lower temperatures, i.e. smaller perturber velocities, the repulsive force is more effective since the collision duration is larger and highly charged perturber has smaller chance to come closer to the emitter. Consequently, for the lower temperatures the Stark broadening parameters have smaller change with Z. One can conclude as well that shifts are more sensitive to the perturber charge increase than widths.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF Mg I SPEC-TRAL LINES*, Physica Scripta **52** pp. 41-51.

Stark-broadening parameters for neutral magnesium lines are of interest for laboratory plasma diagnostics and have been investigated experimentally and theoretically. Moreover, lines of neutral magnesium are present in the solar spectrum and the corresponding Stark broadening parameters are of interest for their analysis as well as for the diagnostic of solar plasma. Especially the infrared lines of Mg I have been observed in the solar spectrum at Kitt Peak and during the Atmos experiment on Spacelab. Due to the fact that with the increase of the principal quantum number increases the importance of the Stark broadening as well, the corresponding Stark widths and shifts are of importance for the structure of solar atmosphere diagnostics. By using the semiclassical - perturbation formalism, we have calculated electron-, proton-, and ionized argon-impact line widths and shifts for 99 Mg I multiplets. We present and discuss the results for Mg I, along with a comparison with experimental data and other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF SPECTRAL LINES OF MULTICHARGED IONS OF ASTROPHYSICAL INTEREST. XII. O IV AND O V*, Astron.Astrophys.Suppl.Series 109, pp. 551-552.

The astrophysical interest of oxygen is obvious due to its high cosmical abundance and presence of its different ionization stages in stellar atmospheres. Stark broadening of O IV and O V spectral lines has been investigated several times theoretically and experimentally. In previous theoretical evaluations various approximate approaches have been used or the more sophysticated semiclassical calculations have been performed only for particular lines. This paper is the twelfth of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions. We have calculated within the semiclassical - perturbation formalism, electron-, proton-, and ionized helium-impact line widths and shifts for 5 O IV and 19 O V multiplets, in order to continue our research of multiply charged ion line Stark broadening parameters.

Data for 3s-3p and 3p-3d multiplets of O IV have been tabulated in Blagojević et al (1994) and have been compared with available experimental results as well as with simple theoretical estimates. This comparison shows good agreement between experimental and semiclassical values.

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Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF Al XI SPEC-TRAL LINES*, in Astrophysical Applications of Powerful New Databases, eds. S.J. Adelman, W.L. Wiese, ASP Conference Series, **78**, pp. 175-177.

In order to provide to astrophysicists the needed Stark broadening parameters, we have calculated electron-, proton-, and He III- impact line widths and shifts for 7 Al XI multiplets. The evaluation of Stark broadening parameters has been performed by using the semiclassical - perturbation formalism. Here, we discuss the obtained results as well as the Stark broadening parameter behaviour within the lithium isoelectronic sequence.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *ON THE STARK BROADENING OF C V LINES IN STELLAR ATMOSPHERES*, B'Hellenic Astronomical Conference, Programme and Abstracts, Thessaloniki, 1995, p. 10.

By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and He III-impact line widths and shifts for 25 C V multiplets, in order to continue our research of multiply , charged ion line Stark broadening parameters. We present and discuss here the obtained results and their astrophysical meaning.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *ELECTRON-IMPACT BROADENING OF Mg II LINES FOR SOLLAR AND STELLAR ATMOSPHERES INVESTI-GATIONS*, B"Hellenic Astronomical Conference, Programme and Abstracts, Thessaloniki, 1995, p. 10.

The ionized magnezium lines are of particular astrophysical interest not only because of their presence in solar and stellar spectra and Mg abundance but also for the modelling of solar and stellar atmospheres, since Mg influence on the atmospheric electron density is important. Data of importance for such investigations are also electron - impact (Stark) broadening parameters, particularly important for transitions involving highly excited states, and for the considerations of subphotospheric layers.

By using the semiclassical-perturbation formalism we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for selected Mg II multiplets. We present and discuss here the obtained results and their astrophysical meaning. The comparison with experimental data and other calculations is made as well.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF LITHIUM ION LINES IN ASTROPHYSICAL AND LABORATORY PLASMAS*, Proc. of the First Hungarian-Yugoslav Astronomical Conference, Baja, eds. I. Vince, M.S. Dimitrijević, L. Balazs, Publ. Obs. Astron. Belgrade, **49** pp. 139-142.

Within the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 29 Li II multiplets. Here, we present and discuss the results for Li II, along with a comparison with other theoretical results.

