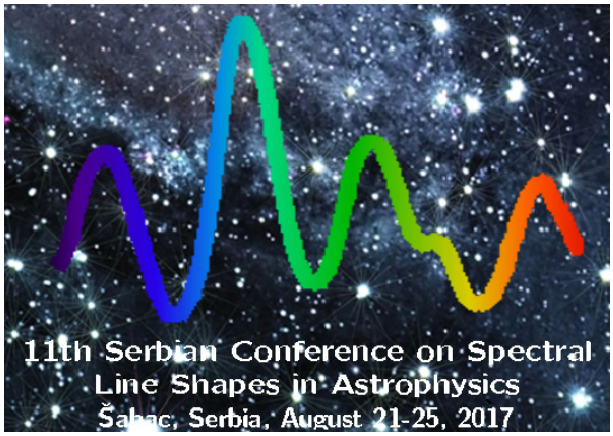
XI SERBIAN CONFERENCE
ON SPECTRAL LINE SHAPES IN ASTROPHYSICS

BOOK OF ABSTRACTS

Eds. Luka Č. Popović, Andjelka Kovačević and Saša Simić



Astronomical Observatory

Belgrade, 2017

XI SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS

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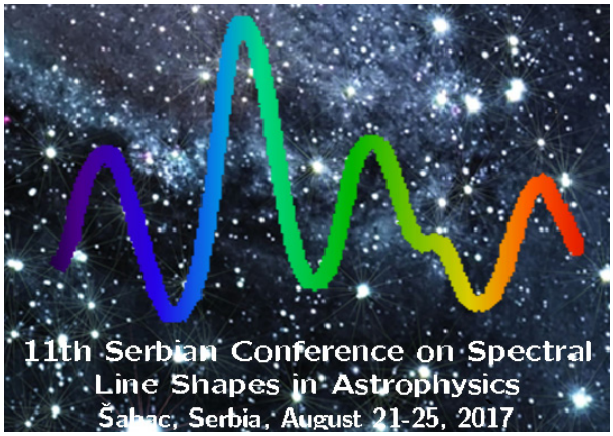

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Invited Lectures

Invited Lecture

SPECTRA OF DIATOMIC MOLECULES: FROM COLD TO HOT

R. Beuc, B. Horvatić and M. Movre

Institute of Physics, Bijenička cesta 46, 10000 Zagreb, Croatia
E-mail: beuc@ifs.hr, bhorvatic@ifs.hr, movre@ifs.hr

Diatomic molecules have been an object of very intensive investigation for different physical conditions. We shall discuss theoretical aspects of some investigations in a wide range of temperatures. At ultra-cold conditions (100 μK) in a magneto-optical trap (MOT) cold molecules can be produced by two-photon photoassociation of colliding atom pairs. The produced molecules are translationally and rotationally cold because only low partial-wave collisions (s-wave and p-wave) of cold atoms contribute to the process. We shall describe one of the scenarios for the formation of cold Cs_2 molecules by photoassociation. Cold helium nanodroplets act as a low-temperature cryostat (0.4 K) for the adsorbed Cs_2 molecules, which "skate" around on the surface, internally cold in the lowest vibrational and rotational state. Excitation spectra of Cs_2 molecules were probed by laser-induced fluorescence between 560 and 690 nm. All observed spectral features are identified by comparison with theoretical spectra simulations based on the simple reflection formula. CO molecules are very important in atmosphere investigation, especially the greenhouse gas remediation. We calculated the quantum-mechanical absorption and emission spectra for the Angstrom transition of CO molecule at room temperature (300 K). We studied absorption and thermal emission of cesium vapor superheated in the all-sapphire cell at very high temperatures (1000 - 1200 K). The measured spectra of the Cs2 diffuse band around 710 nm were compared with theoretical simulations. Because of the small rotational energy splitting in the Cs_2 molecule, in our calculations we used the semiquantum approach. In the case of an alkali-helium dimer, the free-free transitions dominate the optical spectra, so the semiclassical approximation of spectra simulation is acceptable. We compare the fully quantum-mechanical and the semiclassical approach in the case of K-He spectra in the wide range of temperatures (300 – 3000 K) typical for the atmospheres of brown dwarfs and giant exoplanets.

Invited Lecture

ON THE STARK BROADENING OF Si III SPECTRAL LINES IN B TYPE STARS

M. S. Dimitrijević[1,2] and N. Przybilla[3]

[1] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[2] *Observatoire de Paris, 92195 Meudon Cedex, France*
[3] *Institut für Astro- und Teilchenphysik, Universität Innsbruck, Technikerstr. 25/8, A-6020 Innsbruck, Austria*

E-mail: mdimitrijevic@aob.bg.ac.rs, Norbert.Przybilla@uibk.ac.at

Stark broadening is the main pressure broadening mechanism in stellar plasma for temperatures of the order of 10000 K or higher, since than the hydrogen, usually main constituent of stellar atmospheres, is ionized. In white dwarfs this is the dominant line broadening mechanism but it should be also often taken into account in A type, as well as in late B type and early F type stellar atmospheres, especially in line wings.

Using semiclassical perturbation approach and impact approximation (see for example Sahal-Bréchot et al. 2014), as well as modified semiempirical method (Dimitrijević and Konjević, 1980) when the semiclassical perturbation method is not applicable in an adequate way we calculated Stark broadening parameters, line widths and shifts, for a number of Si III lines observed in spectra of B type stars. Including obtained results we synthesized the corresponding parts of the spectra in order to investigate the influence of Stark broadening.

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Invited Lecture

1-m SCHMIDT TELESCOPE RECONSTRUCTION: SCIENTIFIC GOALS AND FIRST RESULTS

S. Dodonov[1], S. Kotov[1], T. Movsessian[2] and M. Gevorgian[2]

[1]*Special Astrophysical Observatory Russia Academy of Science, Nizhnij Arkhyz, Russia*
[2]*Byurakan Astrophysical Observatory National Academy of Science Republic Armenia, Byurakan, Armenia*

E-mail: dodo@sao.ru

During several years we worked on the reconstruction of 1-m Schmidt Telescope of the Byurakan Observatory (Armenia). This well-known Telescope (Markarian Survey was developed on it) up today remains one of the largest Schmidt cameras in the world. A new control system and modern driving motors were installed on the Telescope. A CCD detector (4k x 4k Apogee 16M CCD with liquid cooling system, RON $\sim$ 11.1 e) and a filter wheel were installed in the Telescope focus. As a result we obtained near 1 sq. degree field of view with 0.868 arcsec/pixel image scale. The filter set contains 20 medium band (FWHM = 250 Å, permanently cover 4000 $-$ 9000 Å) and 5 broad band (u,g,r,i,z SDSS) filters. First light on renewed Telescope was obtained in October 2015, since this time we begun several observational programs on the Telescope. In report I will describe current status and some results obtained on 1-m Schmidt Telescope in deep broad band photometry of the outer parts of the galaxies, search for the AGNs with low selection effects with medium band filters to AB=23m.

Invited Lecture

OPTICAL SPECTROSCOPY OF THE CHANGING LOOK AGN HE1136-2304

W. Kollatschny, M. Zetzl, N. Schartel, M. L. Parker and S. Komossa

Institute für Astrophysik, Universität Göttingen, Germany
E-mail: wkollat@astro.physik.uni-goettingen.de

HE1136-2304 has been identified as a Seyfert 1.95 type based on an optical spectrum taken in the year 1993. This was in accordance with a very low X-ray flux found by ROSAT in 1990. However XMM detected an increased X-ray flux by a factor of about 30 in 2014. A subsequent spectrum taken in the optical showed that the Seyfert type of this galaxy has changed to Seyfert 1.5 in July 2014. A follow up variability campaign in the optical - carried out for the years 2014 and 2015 - demonstrated a normal broad line region in this Seyfert galaxy with a Hβ radius of about 10 light days.

Invited Lecture

FAST TELESCOPE CAPABILITIES, AND THE UPCOMING MULTI-BEAM SURVEY

M. Krčo

National Astronomical Observatories, Chinese Academy of Science
E-mail: marko@mkastro.net

Construction of the Five Hundred Meter Aperture Spherical Telescope (FAST) was completed in September of 2016. We are currently in the commissioning stage. This talk will describe the current and planned capabilities of the telescope with a focus on observable lines and new science. The first large project is expected to being in the Fall of 2017. It will be a drift scan survey of the entire FAST sky conducted with the 19-beam receiver (1.05-1.45 GHz). The survey consists of four commensal projects (Galactic HI, Extragalactic HI, Pulsar search, and FRB search). The survey plan will be discussed, with a focus on the Galactic HI (HIFAST) project.

Invited Lecture

ELECTRON SCATTERING DATA AND COLLISIONAL DATABASES NEEDED FOR UNDERSTANDING PROCESSES IN COMAS

B. P. Marinković and B. Tomčik

Institute of Physics Belgrade, Pregrevica 118, 11080 Belgrade, Serbia
E-mail: bratislav.marinkovic@ipb.ac.rs, tomcik@ipb.ac.rs

During the recent exploration of Comet 67P/Churyumov-Gerasimenko by Rosetta mission [http://rosetta.esa.int/] the role of electron induced collisional processes has been revealed in order to explain collected emission spectroscopical data (Bodewits at al. 2016). The spacecraft was equipped with several narrow-band filters which were able to detect the emission from the OH, O I, CN, NH, and NH_2 species that are mostly produced by dissociative electron impact excitation of different parent species. The Belgrade electron/atom-molecule database (BEAMDB) (Marinković et al. 2017) hosted by [http://servo.aob.rs/emol] has been amended with the collection of data that is relevant for these cometary processes. Here we present a short overview and main results of our recent investigations of electron scattering data and BEAMDB as a part of the Virtual Atomic and Molecular Data Centre (VAMDC) consortium [http://portal.vamdc.org/vamdc_portal/home.seam].

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Invited Lecture

BLACK HOLE MASS ESTIMATES FROM HIGH-IONIZATION LINES: BREAKING A TABOO?

P. Marziani[1], A. Del Olmo[2], M. L. Martínez-Aldama[2], D. Dultzin[3], C. A. Negrete[3], M. D'Onofrio[4], E. Bon[5] and N. Bon[5]

[1]*INAF, Osservatorio Astronomico di Padova, IT 35122, Padova, Italy*
[2]*Instituto de Astrofisíca de Andalucía, IAA-CSIC, E-18008 Granada, Spain*
[3]*Instituto de Astronomía, UNAM, México D.F. 04510, Mexico*
[4]*Dipartimento di Fisica & Astronomia "Galileo Galilei", Università di Padova, Padova, Italy*
[5]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
E-mail: paola.marziani@oapd.inaf.it

Can high ionization lines such as C IV λ1549 provide useful virial broadening estimators? The question has been dismissed by several workers as a rhetorical one because blue-shifted, non-virial emission associated with gas outflows is often prominent in C IV λ1549 line profiles. Our analysis on a sample of $\approx$ 100 sources over a broad range of luminosity confirms that the line width of C IV λ1549 is not immediately offering a virial broadening estimator equivalent to the width of low-ionization lines. However, capitalizing on the results of Coatman et al. 2016 and Sulentic et al. 2017, we suggest a correction to FWHM C IV λ1549 for Eddington ratio and luminosity effects that can be applied over four dex in luminosity. Once corrected FWHM C IV λ1549 are used, a C IV λ1549 based scaling law yields black hole mass values with sample standard deviation $\approx$ 0.3 dex with respect to the ones based on Hβ.

Invited Lecture

HIGH-RESOLUTION SOFT X-RAY SPECTROSCOPY OF DILUTE SPECIES (SOME FOR ASTROPHYSICS) AT THE PLEIADES BEAMLINE

A. R. Milosavljević[1], C. Nicolas[1], E. Robert[1], J.-M. Bizau[1,2] and J. Bozek[1]

[1]*SOLEIL, l'Orme des Merisiers, St. Aubin, BP48, 91192 Gif sur Yvette Cedex, France*
[2]*Institut des Sciences Moleculaires d'Orsay (ISMO), CNRS UMR 8214, Université Paris-Sud, Université Paris-Saclay, F-91405 Orsay cedex, France*

E-mail: milosavljevic@synchrotron-soleil.fr

The laboratory investigation of X-ray photoabsorption and photoionization cross sections of atoms and ions are important for modeling of different systems relevant in astrophysical research (see Kallman & Palmery (2007), Tiedtke et al. (2008), McLaughlin et al. (2017) and references therein).

The PLEIADES beamline (https://www.synchrotron-soleil.fr/fr/lignes-de-lumiere/pleiades) of the SOLEIL synchrotron facility in France covers the soft X-ray spectral range from 10 to 1000 eV. The beamline includes three permanently installed experimental stations that allow for: coincident photoelectron photoion measurements (EPICEA), high resolution photoelectron spectroscopy (using the Scienta R4000) and for the investigation of photoionization of ions produced by an ECR source (MAIA) (Bizau et al. 2016). The beamline is designed for ultra-high resolution spectroscopy of dilute species: atoms, molecules, clusters, nanoparticles and ions, as well as of liquid microjets. The beamline can also accommodate for custom user setups.

The talk will address the design of the PLEIADES beamline and discuss its potential for high resolution soft X-ray spectroscopy of dilute species relevant for astrophysical modeling.

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Invited Lecture

FEEDBACK IN THE CENTRAL PARSECS OF ACTIVE GALACTIC NUCLEI MAPPED FROM HIGH-IONIZATION LINES

A. Rodríguez-Ardila[1,*], A. Prieto[2], X. Mazzalay[3], J. A. Fernández-Ontiveros[2], D. May-Nicolazzi[1] and F. Müller-Sánchez[4]

[1] *Laboratório Nacional de Astrofísica*
[2] *Instituto deAstrofísica de Canarias*
[3] *Max-Planck-Institut für extraterrestrische Physik*
[4] *Department of Astrophysical and Planetary Sciences, University of Colorado*
[*] *E-mail: aardila@lna.br*

Apart from the classical broad line region (BLR) at small core distances, and the extended classical narrow-line region (NLR), a subset of active galactic nuclei (AGN) show, in their spectra, lines from very highly ionised atoms, known as Coronal lines (CLs). The precise nature and origin of these CLs remain uncertain. Adaptive optics imaging/spectroscopy in a few AGNs shows CLRs with sizes varying from ∼30 pc to ∼200 pc and aligned preferentially with the direction of the radio-jet. Here, we present results from a study aimed at unveiling the CLR in nearby AGNs. The excellent angular resolution of the data allowed us to map the extension of the coronal line gas and compare it to that emitting low- and mid-ionization lines. The very good match between the radio emission and the CLR suggest that at least part of the high-ionization gas is jet-driven. Photoionization models where the central engine is the only source of energy input strongly fail at reproducing the observed line ratios, mainly at distances larger than 60 pc from the centre. We discuss here other processes that should be at work to enhance this energetic emission and suggest that the presence of coronal lines in AGNs is an unambiguous signature of feedback processes in these sources. With a minimum number of assumptions, we derive mass outflow rates of tens of solar masses per year, comparable to those of powerful AGN. The result has strong implications in the global accounting of feedback mass and energy driven by low- to moderate- luminous AGNs into the medium and the corresponding galaxy evolution.