The agreement between present calculation and calculations of Jones et al is better at higher temperatures, when the inelastic contribution to the width dominates, than

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at lower ones, when differences in cut-off procedure and the symmetrization influence are more significant. Generally, the disagreement of present calculations with the calculations of Griem is larger than for He I. When we have transitions involving highly excited levels, when a close perturbing energy level exist (e.g. 5p), the Debye screening (not explicitely taken into account by Jones et al, but the corresponding correction is indicated) reduces present widths and shifts.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF O V LINES*, Proc. of the First Hungarian-Yugoslav Astronomical Conference, Baja, eds. I. Vince, M.S. Dimitrijević, L. Balazs, Publ. Obs. Astron. Belgrade, **49** pp. 135-138.

Using a semiclassical approach, we have calculated electron-, proton-, and He III - impact line widths and shifts for 19 O V multiplets. The obtained results have been discussed and analyzed.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING PARAMETER TABLES FOR Mg II* , Bull. Astron. Belgrade, **151** pp. 101-114.

Due to the cosmical abundance of magnesium and its ionization potential value, Mg II lines are present in solar and stellar spectra and the corresponding Stark broadening data are of interest for their analysis. In order to provide to astrophysicists the needed Stark broadening data, we have calculated within the semiclassical-perturbation formalism electron-, proton-, and ionized helium-impact line widths and shifts for 52 Mg II multiplets.

Our results are presented for perturber densities of $10^{16}- 10^{19}$ cm^{-3} and temperatures T $= 5,000 - 150,000$ K.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING PARAMETER TABLES FOR Li II* , Bull. Astron. Belgrade, **151** pp. 115-126.

Using a semiclassical approach, we have calculated electron−, proton−, and ionized helium−impact line widths and shifts for 37 Li II multiplets as a function of temperature and perturber density.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF P V LINES*, Proc. of the first Yug. Conf. on Spectral Line Shapes, Publ.Obs. Astron. Belgrade **50**, pp. 51-54.

Stark widths and shifts of P V spectral lines are of interest for the plasma diagnostic as well as for the research of regularities and systematic trends. Recently e.g., estimates of the Stark widths for P V 4s-4p and 4p-4d transitions have been performed within a study on Stark broadening regularities within successive ionization stages of phosphorus.

By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and He III-impact line widths and shifts for 51 P V multiplets, in order to continue our research of multiply charged ion line Stark broadening parameters.

Estimates of the Stark widths for P V 4s-4p transitions obtained by using regularities within successive ionization stages (Srećković *et al.* 1990), give for full width

a value of $0.14\mathring{A}$ for T=40000 K and an electron density of 10^{17} cm^{-3}. We obtain a full width of $0.17\mathring{A}$ at T = 50000 K what is an excellent agreement encouraging the use of regularities and systematic trends for predictions and interpolations of Stark broadening parameters.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *ON THE ELECTRON-IMPACT BROAD-ENING OF O IV LINES*, XIX Int. Conf. on the Physics of Electronic and Ionic Collisions, Whistler (Canada) p. 596.

Stark broadening of O IV spectral lines has been investigated several times theoretically and experimentally. In previous theoretical evaluations various approximate approaches have been used or the more sophysticated semiclassical calculations have been performed only for particular lines. We have calculated
within the semiclassical - perturbation formalism, electron-, proton-, and ionized helium-impact line widths and shifts for and 19 O V multiplets. Obtained results have been discussed as well.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *BROADENING OF Li II LINES BY COLLISIONS WITH CHARGED PARTICLES*, XIX Int. Conf. on the Physics of Electronic and Ionic Collisions, Whistler (Canada) p. 595.

Stark-broadening parameters for singly charged lithium lines are of interest for Stark broadening theory investigations since the He-like Li II spectrum is suitable for theoretical research. Stark broadening parameters for Li II lines have been investigated theoretically. They are of interest for the examination of regularities and systematic trends within He isoelectronic sequence as well.
By using the semiclassical-perturbation formalism, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 29 Li II multiplets. Here, we present and discuss the results for Li II, along with a comparison with other theoretical results.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING OF C V SPEC-TRAL LINES OF ASTROPHYSICAL INTEREST*, JENAM-95, (Joint European and National Astronomy Meeting) Progress in European Astrophysics, Catania p. 197.

Line broadening data for spectral lines of carbon ions in different ionization stages are of particular astrophysical interest, since such lines are present in stellar atmospheres. For studies as *e.g.* numerical modelling of stellar plasma or abundance determinations, data on C V lines are of importance. Stark broadening parameters are needed especially for hot and dense stars.Our results for 25 C V multiplets, for perturber densities 10^{17} - 10^{22}cm^{-3} and temperatures T = 50,000 - 1,000,000K will be published elsewhere. Here the obtained results are doiscussed only.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *ON THE STARK BROADENING OF Mg II SPECTRAL LINES OF ASTROPHYSICAL INTEREST*, JENAM-95, (Joint European and National Astronomy Meeting) Progress in European Astrophysics, Catania p. 196.