Invited Lecture

LINE SHAPE MODELING FOR MAGNETIC WHITE DWARF AND TOKAMAK EDGE PLASMAS: COMMON CHALLENGES

J. Rosato[1], N. Kieu[1], I. Hannachi[1], R. Stamm[1], M. S. Dimitrijević[2] and Z. Simić[2]

[1] *Aix-Marseille Université, CNRS, PIIM UMR 7345, 13397 Marseille Cedex 20, France*
[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
E-mail: joel.rosato@univ-amu.fr

About 10% of white dwarfs are known to have a magnetic field strength of 10^5 to 5×10^8 G, as indicated from spectroscopic observations and models (Kepler et al. 2013, Landstreet et al. 2012, Külebi et al. 2009). An interpretation of the shape of absorption lines requires the Zeeman effect be accounted for in line broadening models, in addition to the Stark effect associated to the plasma microfield. Under specific conditions, the plasma located at the edge of tokamaks has conditions close to white dwarf stellar atmospheres (T_e and T_i are of the order of 10^4 K and N_e can be higher than 10^{14} cm^{-3} in divertor configurations (Potzel et al. 2014, Lipschultz et al. 1998)) and the magnetic field can be strong enough so that line shapes are affected both by the Zeeman effect and Stark broadening. In this work, we report on line broadening models accounting for the simultaneous action of electric and magnetic fields. A focus on collision operator models is done. In particular, it is shown that the early work by Griem, Baranger, Kolb, and Oertel ("GBKO" model (R. Griem et al. 1962)) for nondegenerate energy levels can be adapted to hydrogen emitters affected by the Zeeman effect. Following previous works for ion broadening in a near-impact regime (Rosato et al. 2009), we perform new calculations of hydrogen Balmer lines in magnetized plasmas. An extension of collision operator models to regimes where non-binary interactions between an emitter and perturbers are present can be devised through an adaptation of the so-called unified theory (Rosato et al. 2012). We discuss this model and present an adaptation to magnetized plasmas.

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Invited Lecture

ATOM-ATOM AND ION-ATOM COLLISIONAL PROCESSES: MODELING OF STELLAR ATMOSPHERES

V. A. Srećković[1], Lj. M. Ignjatović[1] and M. S. Dimitrijević[2,3]

[1]*Institute of Physics, Pregrevica 118, 11080 Zemun, Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*
[3]*LERMA, Observatoire de Paris, UMR CNRS 8112, UPMC, 92195 Meudon Cedex, France*

E-mail: vlada@ipb.ac.rs, ljuba@ipb.ac.rs, mdimitrijevic@aob.rs

We present the results obtained during our long-term research (see e.g. Mihajlov et al. 2011, 2003, Srećković et al. 2013, 2014) on the influence of two groups of collisional processes (atom-atom and ion-atom) on the optical and kinetic properties of weakly ionized stellar atmospheres layers. The first type includes radiative processes of the photodissociation/association and radiative charge exchange, the second one the chemi-ionisation/recombination processes. The effect of the radiative processes is estimated by comparing their intensities with those of the known concurrent processes in application to the solar photosphere and to the photospheres of DB white dwarfs. The investigated chemi-ionisation/recombination processes are considered from the viewpoint of their influence on the populations of the excited states of the hydrogen atom (the Sun and an M-type red dwarf) and helium atom (DB white dwarfs). The effect of these processes on the populations of the excited states of the hydrogen atom has been studied using the general stellar atmosphere code, which generates the model. The presented results demonstrate the undoubted influence of the considered radiative and chemi- ionisation/recombination processes on the optical properties and on the kinetics of the weakly ionized layers in stellar atmospheres.

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Invited Lecture

A STUDY OF SUPERSONIC TURBULENCE IN STAGNATING PLASMAS

E. Stambulchik[1], E. Kroupp[1], A. Starobinets[1], D. Osin[1], V. I. Fisher[1], D. Alumot[1], Y. Maron[1], S. Davidovits[2], N. J. Fisch[2] and A. Fruchtman[3]

[1] *Weizmann Institute of Science, Rehovot 7610001, Israel*
[2] *Princeton University, Princeton, New Jersey 08540, USA*
[3] *H.I.T.—Holon Institute of Technology, Holon 5810201, Israel*

E-mail: Evgeny.Stambulchik@weizmann.ac.il, sdavidov@princeton.edu

Evolution of the ion kinetic energy in a stagnating z-pinch plasma was determined from Doppler-dominated lineshapes augmented by measurements of plasma properties and assuming first a uniform-plasma model. Notably, the energy was found to be dominantly stored in hydrodynamic flow. The Reynolds and Mach numbers are such that this motion could be supersonically turbulent, implying a non-uniform distribution of the plasma density. The data was re-analyzed under this assumption, resulting in a substantially decreased inferred mean density, while improving agreement of the model with observations. Beyond aiding our understanding of z-pinches, it is hoped that this study has highlighted fertile ground for relation to problems of astrophysical interest, such as the star formation efficiency or molecular cloud dynamics.

Invited Lecture

STARK BROADENING FROM IMPACT THEORY TO SIMULATIONS

R. Stamm[1], I. Hannachi[1,2], L. Godbert-Mouret[1], M. Koubiti[1], Y. Marandet[1], J. Rosato[1], M. S. Dimitrijević[3] and Z. Simić[3]

[1]*PIIM, Aix-Marseille Université-CNRS, centre Saint Jérôme, 13397 Marseille, France*
[2]*PRIMALAB, Faculty of Sciences, University of Batna 1, Batna, Algeria*
[3]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*

E-mail: roland.stamm@univ-amu.fr

Stark profiles are used in astrophysics and other kinds of plasmas for obtaining information on the charged environment of the emitting particles. Using the light for conveying information on the plasma often requires a modeling of both the plasma and radiator. We will review different situations requiring different modeling approaches. The impact broadening approach considers the emitter plasma interaction as a sequence of brief separate collisions decorrelating the radiative dipole. Impact models are very effective in many types of plasmas, and can be applied to most kinds of emitters, hydrogen being an exception in many types of plasmas. We will identify situations for which other models are helpful, e.g. the far wing of a line or the case were the emitter-perturbers interactions can not be represented by a sequence of collisions. Such models use the statistical properties of the electric field created by the perturbing particles. In astrophysics, the model microfield methods provide an efficient alternative for the cases were neither the impact nor the static approximation are valid. For such conditions several models have been developed and interfaced with atomic data. Their accuracy can be tested by simulation techniques avoiding some approximations, but at the expenses of computer time. Such computer simulations can be used for analyzing the various physical processes involved in plasmas under arbitrary conditions. We will illustrate their use in the case of wave collapse and plasma rogue waves.

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Invited Lecture

IRRADIATION EFFECTS IN SPECTRA OF CLOSE BINARY SYSTEMS

M. Vučković

Instituto de Física y Astronomía, Universidad de Valparaíso, Avenida Gran Bretaña 1111, Valparaíso, Chile

E-mail: maja.vuckovic@uv.cl

Irradiation effects in secondary stars of close binary systems are crucial for a reliable determination of system parameters and understanding the close binary evolution. They affect the stellar structure of the irradiated star and are reflected in the appearance of characteristic features in the spectroscopic and photometric data of these systems. I will present the research we have done studying the light originating from the irradiated side of the low mass component of close binary eclipsing systems comprising a hot subdwarf primary and a low mass companion, in order to precisely interpret their high precision photometric and spectroscopic data, and accurately determine their system and surface parameters. The talk will focus on the spectra of AA Dor system where irradiation features have already been detected. After removing the predominant contribution of the hot subdwarf primary, the residual spectra reveal more than 100 emission lines from the heated side of the secondary that show maximum intensity close to the phases around secondary eclipse. We analyse the residual spectrum in order to model the irradiation of the low mass secondary. We performed a detailed analysis of 22 narrow emission lines of the irradiated secondary, mainly of O II, with a few significant C II lines. Their phase profiles constrain the emission region of the heated side to a ≥ 95 % of the radius of the secondary, while the shape of their velocity profiles reveals two distinct asymmetry features one at the quadrature and the other at the secondary eclipse. In addition, we identify weaker emission signatures originating from more than 70 lines including lines from He I, N II, Si III, Ca II and Mg II. From the emission lines of the heated side of the secondary star we determine the radial velocity semi-amplitude of the center-of-light and correct it to the centre-of-mass of the secondary which in turn gives accurate masses of both components of the AA Dor system. The resulting masses $M_1 = 0.46 \pm 0.01 M_\odot$ and $M_2 = 0.079 \pm 0.002 M_\odot$ are in perfect accordance with those of a canonical hot subdwarf primary and a low mass just at the substellar limit for the companion. We also compute a first generation atmosphere model of the low mass secondary, which includes irradiation effects and matches the observed spectrum well. We find an indication of an extended atmosphere of the irradiated secondary star.