Due to the cosmical abundance of magnesium and its ionization potential value, Mg II lines are present in solar and stellar spectra and the corresponding Stark broadening data are of interest for their analysis. In order to provide to astrophysicists the needed Stark broadening data, we have calculated within the semiclassical-perturbation formalism electron-, proton-, and ionized helium-impact line widths and shifts for 52 Mg II multiplets.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *ON THE STARK BROADENING OF Mg I SPECTRAL LINES IN SOLAR AND STELLAR SPECTRA*, Cool Stars Stellar Systems and the Sun, Florence p. 64.

The infrared lines of Mg I have been observed in the Solar spectrum at Kitt Peak and during the Atmos experiment on Spacelab. Due to the suitability of these lines for the solar atmosphere investigations and to the fact that with the increase of the principal quantum number increases the importance of Stark broadening as well, the corresponding Stark widths and shifts are of importance for the structure of the Solar atmosphere research and solar plasma diagnostic. Stark broadening data for Mg I lines are also of interest for laboratory plasma research and have been investigated experimentally and theoretically several times.

Within the semiclassical-perturbation formalism we have analyzed electron-, proton-, Mg II-, Si II-, and Fe II-impact line broadening parameters for selected Mg I multiplets , in order to provide the needed Stark broadening parameters for investigation and modelling of Solar plasma.

Dimitrijević M. S., Sahal-Bréchot S., 1995, *STARK BROADENING PARAMETER TABLES FOR C V AND P V* , Bull. Astron. Belgrade, **152** pp. 99-129.

Using a semiclassical approach, we have calculated electron−, proton−, and He III−impact line widths and shifts for for 25 C V and 51 P V multiplets as a function of temperature and perturber density.

Dimitrijević M. S., Todorović N. K., 1995, *THE ANALYSIS OF THE SIMPLIFIED FORMULA FOR THE STARK BROADENING OF NEUTRAL ATOM LINES*, Proc. of the first Yug. Conf. on Spectral Line Shapes, Publ.Obs. Astron. Belgrade **50**, pp. 55-60.

The approximate semiclassical formula of Dimitrijević and Konjević for isolated neutral atom spectral lines has been applied to neutral helium lines . The disagreements with the more sophisticated full semiclassicakl calculations of Griem are within 20 per cents. It is demonstrated as well how one can introduce simple corrections in order to achieve even better agreement. With such corrections the largest disagreement is 2 per cents.

Dimitrijević M. S., Todorović N. K., 1995, *THE ANALYSIS OF THE SIMPLIFIED FORMULA FOR THE STARK BROADENING OF NEUTRAL ATOM LINES*, Proc. of the first Yug. Conf. on Spectral Line Shapes, Publ.Obs. Astron. Belgrade **50**, pp. 55-60.

The approximate semiclassical formula of Dimitrijević and Konjević for isolated neutral atom spectral lines has been applied to neutral helium lines . The disagreements with the more sophisticated full semiclassicakl calculations of Griem are within 20 per cents. It is demonstrated as well how one can introduce simple corrections in order to achieve even better agreement. With such corrections the largest disagreement is 2 per cents.

Djeniže S., Skuljan Lj., Konjević R, 1995, *EXPERIMENTAL STARK SHIFTS OF SEVERAL HeI AND ArI SPECTRAL LINES*, J. Quant. Spectrosc. Radiat. Transfer **54**, 581.

Jankov S., 1995, *FOURIER ANALYSIS OF ROTATIONALLY BROADENED STELLAR SPECTRA*, Publ. Obs. Astron. Belgrade **50**, 75–80.

Popović L. Č., Dimitrijević M. S., 1995, *THE MODIFIED SEMIEMPIRICAL APPROACH FOR THE STARK WIDTHS OF COMPLEX ION LINES OF ASTROPHYSICAL INTEREST*, ASP Conference Series **78** (eds. S. J. Adelman and W. L. Wiese), pp. 165-167.

We have applied the modified semiempirical approach for calculation of Stark line widths of several complex ions. Our results are compared with available experimental data. The average ratio of experimental and theoretical Stark widths is $w_{exp}/w_{th} = 1.4 \pm 0.3$.

Popović L. Č. & Dimitrijević M. S., 1995, *STARK BROADENING OF DOUBLE IONIZED ATOMS : As III and Se III*, Publ. Obs. Astron. **50**, 105-106.

Stark widths for four transitions of As III and three transitions of Se III are given.