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Invited Lecture

SUPER-EDDINGTON ACCRETING MASSIVE BLACK HOLES IN ACTIVE GALACTIC NUCLEI

J.-M. Wang

Institute of High Energy Physics, Chinese Academy of Sciences, Beijing 100049, China

E-mail: wangjm@ihep.ac.cn

Reverberation mapping of active galactic nuclei (AGNs) provides reliable technique to measure the central black hole mass. An empirical relation between the broad-line region size and optical luminosity, known as $R-L$ relation, has been set up by great efforts over more three decade since 1980s. Nowadays, the $R-L$ relation has been popularly applied to estimations of black hole mass in large samples of AGNs and quasars. A large undergoing campaign of spectroscopically monitoring active galactic nuclei with super-Eddington accretion rates have performed about 30 targets since 2012. We show among these AGNs: 1) Hβ lags are much shorter than the expected by the $R-L$ relation strongly depending on accretion rates; 2) optical Fe II emissions have clear reverberation to the varying continuum and lags rely on flux ratio of Fe II to Hβ; 3) the presence of saturated luminosities agreeing with the classical model of slim accretion disks, namely the radiate luminosities are only sensitive to the black hole mass; 4) super-Eddington accreting massive black holes are expected as a new kind of candles to measure cosmological distance of high-z Universe beyond the scope of type Ia SN; 5) the current black hole mass is underestimated by the $R-L$ relation in about 1/3 AGNs and quasars. Besides these findings, I will report all new results of the campaign of observations since 2015.

Progress Reports

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Progress Report

TIME-SCALE VARIATION OF THE COMPONENTS THAT FORM THE C IV AND Si IV DACs IN THE UV SPECTRUM OF THE O-STAR HD 93521

A. Antoniou[1], E. Danezis[1], E. Lyratzi[1,2], D. Stathopoulos[1,2] and D. Tzimeas[1]

[1]*National and Kapodistrian University of Athens, Faculty of Physics, Department of Astrophysics, Astronomy and Mechanics, Panepistimioupoli, Zographou 157 84, Athens, Greece*
[2]*Eugenides Foundation, 387 Sygrou Av., 17564, Athens, Greece*
E-mail: ananton@phys.uoa.gr, edanezis@phys.uoa.gr, elyratzi@phys.uoa.gr, dstatho@phys.uoa.gr, dtzimeas@phys.uoa.gr

In this paper we analyse the C IV and Si IV broad absorption troughs in the O-star HD 93521, in four different periods in a time interval of 16 years, to the individual components they consists of.

By analysing a DAC/SAC trough to its components we have the advantage to study the variations of the individual absorbing systems in the line of sight and not just the variations of the whole absorption trough or the variations of selected portions of DAC troughs exhibiting changes.

Specifically, we examine the time-scale variation of the radial velocities as well as the line fluxes of these absorption components. Our aim is to test the idea that DACs complex profiles are the product of individual components, originating from a series of dense plasma regions embedded in an expanding stellar wind, can be confirmed through the variability of DACs absorption troughs.

Progress Report

CONTRIBUTION OF LIENARD-WIECHERT POTENTIAL TO THE ELECTRON BROADENING OF SPECTRAL LINE SHAPES IN PLASMAS

K. Arif, K. Chenini, K. Ahmed-Touati, S. Douis and M. T. Meftah

LRPPS, Faculty of Mathematics and Matter Sciences, Kasdi Merbah University, Ouargla, 30000, Algeria

E-mail: mewalid@yahoo.com

Lienard-Wiechert or retarded electric and magnetic fields are produced by moving electric charges with respect to a rest frame. In hot plasmas, such fields may be created by high velocity free electrons. The resulting electric field has a relativistic expression that depends on the ratio of the free electron velocity to the light velocity c. In this work we consider the semi-classical dipole interaction between the ion radiators and the Lienard-Wiechert electric field of the free electrons and compute its contribution to the broadening of the spectral line shape in hot and dense plasmas.

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Progress Report

TESTING A BINARY BLACK HOLE HYPOTHESIS FOR THE CASE OF NGC 5548

E. Bon[1], P. Marziani[2], N. Bon[1] and P. Jovanović[1]

[1]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*
[2]*INAF, Osservatorio Astronomico di Padova, IT 35122, Padova, Italy*
E-mail: ebon@aob.rs, paola.marziani@oapd.inaf.it, nbon.rs, pjovanovic@aob.rs

Recent results indicate periodic variability in NGC 5548 (see Bon et al 2016 and Li et al 2016). We test the hypothesis that such periodic variability in light and radial velocity curves could be produced by a supermassive binary black hole system in its core, using spectroscopic data from a very long monitoring campaigns spanning over 42 years. We model orbital elements and mass ratio of the binary system.

Progress Report

CALCULATION OF STARK BROADENING PARAMETERS OF S II MULTIPLETS AND STELLAR MODELS ANALYSIS

M. S. Dimitrijević and N. Milovanović

Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia
E-mail: mdimitrijevic@aob.rs, nmilovanovic@aob.rs

The electron-impact broadening data are needed for various problems in astrophysics and physics, as e.g. for diagnostic and modeling of laboratory and stellar plasma, investigation of its physical properties, stellar abundance, opacity and luminosity calculations, and nuclear processes in stellar interiors. These investigations provide us with useful information for modeling of stellar evolution. Electron-, proton-, and helium-ion-impact broadening parameters for ionized sulfur (S II) multiplets $3p^2 3d\ ^4F - 3p^2(^3P)4p\ 4D^o$ (560.611 nm) and $3p^2 4s\ ^4P - 3p^2(^3P)4p\ 4D^o$ (542.864 nm) calculated using semiclassical perturbation method and modified semiclassical method (MSE) are given. Energy levels for these calculations have been taken from NIST Atomic Spectra Database Levels Data, while for the needed oscillator strengths, Bates-Damgaard method has been used together with the tables of Oertel and Shomo. Also, we include analysis of Stark widths (FWHM) and Doppler width for these S II multiplets as a function of atmospheric layer temperatures for 8 atmospheric models and 7 values of model gravity.

Progress Report

STARK BROADENING OF Se IV, Sn IV, Sb IV AND Te IV SPECTRAL LINES

M. S. Dimitrijević[1], Z. Simić[1], R. Stamm[2], J. Rosato[2], N. Milovanović[1] and C. Yubero[3]

[1]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[2]*Aix-Marseille Université, CNRS PIIM UMR 7345, 13397 Marseille Cedex 20, France*
[3]*Grupo de Física de Plasmas: Diagnosis, Modelos y Aplicaciones (FQM-136), Universidad de Córdoba, Edificio A. Einstein (C-2), Campus de Rabanales, 14071 Córdoba, Spain*

E-mail: mdimitrijevic@aob.rs, zsimic@aob.rs, roland.stamm@univ-amu.fr, joel.rosato@univ-amu.fr, nmilovanovic@aob.rs, f62yusec@uco.es

Stark broadening parameters, line width and shift, are needed for investigations, analysis and modelling of astrophysical, laboratory, laser produced and technological plasmas. Especially in astrophysics, due to constantly increasing resolution of satellite borne spectrografs, and large terrestrial telescopes, data on trace elements, insignificant before, now have increasing importance.

Using the modified semiempirical method (Dimitrijević and Konjević, 1980), here have been calculated Stark widths for 1 Se IV, 5 Sn IV, 2 Sb IV and 1 Te IV transitions. Since Sn, Sb, and Te are succesive elements in the periodic system, and Se and Te homologous, the obtained results have been used to discuss systematic trends.

Obtained results will be implemented in the STARK-B database (http://stark-b.obspm.fr) which is also a part of Virtual atomic and molecular data center (VAMDC - http://www.vamdc.org/.

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Progress Report

DOPPLER BROADENING OF SPECTRAL LINE SHAPES IN RELATIVISTIC PLASMAS

H. Gossa, K. Ahmed-Touati, A. Naam, K. Chenini and M. T. Meftah

LRPPS, Faculty of Mathematics and Matter Sciences, Kasdi Merbah University, Ouargla, 30000, Algeria

E-mail: mewalid@yahoo.com

In this work, we report some relativistic effects on the spectral line broadening. In particular, we give a new Doppler broadening of spectral line shapes in extra hot plasmas that takes into account the possible high velocity of the emitters. This suggests to use an appropriate distribution of the velocities for the emitters.

Progress Report

EFFECT OF TURBULENCE ON LINE SHAPES IN ASTROPHYSICAL AND FUSION PLASMAS

I. Hannachi[1,2], M. Mereini[2], J. Rosato[2], R. Stamm[2] and Y. Marandet[2]

[1]*PRIMALAB,Faculty of Sciences, University of Batna 1, Batna, Algeria*
[2]*PIIM, Aix-Marseille Université-CNRS, centre Saint Jérôme, 13397 Marseille, France*
E-mail: ibtissem.hannachi@univ-amu.fr, ibtissem.hannachi@univ-batna.dz

The problem of plasma turbulence is of interest both from a theoretical point of view and from an experimental one for laboratory, fusion, and astrophysical plasmas. One kind of plasma turbulence suspected to be present in astrophysical and fusion plasma is driven by plasma and electromagnetic waves. We have studied the case of strong Langmuir turbulence, a phenomenon occurring in presence of an external source of energy, and coupling nonlinearly the Langmuir waves with ion sound and electromagnetic waves. Due to this coupling, the density fluctuations associated with ion sound waves refracts the Langmuir waves in regions of low densities. Coherent wave packets localize in such regions, and experience a cycle driven by the ponderomotive force which decreases them to shorter scales and enhances their intensity (wave collapse). In such conditions, numerous wave collapses sites are present in the plasma, and change its radiative properties. We have proposed a model for calculating the change on a line shape of atoms submitted to the electric field of a nearby wave collapse (Hannachi et al. 2016). Our model uses the numerical solution of the emitter Schrödinger equation submitted to an electric field taken as a sequence of envelope solitons oscillating at the plasma frequency. We have used the results of numerical simulations of wave collapse (Robinson 1997) for sampling the lifetime of each soliton, and the probability density function for the magnitude of the electric field. We will present the change expected on a line shape of hydrogen for different plasma conditions of interest in astrophysical and fusion plasmas.

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Progress Report

ACTIVE GALACTIC NUCLEI SEARCH

S. S. Kotov and S. N. Dodonov

Special Astrophysical Observatory, Nizhnij Arkhyz, Zelenchukskiy region, Karachai-Cherkessian Republic, Russia 369167

E-mail: sss.kotov@mail.ru, dodo@sao.ru

We present the first results of medium band photometric observations on 1-m Schmidt Telescope of Byurakan Astrophysical Observatory (Armenia). Object sample was created in SA68 field. Medium band filter set (13 filters with FWHM $= 250\mathring{A} + 5$ broadband SDSS filters) allows us to create low-resolution spectra of each object in SA68 field. We compare them with template spectra to select AGNs and to determine their photometric redshifts. Our sample consists of 330 objects with 0.55.1 redshift range and complete up to 23.0 AB magnitude. Comparison of our sample with SDSS DR10 and BOSS+MMT QSO samples showed that we have found sufficiently more objects in 3.25.1 redshift range.

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Progress Report

THE CONNECTIONS BETWEEN THE MID-INFRARED AND OPTICAL SPECTRAL LINE AND CONTINUUM CHARACTERISTICS OF AGNs: AGN VS. STARBURST EMISSION

M. Lakićević, J. Kovačević-Dojčinović and L. Č. Popović

Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia
E-mail: mlakicevic@aob.rs, jkovacevic@aob.rs, lpopovic@aob.rs

We investigate the optical and mid-infrared (MIR) spectral characteristics of the Type 1 AGNs (z<0.7) which have been observed with SDSS DR12 and Spitzer telescopes. We explore connections between starbursts and AGN. The optical and MIR spectral characteristics do not always give the same results about the AGN and starburst contribution to the emission of Type 1 AGNs, but these results are related. A similar conclusion we also obtain for a data set of Type 2 AGNs (collected from the literature). These differences had been explained in the literature by the several possibilities, such as the extinction at the optical wavelengths, different sizes of slits, or the radiation may come from the different regions. Analyzing the spectral line and continuum parameters in the optical and MIR we discuss a complex model that has an AGN (central optical source and torus which contribute to the MIR) and contribution of the starburst emission (narrow optical lines and MIR).

Progress Report

MODELS OF EMISSION LINE PROFILES AND SPECTRAL ENERGY DISTRIBUTIONS TO CHARACTERIZE THE MULTIPLE FREQUENCY PROPERTIES OF ACTIVE GALACTIC NUCLEI

G. La Mura, M. Berton, S. Chen, S. Ciroi, V. Cracco, E. Congiu, M. Frezzato and P. Rafanelli

Dep. of Physics and Astronomy - University of Padua, Vicolo dell'Osservatorio 3, 35122 - Padua, Italy

E-mail: giovanni.lamura@unipd.it

The spectra of Active Galactic Nuclei (AGN) are often characterized by a wealth of emission lines with different profiles and intensity ratios that led to a complicated classification scheme. In addition, the electro-magnetic radiation produced by these objects spans more than 10 orders of magnitude in frequency. AGNs are therefore associated with a much more extended radiation spectrum than the characteristic thermal emission of other quiescent stellar systems. In spite of the striking differences between their various classes, the origin of their activity is generally attributed to a combination of emitting components, surrounding an accreting Super Massive Black Hole, according to a well established Unification Model.

At present, the execution of extensive surveys of the sky, with instruments operating at various frequencies, are providing the attractive possibility to detect and to investigate the properties of AGNs on very large statistical samples. Thanks to the large spectroscopic surveys that, nowadays, allow detailed investigation of many of these sources, we have the opportunity to place new constraints on the nature and evolution of AGNs and to investigate their relations with the host systems. In this contribution we present the results obtained by carrying out a multiple frequency data survey, to investigate the range of AGN spectral energy distributions and we discuss their relations with optical spectra obtained by follow up observations. We compare our findings with the expectations based on the AGN Unification Model, and we discuss the perspectives of multiple wavelength approaches to address the physics of AGN related processes such as black hole accretion and acceleration of relativistic jets.

Progress Report

REGULARITIES AND SYSTEMATIC TRENDS ON Zr IV STARK WIDTHS

Z. Majlinger[1], M. S. Dimitrijević[2] and Z. Simić[2]

[1]*Faculty of Humanities and Social Sciences, University of Rijeka, 51000 Rijeka, Croatia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
E-mail: zlatko.majlinger@gmail.com, mdimitrijevic@aob.rs, zsimic@aob.rs

Regularities and systematic trends among the Stark widths of 18 Zr IV spectral lines obtained by modified semiempirical approach have been discussed. Also we checked the possibility to approximate those calculated Stark broadening parameters with some of the most popular estimating methods. Results of such performed statistical analysis can be used to roughly predict new Stark width data for the ions in the same homologous or isoelectronic sequence, if the conditions are not satisfied to use more accurate theoretical methods, or a quick estimate is needed.