Popović L. Č. & Dimitrijević M. S., 1995, *STARK BROADENING OF Ge III and Ge IV*, Program & abstracts of 2nd Hellenic Astronomical Conference, Thessaloniki. p. 39

Here we present Stark width for several Ge III and Ge IV spectral lines. For calculation the modified semiempirical approach has been used.

Popović L. Č., Vince I., Jankov S., Djurašević G., Atanacković-Vukmanović O. and Jevremović D., 1995, *ANALYSIS OF THE Mg II h SPECTRAL LINE SHAPES IN HR 7275 AND IM Peg*, (Proc. of The first Yugoslav conference on spectral line shapes, eds. Dimitrijević and L. Č Popović) Publ. Obs. Astron. Belgrade **50**, 111–114.

The analysis of high-resolution IUE spectra of RS CVn type stars HR 7275 and IM Peg is presented. The inverse method technique was applied to the MgII h chromospheric emission line, that shows the presence of interstellar absorption, in order to recover the intrinsic stellar line profile parameters.

Skuljan Lj., Milosavljević V., Srećković A., Djeniže S, 1995, *MEASURED STARK WIDTHS OF 425.94 nm Ar SPECTRAL LINE*, Bull. Astron. Belgrade **151**, p. 17.

Skuljan Lj., Bukvić S., Djeniže S, 1995, *MEASURED STARK WIDTH OF THE 324.7 nm CuI RESONANCE SPECTRAL LINE*, Publ. Obs. Astron. Belgrade **50**, pp. 103 – 104.

Vince I., Popović L. Č., Jankov S., Djurašević G., Atanacković-Vukmanović O. and Jevremović D., 1995, *ON INVERSE METHODS USED AT BELGRADE OBSERVATORY FOR ANALYSIS OF SPECTRAL LINE SHAPES*, (Proc. of The first Yugoslav conference on spectral line shapes, eds. Dimitrijević and L. Č. Popović) Publ. Obs. Astron. Belgrade **50**, 21–26.

In this paper we present inverse methods used for analysis of the spectral line shapes at Belgrade Observatory. A short description of the methods and some examples of application are given.

11.3. Atoms and Atomic collisional processes
11.3. Атоми и атомски сударни процеси

Mihajlov A. A., Ljepojević N. N., Dimitrijević M. S., 1992, *INFLUENCE OF ION - ATOM COLLISIONS ON THE RECOMBINATION OF ELECTRONS*, J.Phys.B. **25** pp. 5121-5127.

We show that for the study of recombination of ions and electrons in weakly ionized low temperature hydrogen plasmas, the processess $H + H^+ + e \rightarrow H + H^*(n)$ and $H_2^+ + e \rightarrow H + H^*(n)$ must both be considered since their contributions are comparable. A simple method for the calculation of the corresponding rate coefficients is presented.

Mihajlov A. A., Ljepojević N. N., Dimitrijević M. S., 1993, *RECOMBINATION OF ELECTRONS ON BINARY ION-ATOM SYSTEMS*, ATMOP 3, Daresbury 1 page without page number.

Radiative recombination in symmetrical ion - atom collisions were considered using a semiclassical adiabatic model of collisions in low - temperature plasmas.

Dimitrijević M. S., Grujić P. V., Simonović N., 1994, *SMALL-ENERGY THREE-BODY SYSTEMS : V. THRESHOLD LAWS WHEN WANNIER THEORY FAILS*, J.Phys.B **27** pp. 5717-5730.

We investigate cases of Coulombic systems near the break - up threshold for which the Wannier model holds, but not Wannier theory. Making use of the classical trajectory method, we derive threshold laws for a model system of fractional charge ($Z = 0.25$ a.u.) nucleus and electrons, and a real (though perhaps impractical) system of two beryllium nuclei and an antiproton. For the first system we find the threshold law of the form $\exp(-\lambda/E^{1/2})$, where E is the total energy, and for the second one a number of characteristic features above the classical threshold have been obtained. Finally, we investigate numerically a realistic case of an electron and two beryllium nuclei and discuss some general features of the ionization probability above the classical threshold.

11.4. Laser produced and laboratory plasmas
11.4. Ласерски произведене и лабораторијске плазме

Mihajlov A. A., and Dimitrijević M. S., 1991, *INFLUENCE OF ION-ATOM COLLISIONS ON THE ABSORPTION OF RADIATION IN HELIUM PLASMA*, I DIAM, (Dynamique des Ions, Atomes et Molecules), Bourges pp. 106(1-2).

The influence of the radiative charge exchange and the radiative ion - atom recombination processes on the continuous emission from a low - temperature helium plasma has been investigated.