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Progress Report

DETERMINATION OF GAS TEMPERATURE IN MICROWAVE DISCHARGES SUSTAINED IN ARGON-NEON MIXTURES BY USING PRESSURE BROADENED SPECTRAL LINES

J. Muñoz[1], R. Rincón[1], C. Melero[1], M. S. Dimitrijević[2] and M. D. Calzada[1]

[1] *Laboratorio de Innovación en Plasmas (LIPs), Edificio Einstein (C-2), Campus de Rabanales, Universidad de Córdoba, E-14071 Córdoba, Spain*
[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*

E-mail: jmespadero@uco.es,rocio.rincon@emt.inrs.ca, mdimitrijevic@aob.rs, fa1cazal@uco.es

Mixed gas discharges containing rare gases have different applications not only in scientific but also in technological fields like e.g. medical instrument sterilization or metal surface nitriding. Typically used gas is argon, but if a higher excitation/ionization efficiency is needed, in order to improve the excitation of atoms and ions in the samples introduced into the plasma, Ar can be replaced or mixed with He, since its metastable and excited states have higher energies than those of Ar. Since the energy of Ne metastable atoms lies between those of Ar and He, the Ar-Ne mixtures could be considered as an alternative to Ar, He or Ar-He plasmas.

A key parameter to understand the processes that take place in a plasma is gas temperature, related to the energy of the heavy plasma particles participating in the formation of radicals from the substances introduced into discharges. In atmospheric pressure plasmas, a common method is to measure gas temperature from the rovibrational spectra of OH or $N2^+$, usually present in the discharge due to the existence of water and nitrogen impurities at trace level. If their concentration is so low that it is difficult to detect them, the gas temperature can be determined from the van der Waals broadening.

Yubero et al. (2007) proposed a method to determine the gas temperature of an Ar discharge at atmospheric pressure from the van der Waals broadening of the spectral lines which have also a comparable Stark broadening contribution, and they found that the Ar I 603.2, 549.6 and 522.1 nm spectral lines are suitable for the gas temperature measurements. In Muñoz et al. (2009) this method has been extended for atmospheric pressure Ar-He plasmas. Different Ar lines were examined in that study and it has been found that Ar I 603.2 nm line could be considered appropriate to measure the plasma gas temperature from the van der Waals broadening.

In the present work, the applicability of the method for the measurement of gas temperature in argon-helium plasma at atmospheric pressure, using the van der Waals broadening of spectral lines, proposed by Muñoz et al. (2009), for the determination of gas temperature in argon-neon mixtures, has been studied. It has been established

that the Ar I 425.9 nm and 603.2 nm spectral lines are recommendable for such measurements, especially when the use of OH radicals is difficult or its the contribution to the plasma pollution should be avoided.

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Progress Report

SPATIAL BEHAVIOR OF D-REGION PLASMA PARAMETERS DURING THE DOMINANT INFLUENCE OF Lyα LINE AFTER A SOLAR X-RAY FLARE

A. Nina[1] and V. M. Čadež[2]

[1]*Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*

E-mail: sandrast@ipb.ac.rs, vcadez@aob.rs

Lyα photons emitted by solar hydrogen dominate in ionization within the upper ionospheric D-region during quiet, unperturbed, conditions when plasma parameters are in a quasi-equilibrium state. Occurrence of sudden events induces specific time and space dependent perturbations of plasma characteristics which is the subject of our paper. In this sense, we study variations of plasma parameters and their gradients lasting after occurrence of a solar X-ray flare when the major ionization source at the D-region altitudes above 70 km are Lyα photons. In particular, we analyze behavior of the electron density, effective recombination coefficient, and photo-ionization and recombination rates.

Progress Report

KINEMATICS OF IONIZED GAS OUTFLOWS CAUSED BY STAR FORMATION

D. Oparin and A. Moiseev

Astronomical Observatory, Nizhnij Arkhyz, Zelenchukskiy region, Karachai-Cherkessian Republic, Russia, 369167

E-mail: doparin2@gmail.com, moisav@gmail.com

Using 3D spectroscopy with the scanning Fabry-Perot interferometer (FPI) on the SAO RAS 6-m telescope, we studied ionized gas outflows related with the current star formation feedback. We considered the galaxies with a moderate star formation rate (SFR¡1 Mo/yr). NGC4460 is a lenticular galaxy with biconical galactic wind nebulae produced by outflows from circumnuclear regions of star formation. We applied a simple kinematical model to estimate the mean wind speed from the ionized gas velocity field. The same technique was also used to obtain galactic wind parameters in the edge-on galaxy UGC10043. Unlike those cases, the outflows in the dwarf galaxy NGC3077 do not form a single cone structure. Using diagnostic diagrams based on the combination of FPI maps and optical spectroscopy data, we analyzed the contribution of different processes (shock waves, photoionization, etc.) to the formation of ionized gas regions in these galaxies.

Progress Report

LONG-TERM MONITORING SUPER-MASSIVE BINARY CANDIDATES: VARIABILITY IN THE BROAD LINES AND CONTINUUM

L. Č. Popović[1] and S. Simić[2]

[1]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[2]*Faculty of Science, University of Kragujevac, Serbia*
E-mail: lpopovic aob.bg.ac.rs, ssimic kg.ac.rs

Here we modeled the variation in the broad emission lines and continuum during several orbits of a super-massive black hole binary system. We assume that both black holes have accretion disks and broad line regions (BLRs). The BLR dimensions are connected with the luminosity of the central sources, and kinematics with the masses of components. We include gravitational interaction between components that affects the temperature and rate of accretion in each component, after that we modeled the line and continuum light curves for several orbital periods. Including the white noise in the continuum and line, we perform the cross correlation function (to find time lag between the continuum and broad line variability) and Lomb-Scargle periodogram (to find the periodicity) to the simulated light curves. We discuss the long-term monitoring as a perspective to confirm super-massive black hole binary systems in some AGNs which show some other indications (as e.g. double peaked lines, high offset in the broad line center) for binarity.

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Progress Report

SPECTRAL LINE CHARACTERISTICS OF AGNs IN THE FRAME OF THE INTRINSIC BALDWIN EFFECT

N. Rakić[1], D. Ilić[2] and L. Č. Popović[3]

[1]*Faculty of Science, University of Banjaluka, Mladena Stojanovia 2, 78000 Banjaluka, Republic of Srpska, Bosnia and Herzegovina*
[2]*Department of Astronomy, Faculty of Mathematics, University of Belgrade, Studentski Trg 16, 11000 Belgrade, Serbia*
[3]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
E-mail: nemanja.rakic@unibl.rs

The intrinsic Baldwin effect is an anti-correlation between the line equivalent width and the flux of underlying continuum detected in a single variable active galactic nucleus (AGN). This effect, in spite of the extensive research, is still not well understood, and might give us more information about the physical properties of the emission line regions. Here we investigate the intrinsic Baldwin effect in the large sample of AGNs taken from the Sloan Digital Sky Survey Reverberation Mapping project (SDSS-RM) considering the broad Hβ and iron lines. In our sample we are considering type 1 AGNs with different broad line characteristics: Seyfert 1 galaxies, double-peaked broad line profiles and narrow line Seyfert 1 galaxies in order to constrain the nature of intrinsic Baldwin effect. Here we give preliminary results of our research.

Progress Report

REVERBERATION OF OPTICAL POLARIZATION IN AGN

P. A. Rojas Lobos[1], R. W. Goosmann[1], F. Marin[1] and Dj. V. Savić[1,2]

[1] *Observatoire Astronomique de Strasbourg, Université de Strasbourg, 11 rue de l´Université, 67000 Strasbourg*
[2] *Astronomical Observatory of Belgrade, Volgina 7, 11060 Belgrade, Serbia*
E-mail: parltest@gmail.com

Active Galactic Nuclei (AGN) belong to one of the most luminous classes of astronomical sources. Its bolometric luminosity is produced by a supermassive black hole (SMBH) surrounded by an accretion and ejection flow. Optical observations cannot resolve the innermost structures of AGN, and indirect methods are necessary to infer the composition, geometry and physics close to the SMBH. These indirect measurements continue to help to further develop the unified model of AGN by providing constraints on the spatial scales of the central media. Reverberation mapping, both in spectroscopy and in polarization, aims to resolve the central region of AGN at subparsec scales. In my talk, I present modeling of the scattering-induced polarization from an AGN model to determine how precise the constrants can be. I test different geometries for the circumnuclear region, with two kinds of dust distributions with and without polar-winds. By doing so, I provide theoretical predictions for the time-lag in polarization to be compared to spectropolarimetric observations campaigns. The results confirm several known polarization characteristics such as the importance of the observer's viewing angle. For flared equatorial geometries, the time-lag is significantly different between pole-on and edge-on orientations, while a toroidal equatorial geometry gives less sensitive polarized time-lags. The presence of a polar-winds increases the time-lag for all the models tested and brings the modeling closer to observations.