Mihajlov A. A., Dimitrijević M. S., Ermolaev A. M., 1993, *RADIATIVE ION-ATOM PROCESSES AS A SOURCE OF CONTINUAL EM-RADIATION FROM LOW TEMPERATURE HELIUM PLASMA*, XVIII Int.Conf.Phys.Electronic and Atomic Collisions Arhus p. 826.

We show that the processess $He + He^+ \rightarrow He + He^+ + h\nu$ and $He + He^+ \rightarrow He_2^+ + h\nu$ must be treated as a source of continual electro-magnetic radiation from low temperature plasma. Both reaction channels are treated separately and the corresponding total and partial spectral coefficients have been calculated for helium plasma at $T \leq 3$ 10^4 K. The obtained results have been also compared with the corresponding spectral densities for electron-ion scattering.

Mihajlov A. A., Dimitrijević M. S., Ljepojević N. N., 1993, *EXCITED HELIUM ATOM STATES POPULATION DUE TO ELECTRON-ION-ATOM RECOMBINATION*, European Astronomical Society, 2nd General Meeting Extragalactic Astronomy and Observational Cosmology, Torun p. 54.

On the basis of the semi-classical theory, the influence of $He + HE^+ + e$ and $He_2^+ + e$ recombination processes on the population of $He^*(n)$ atoms in helium plasma was considered and the corresponding rate coefficient were determined. These processes were compared with the electron - electron - ion recombination processes in the case of non-equilibrium helium plasma. It was shown the significant role of the considered processes and demonstrated the necessity to take them into account for the low temperature plasma modeling. It was pointed out particularly that the influence of the recombination processes, in some cases, may have even dominant role.

Mihajlov A. A., Dimitrijević M. S., Ermolaev A. M., 1993, *RADIATION CHARGE EXCHANGE AND RADIATION ION-ATOM RECOMBINATION AS A SOURCE OF CONTINUAL E-M RADIATION FROM ASTROPHYSICAL PLASMA*, in Planetary Nebulae (eds. R.Weinberger, A.Acker), Kluwer Acad.Publ., Dordrecht, Boston, London p. 189.

We show that for the study of emission from weakly ionized low temperature hydrogen plasmas, the processes

$$A + A^+ \rightarrow A_2^+ + \hbar\omega \tag{1a}$$

$$A + A^+ \rightarrow \begin{cases} A + A^+ \\ A^+ + A \end{cases} + \hbar\omega \tag{1b}$$
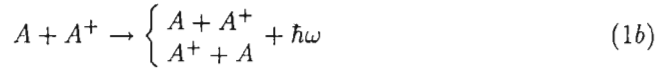
(where A denotes a neutral atom in ground state, and A^+ and A_2^+ atomic and molecular ions) must be treated as a source of continual e−m radiation from stellar plasma. Both reaction channels are treated separately and the corresponding total and separate spectral intensities are determined for hydrogen plasma at $T \leq 10^4$K. The obtained results have been also compared with the corresponding spectral intensities for electron−ion bremsstrahlung and electron−ion photorecombination.

Mihajlov A. A., Dimitrijević M. S., Ermolaev A. M., 1993, *RADIATIVE ION-ATOM COLLISIONS AS A SOURCE OF CONTINUAL EM-RADIATION FROM LOW TEMPERATURE HELIUM PLASMA*, IX Gen.Conf.European Phys.Soc. Trends in Physics, Firenze 152.

We show that the processess He + He$^+$ → He + He$^+$ +hν and He + He$^+$ → He$_2^+$ + hν must be treated as a source of continual electro-magnetic radiation from low temperature plasma. Both reaction channels are treated separately and the corresponding total and partial spectral coefficients have been calculated for helium plasma. The obtained results have been also compared with the corresponding spectral densities for electron-atom and electron-ion scattering.

The presented results show that in the case of helium plasma one must particularly be carefull concerning the continuous EM-radiation spectrum nature. Namely, from our results follows that at typical values of electron and atom component ratio in helium plasma, the investigated radiation processes might be of importance for the determination of the character of spontaneous EM-radiation spectrum.

Besides the interest for laboratory plasma, our results are of interest for research of different types of helium rich stars, particulariy those where hydrogen is burnt up and as e.g. for DB white dwarfs.

Mihajlov A. A., Ermolaev A. M., Dimitrijević M. S., 1993, *CONTINUOUS EMISSION FROM A LOW-TEMPERATURE HELIUM PLASMA DUE TO RADIATIVE CHARGE EXCHANGE AND RADIATIVE ION-ATOM RECOMBINATION*, J.Quant.Spectrosc.Radiat.Transfer, 50 pp. 227-232.