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SUPER-MASSIVE BINARY BLACK HOLE AND POLARIZATION IN THE BROAD LINES

Dj. V. Savić[1], L. Č. Popović[1], R. W. Goosmann[2] and F. Marin[2]

[1] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[2] *Observatoire Astronomique de Strasbourg, Université de Strasbourg, CNRS, UMR 7550, 11 rue de lUniversité, 67000 Strasbourg, France*

E-mail: djsavic@aob.rs, lpopovic@aob.rs, goosmann@astro.unistra.fr, frederic.marin@astro.unistra.fr

A number of active galactic nuclei (AGNs) show complex broad lines (with double peaks, highly shifted to the blue or red, and with a strong asymmetry). Some of these AGNs are established as super-massive binary black hole (SMBBH) candidates. Here we explore the polarization characteristics across broad emission Lines when an AGN hosts a SMBBH. We used the 3D Monte Carlo radiative transfer code STOKES Goosmann & Gaskell (2007), Marin et al. (2012, 2015) to investigate polarized broad line emission conducting modeling for a range of system parameters.

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Progress Report

PHOTOMETRIC AND POLARIMETRIC INTERPRETATION OF BLAZAR AO 0235+164 BEHAVIOUR

E. Shablovinskaya

Saint Petersburg State University, Universitetsky pr., 28, 198504, Peterhof, Saint Petersburg, Russia
Special Astrophysical Observatory, Nizhnij Arkhyz, 369167, Zelenchukskiy region, Karachai-Cherkessian Republic, Russia
E-mail: gaerlind09@gmail.com

Among the great number of controversial issues the most topical one both for theoretical and observational astrophysics presently is a problem of active galactic nuclei investigation. To explain the behaviour of blazar AO 0235+164, which has been being observed at the LX-200 telescope (SPbSU) since 2002, the method of analyzing developed by V.A. Hagen-Thorn and S.G. Marchenko was used. It is based on the assumption that in case of observational data lying on the straight line in the absolute Stokes parameters space $\{I, Q, U\}$ (for polarimetry) and the fluxes space $\{F_1, .. F_n\}$ (for photometry) relative Stokes parameters and relative flux ratios stay unchanging, and, consequently, the only one source is corresponding for the variability of general value of flux. In given paper, the photometric and polarimetric interpretation of blazar behaviour is presented. Furthermore, the flux and lux-flux diagrams are obtained for 3 periods of object monitoring: 2006-2007 and 2008 (outbursts) and 2009-2016 (decline with 2015 outburst). Eventually, according to diagrams analysis the supposition of the single source correspondence was done.

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Progress Report

PROGRESS REPORT ON THE SAO OPTICAL MONITORING OF TYPE 1 AGN

A. I. Shapovalova[1], L. Č. Popović[2,3], D. Ilić[3], A. Kovačević[3], A. N. Burenkov[1] and V. H. Chavushian[4]

[1]*Special Astrophysical Observatory of the Russian Academy of Science, Nizhnij Arkhyz, Karachaevo-Cherkesia 369167, Russia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*
[3]*Department of Astronomy, Faculty of Mathematics, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia*
[4]*Instituto Nacional de Astrofsica, Optica y Electronica, Apartado Postal 51, CP 72000, Puebla, Pue. Mexico*

E-mail: dilic@math.rs

Here we give a progress report on the latest result of the long-term optical monitoring of type 1 active galactic nuclei (AGN). A campaign, which is coordinated by the Special Astrophysical Observatory (SAO) is performed using telescopes of SAO (Russia), INAOE and OAN-SPM (Mexico), with the main aim to use the broad line shape variability to constrain the physics and kinematics of the line emitting regions. In total a dozen of type 1 AGN are observed for decades, and here we outline the latest results, especially in case of a quasar E1821+643 and Seyfert 1 galaxy NGC 7469.

Progress Report

UNCOMMON LINE SHAPES OF Cu I LINES IN LASER INDUCED PLASMA

M. Skočić, D. Dojić and S. Bukvić

University of Belgrade, Faculty of Physics, Studentski Trg 12-16, Belgrade 11000, Serbia

E-mail: skocic@ff.bg.ac.rs, dejan.dojic@ff.bg.ac.rs, ebukvic@ff.bg.ac.rs

Laser induced plasma (LIP) is generated by focusing a high power pulsed laser beam on the target surface. At low surrounding gas pressures laser induced plasma expands very fast with pronounced density and temperature gradients. These features result in a complex form of the spectral lines, see Fig 1.

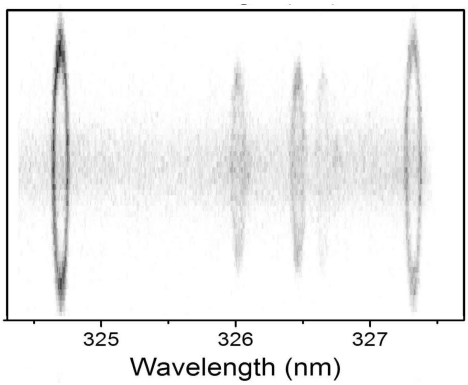

Figure 1: Spectrum of Cu I lines 324.75 nm and 327.40 nm recorded side-on in the image mode of CCD camera. All spectral lines have the oval form.

We show that these characteristic profiles are caused by distinct Doppler effect. The profiles contain valuable information regarding the expansion velocity, plasma deceleration, emitters temperature, electron density and so on. We propose a simple procedure for numerical processing of the presented profiles. The expansion velocity is found to be $v \sim 45\ 000$ m/s, while temperature of the emitters is $T \sim 10^5$ K. The electron density is low, marginally above the detection limit. This features put LIP in an extremely interesting spectroscopic source with great potential in studying the spectral line shapes.

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Progress Report

REVEALING THE STRUCTURE OF AGN IN CIRCINUS

M. Stalevski

Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia
E-mail: mstalevski@aob.rs

Recent observations resolving for the first time a number of nearby AGN surprisingly revealed that a major fraction of their mid-infrared (MIR) emission comes from the polar regions, contrary to the expectation based on the unification scheme, which postulates an equatorial torus of dust. New highest quality MIR images of archetypal AGN in Circinus galaxy were obtained as part of the science verification program of the upgraded VISIR instrument mounted on the VLT. A striking feature of these images is a prominent bar extending 40 pc from both sides of the nucleus in the polar direction. Motivated by the observation across a wide wavelength range and on different spatial scales, we propose a dust emission model for AGN in Circinus consisting of a compact dusty disk and large-scale dusty cone shell, illuminated by a tilted accretion disk with anisotropic emission pattern. Undertaking detailed radiative transfer simulations, we demonstrate that such a model is able to explain the peculiar MIR morphology and account for the entire spectral energy distribution. Our results call for caution when attributing dust emission of unresolved sources entirely to the torus and warrant further investigation of MIR emission in the polar regions of AGN.