Radiative recombination and radiative charge exchange in symmetrical He$^+$ + He collisions are considered using a semiclassical adiabatic model of collisions in low -

temperature plasmas. The reaction channels are assumed to be uncoupled and the corresponding total and partial spectral coefficients for the spontaneous continuous electromagnetic emission are calculated for helium plasma temperatures below 3×10^4 K. The results are compared with the similar spectral densities for electron - ion and electron - atom scattering. It is found that in a wide range of physical conditions radiative processes involving ion - atom collisions should be taken into account in the analysis of the continuum radiation from helium plasmas.

Ermolaev A. M., Mihajlov A. A., Ignjatović Lj. M., Dimitrijević M. S., 1995, *CONTINUOUS EMISSION DUE TO RADIATIVE ION-ATOM ASSOCIATION AND CHARGE EXCHANGE IN WEAKLY IONIZED PLASMAS OF H, HE, Li and Na*, J.Phys.D : Appl.Phys. **28** pp. 1047-1057.

The contribution of radiative charge exchange and radiative association in symmetrical ion - atom collisions to continuous EM radiation from weakly ionized gaseous plasmas has been considered within the semiclassical adiabatic theory. The differential cross sections for spontaneous photon emission and the general expressions for the spectral coefficients of emission and absorption are given. The hydrogen and helium plasmas that are representative of two different optical types of gaseous medium have been studied in a broad range of T and λ, $4000 \leq T(K) \leq 20000$ and $200 \leq \lambda(nm) \leq 1000$. The domain of T and λ, where ion - atom collisions contribute significantly to continuous plasma spectra, has been established. The case of weakly ionized alkali metal plasmas of Li and Na has been studied in the same interval of λ but at lower temperatures, $1500 \leq T(K) \leq 3500$. The relevance of the results to the studies of laboratory plasmas is discussed.

Mihajlov A. A., Ermolaev A. M., Dimitrijević M. S., 1995, *RADIATIVE SYMMETRICAL ION-ATOM COLLISIONS AS AN ADDITIONAL SOURCE OF CONTINUOUS RADIATION FROM WEAKLY - IONIZED PLASMA*, 5th EPS Conf. on Atomic and Molecular Physics, Edinburg, EPS Conf.Abstracts, **19A**, Part II p. 793.

The contribution of radiative charge exchange and radiative association in symmetrical ion - atom collisions to continuous EM radiation from weakly ionized gaseous plasmas has been considered within the semiclassical adiabatic theory. The differential cross sections for spontaneous photon emission and the general expressions for the spectral coefficients of emission and absorption are given. The hydrogen and helium plasmas have been studied as well as the case of weakly ionized alkali metal plasmas of Li and Na. The relevance of the results to the studies of laboratory plasmas is discussed.

Mihajlov A. A., Ignjatović Lj. M., Djurić Z., Dimitrijević M. S., 1995, *ELECTRON-ION-ATOM AND ELECTRON-MOLECULAR ION RECOMBINATION IN HYDROGEN PLASMA*, XIX Int. Conf. on the Physics of Electronic and Ionic Collisions, Whistler (Canada), p. 587.

On the basis of a semi-classical theory, the rate coefficients of collisional $H - H^*(n)$ recombination during electron scattering on $H - H^+$ complexes and H_2^+ ions were determined in this paper. The calculations were carried out in the case of non-equilibrium hydrogen plasma, in function of atomic temperature T_a and electronic temperature T_e, with the principal quantum number $4 \leq n \leq 10$.

LECTURES HELD AT THE ASTRONOMICAL OBSERVATORY
IN THE PERIOD 1991-1995
ПРЕДАВАЊА И СЕМИНАРИ ОДРЖАНИ НА АСТРОНОМСКОЈ
ОПСЕРВАТОРИЈИ У ПЕРИОДУ ОД 1991-1995

25. 04. 1991.
И. Винце
ЕКСПЕДИЦИЈА У МЕКСИКО ЗА ПРАЋЕЊЕ ТОТАЛНОГ ПОМРАЧЕЊА
СУНЦА 11. 7. 1991.

15. 05. 1991.
З. Кнежевић
СЕКУЛАРНЕ РЕЗОНАНЦИЈЕ ОД 2 ДО 5 А.Ј.

24. 05. 1991
А. Оскањан
ОБЛАСТИ ЈОНИЗОВАНОГ ВОДОНИКА У НАШОЈ ГАЛАКСИЈИ И ОБЛАСТИ
ВРЛО МЛАДИХ ЗВЕЗДА У О АСОЦИЈАЦИЈАМА

05. 06. 1991.
М. С. Димитријевић
ПРОБЛЕМИ ТРИ ТЕЛА У КУЛОНОВОМ ПОЉУ

19. 06. 1991.
С. Нинковић
КРИВЕ РОТАЦИЈЕ И МОДЕЛИ СПИРАЛНИХ ГАЛАКСИЈА

06. 11. 1991.
С. Нинковић
ЛОКАЛНА ГРУПА ГАЛАКСИЈА

20. 11. 1991.
В. Чадеж
MHD ПОВРШИНСКИ ТАЛАСИ

04. 12. 1991.
З. Кнежевић
НЕЛИНЕАРНЕ СЕКУЛАРНЕ РЕЗОНАНЦЕ У ОБЛАСТИ АСТЕРОИДНОГ ПР-
СТЕНА

11. 12. 1991.
М. Дачић
ПРИМЕНА РАДИОИНТЕРФЕРОМЕТРИЈСКИХ МЕТОДА У САВРЕМЕНОЈ АС-
ТРОМЕТРИЈИ

18. 12. 1991.
С. Саџаков
КОРДИНАТЕ РАДИОИЗВОРА ДОБИЈЕНЕ ИЗ ПОСМАТРАЊА СА ДУГОБАЗИ-
ЧНОМ ИНТЕРФЕРОМЕТРИЈОМ

15. 04. 1992.
С. Нинковић
СУНЧЕВА ОКОЛИНА ГАЛАКСИЈЕ

27. 05. 1992.
В. Чадеж
ПРОЦЕСИ ГЕНЕРАЦИЈЕ РАДИО-ТАЛАСА У СТЕЛАРНИМ ПЛАЗМАМА (I)

03. 06. 1992.
В. Чадеж
ПРОЦЕСИ ГЕНЕРАЦИЈЕ РАДИО-ТАЛАСА У СТЕЛАРНИМ ПЛАЗМАМА (II)

10.06. 1992.
С. Саџаков, М. Дачић, З. Цветковић
МЕЂУНАРОДНИ СПЕЦИЈАЛНИ ПРОГРАМИ МЕРИДИЈАНСКИХ ПОСМА-
ТРАЊА УПОРИШНИХ И ПРОГРАМСКИХ ЗВЕЗДА

08. 12. 1992.
М. С. Димитријевић
СЕМИКЛАСИЧАН ПРОРАЧУН ПРОФИЛА АСТРОФИЗИЧКИ ЗНАЧАЈНИХ
ЛИНИЈА

22. 12. 1992.
С. Нинковић
ЗБИЈЕНА ЗВЕЗДАНА ЈАТА И ЊИХОВО КРЕТАЊЕ КРОЗ ГАЛАКСИЈУ

12. 05. 1993.
А. А. Михајлов, М. С. Димитријевић
УТИЦАЈ ЈОН – АТОМСКИХ СУДАРНИХ КОМПЛЕКСА НА НЕПРЕКИДНИ
СПЕКТАР СУНЦА

19. 05. 1993.
С. Саџаков, З. Цветковић, М. Дачић
АСТРОМЕТРИЈСКИ ЗНАЧАЈ ПОСМАТРАЧКИХ ПОДАТАКА ДОБИЈЕНИХ ПО-
МОЋУ ЗЕМЉИНИХ ВЕШТАЧКИХ САТЕЛИТА HIPPARCOS И SPACE TELE-
SCOPE

26. 05. 1993.
З. Кнежевић
НЕЛИНЕАРНЕ СЕКУЛАРНЕ РЕЗОНАНЦЕ У АСТЕРОИДНОМ ПРСТЕНУ

09. 06. 1993.
В. Чадеж
МАГНЕТНЕ АРКАДЕ У СУНЧЕВОЈ КОРОНИ

16. 06. 1993.
И. Винце
ПРОМЕНЕ ФРАУНХОФЕРОВИХ ЛИНИЈА У ТОКУ ВРЕМЕНА

20. 10. 1993.
В. Челебоновић
ФИЗИКА И АСТРОФИЗИКА ГУСТЕ МАТЕРИЈЕ : НЕКИ РЕЗУЛТАТИ И НЕКИ
ПРОБЛЕМИ

03. 11. 1993.
З. Ћатовић
КОМПЈУТЕРСКА ОБРАДА ПОСМАТРАЊА ВИЗУЕЛНО ДВОЈНИХ ЗВЕЗДА :
ЈЕДАН МОГУЋИ ПРИСТУП

10. 11. 1993.
Л. Ч. Поповић
УТИЦАЈ ГРАВИТАЦИОНОГ ПОЉА НА ОБЛИК СПЕКТРАЛНИХ ЛИНИЈА ИЗ
СПЕКТАРА СЕЈФЕРТОВИХ ГАЛАКСИЈА И КВАЗАРА

24. 11. 1993.
Ј. Скуљан
ПРИМЕНА CCD КАМЕРЕ НА СУНЧЕВОМ СПЕКТРОГРАФУ

23. 12. 1993.
М. Филиповић
НАЈНОВИЈИ РЕЗУЛТАТИ ИСТРАЖИВАЊА ВЕЛИКОГ МАГЕЛАНОВОГ ОБЛА-
КА У РАДИО ПОДРУЧЈУ

12. 05. 1993.
А. Томић
О ОДРЕЂИВАЊУ ЕЛЕМЕНАТА ПОМРАЧЕЊА СУНЦА ИЗ ФОТОГРАФСКИХ
ПОСМАТРАЊА

18. 05. 1994.
Д. Олевић
ЈЕДАН ПОСТУПАК ЗА ИЗРАЧУНАВАЊЕ ПАРАМЕТАРА ДВОЈНИХ ЗВЕЗДА

25. 05. 1994.
В. Челебоновић
ФИЗИКА ГУСТЕ МАТЕРИЈЕ — ДВА АСТРОФИЗИЧКА ПРОБЛЕМА

16. 11. 1994.
М. С. Димитријевић
ШИРЕЊЕ СПЕКТРАЛНИХ ЛИНИЈА Fe II И Ni II

23. 11. 1994.
Л. Ч. Поповић, Д. Јевремовић, А. Кубичела, Ј. Арсенијевић, И. Винце
ПАД КОМЕТЕ ШУМЕЈКЕР - ЛЕВИ 9 НА ЈУПИТЕР — ПОСМАТРАЊА СА АСТРОНОМСКЕ ОПСЕРВАТОРИЈЕ

07. 12. 1994.
А. А. Михајлов, М. С. Димитријевић, Љ. Игњатовић
ПРОЦЕСИ РЕКОМБИНАЦИЈЕ И ЈОНИЗАЦИЈЕ У ЗВЕЗДАНИМ АТМОСФЕРАМА

14. 12. 1994.
С. Нинковић, Р. Павловић
ЗБИЈЕНА ЗВЕЗДАНА ЈАТА И ПАТУЉАСТЕ ГАЛАКСИЈЕ КОД САТЕЛИТА ВЕЋИХ ГАЛАКСИЈА

21. 12. 1994.
С. Јанков
ТОМОГРАФСКО ОСЛИКАВАЊЕ ЗВЕЗАНИХ АТМСФЕРА У ПРОГРАМУ MUSICOS (Multi Site Continuous Spectroscopy)

17. 05. 1995.
А. А. Михајлов, М. С. Димитријевић, Љ. Игњатовић, З. Ђурић
РАДИЈАЦИОНИ $He^+(1s)$ - $He(1s^2)$ ПРОЦЕСИ У АТМОСФЕРАМА БЕЛИХ ПАТУЉАКА

24. 05. 1995.
С. Јанков
ОРГАНИЗАЦИЈА ПОСМАТРАЊА НА ОПСЕРВАТОРИЈАМА ЗАПАДНО — ЕВРОПСКЕ ЗАЈЕДНИЦЕ

31. 05. 1995.
Ј. Милоградов - Турин, С. Николић
ДИФЕРЕНЦИЈАЛНИ СПЕКТРАЛНИ ИНДЕКСИ

07. 06. 1995.
Л. Ч. Поповић, О. Атанацковић - Вукмановић, И. Винце, А. Кубичела
АСИМЕТЕРИЈА ЕМИСИОНИХ ЛИНИЈА КОД AGN : УТИЦАЈ ГРАВИТАЦИОНОГ ЦРВЕНОГ ПОМАКА

27. 06. 1995.
N. Polosukhina (Кримска астрофизичка опсерваторија, Научни)
THE CRIMEAN OBSERVATORY - TODAY

29. 06. 1995.
N. Polosukhina (Кримска астрофизичка опсерваторија, Научни)
THE INVESTIGATION OF CP STARS IN CRIMEAN OBSERVATORY

25. 10. 1995
М. С. Димитријевић
ИЗВЕШТАЈ СА КОНФЕРЕНЦИЈЕ ЕВРОПСКОГ АСТРОНОМСКОГ ДРУШТВА

08. 11. 1995.
М. С. Димитријевић
АСТРОНОМИЈА У ТАТАРСТАНУ, ЕСТОНИЈИ, ЛИТВИ И ЛАТВИЈИ

22. 11. 1995.
Г. Ђурашевић
ИСПИТИВАЊЕ ТЕСНИХ ДВОЈНИХ СИСТЕМА

20. 12. 1995
А. А. Михајлов, Љ. М. Игњатовић, М. С. Димитријевић
ПРОЦЕСИ ЕЛЕКТРОН-ЈОН-АТОМСКЕ РЕКОМБИНАЦИЈЕ У СУНЧЕВОЈ АТ-
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