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Progress Report

LONG TERM VARIABILITY OF Si IV AND C IV BROAD ABSORPTION TROUGHS OF 10 BALQSOs

D. Stathopoulos[1,2], E. Danezis[1], E. Lyratzi[1,2], A. Antoniou[1] and D. Tzimeas[1]

[1]*National and Kapodistrian University of Athens, Faculty of Physics, Department of Astrophysics, Astronomy and Mechanics, Panepistimioupoli, Zographou 157 84, Athens, Greece*
[2]*Eugenides Foundation, 387 Syngrou Av., 175 64, Paleo Faliro, Athens, Greece*
E-mail: dstatho@phys.uoa.gr, edanezis@phys.uoa.gr, elyratzi@phys.uoa.gr, ananton@phys.uoa.gr, dtzimeas@phys.uoa.gr

Broad absorption lines (BALs) in quasar spectra identify powerful and high velocity outflows emanating from the central regions that power the QSOs. The structure, evolution and physical properties of these outflows still remain open questions. A method that can provide useful information that could potentially help answer these questions, is variability of broad absorption lines. In this paper we study the variability of BALs by performing multicomponent analysis of Si IV and C IV broad absorption troughs in the case of 10 BALQSOs. By analyzing each Si IV and C IV BAL trough to the individual and uniquely determined components it consists of, we are able to study not only the variability of the whole absorption trough but also the variability of each individual component that contributes to the formation of a BAL. As a consequence, we have the advantage to study the variations of the individual absorbing systems in the line of sight. We do not find any evidence of acceleration as the velocity shifts of individual components for all studied BALQSOs do not change as a function of time. Furthermore, the FWHMs of individual components remain constant as a function of time. In our sample of 10 BALQSOs, all variable components show changes in the optical depths at line centers which are manifested as variations in the EW of the components. In general, Si IV has higher incidence of variability than C IV and in cases where both ions vary over corresponding velocities, Si IV is more variable than C IV. From our analysis, evidence is in favor of different covering fractions between C IV and Si IV. Finally, although most of our results favor the crossing cloud scenario as the cause of variability, there is also strong piece of evidence indicating changing ionization as the source of variability. Thus, a mixed situation where both physical mechanisms contribute to BAL variability is the most possible scenario.

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Progress Report

ASTA SOFTWARE: AN ADVANCED SPECTRAL ANALYSIS ALGORITHMIC ENVIRONMENT FOR EMISSION AND ABSORPTION LINE SPECTRA

D. Tzimeas[1], D. Stathopoulos[1,2], E. Danezis[1], E. Lyratzi[1,2] and A. Antoniou[1]

[1]*National and Kapodistrian University of Athens, Faculty of Physics, Department of Astrophysics, Astronomy and Mechanics, Panepistimioupoli, Zographou 157 84, Athens, Greece*
[2]*Eugenides Foundation, 387 Syngrou Av., 175 64, Paleo Faliro, Athens, Greece*
E-mail: dtzimeas@phys.uoa.gr,dstatho@phys.uoa.gr, edanezis@phys.uoa.gr, elyratzi@phys.uoa.gr, ananton@phys.uoa.gr

As we know DACs (in the case of Hot Emission Stars) and BALs (in the case of Quasars) are spectral lines of the same ion and the same wavelength as the main spectral line, shifted at different $\Delta\lambda$, as they are created in different density regions which rotate and move radially with different velocities. The currently accepted view is that BALs and DACs may be due to a flow of many individual density enhancements, called clouds, cloudlets or clumps which are optically thick and very small compared with the size of the central continuum source. These density enhancements are not preexisting entities but are formed inside an unstable and turbulent wind. A second interesting point is that BALs/DACs indicate very complex profiles. According to this phenomenon, a prevailing view is that BALs/DACs are not simple absorption lines, but the synthesis of a group of classical absorption line components of the same spectral line. These complex structures of BALs/DACs pose a series of questions: Can BALs be simulated and analyzed taking into account their complex structure and large widths? How can Si IV and C IV BALs be analyzed? Accepting the point of view that BALs are the synthesis of a series of components, is there a way to study not only the whole profile but the profiles of each individual component (line function of each individual absorbs in the line of sight)? Which is the interpolation polynomial that describes the whole BAL profile? In the case of multiple BAL which is the interpolation polynomial that describes the whole absorbing region? Can the two members of the resonance doublets (e.g. Si IV and C IV) be studied independently? Until now the BALs/DACs doublets the resonance doublets (e.g. C IV and Si IV are considered one spectral line. In order to answer in this set of questions Astrophysical Spectroscopy Team of the National and Kapodistrian University of Athens constructed the GR model which incorporates all the previously mentioned characteristics. At this point it is clear that we need to create a software capable, not only to run GR model but to help accelerate complex mathematical precision checks and confirm the uniqueness of the calculated physical parameters and the number

of the absorption components that construct every BAL/DAC. This is the software A.S.T.A. (Astrophysical Team of Athens) which we present in a package with the manual and some information about the mathematical structure of GR Model. The package AS.T.A will be freely available to the scientific community.

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Progress Report

AUTOMATIC SHAPE RECOGNITION OF TYPE III RADIO BURSTS IN SOLAR WIND DYNAMICAL RADIO SPECTRA

S. Vidojević[1], M. Dražić[2] and M. Maksimovic[3]

[1]*State University of Novi Pazar, Vuka Karadzica bb, 36300 Novi Pazar, Serbia*
[2]*Faculty of Mathematics, Studentski trg 16, 11000 Belgrade, Serbia*
[3]*CNRS and LESIA Observatoire de Paris, 92195 Meudon, France*
E-mail: sonja@matf.bg.ac.rs, mdrazic@sezampro.rs, milan.maksimovic@obspm.fr

Modern technology is particularly vulnerable to various aspects of space weather. Radio spectrograph instruments are used to monitor the suns coronal emissions of plasma that travel with solar wind towards the Earth. Dynamical radio spectra are detected by radio observatories in space and around the world producing a huge amount of data. An automatic detection of potentially dangerous event travelling toward the Earth is extremely important. The focus of this work is on the automated detection of Type III radio bursts. The physical mechanism causing this type of bursts is related to energetic electrons propagating along magnetic field lines in the solar corona. As these beams escape upward into interplanetary space, away from the solar corona, they encounter decreasing plasma density which results in a decrease in the radio frequency which gives the Type III bursts their characteristic decrease in frequency with time. Data from WIND spacecraft are used to test and validate the method. The development of an automated detection was motivated by the ability to rapidly find solar radio events in archives. Type III radio bursts occur frequently so the database of these events is quite large. An algorithm for identification of shapes of type IIIs embedded in complex background is developed.

Progress Report

ON THE GAS TEMPERATURE DETERMINATION IN Ar PLASMA AT ATMOSPHERIC PRESSURE FROM BROADENINGS OF ATOMIC EMISSION LINES

C. Yubero[1], A. Rodero[1], M. S. Dimitrijević[2], A. Gamero[1] and M. C. García[1]

[1] *Grupo de Física de Plasmas: Diagnosis, Modelos y Aplicaciones (FQM-136), Universidad de Córdoba, Edificio A. Einstein (C-2), Campus de Rabanales, 14071 Córdoba, Spain*

[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*

E-mail: f62yusec@uco.es, fa1rosea@uco.es, mdimitrijevic@aob.rs, fa1garoa@uco.es, fa1gamam@uco.es

A new spectroscopic method (Yubero et al., 2017), for gas temperature determination in argon non-thermal plasmas sustained at atmospheric pressure, will be presented. It is based on the measurements of pairs of argon atomic lines which are selected as convenient ones, namely: Ar I 603.2 nm/Ar I 549.6 nm, Ar I 603.2 nm/Ar I 522.1 nm and Ar I 549.6 nm/Ar I 522.1 nm. The advantage of this method is that for gas temperature determination, there is no need to know the degree of thermodynamic equilibrium existing in the plasma. In order to check it, the obtained values of the gas temperature, have been compared with the rotational temperatures derived from the OH ro-vibrational bands, using the Boltzmann-plot technique and the best fitting to simulated ro-vibrational bands.

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Posters

Poster

QUANTUM AND SEMICLASSICAL STARK WIDTHS OF Ar VII SPECTRAL LINES

R. Aloui[1], H. Elabidi[2,3], S. Sahal-Bréchot[4] and M. S. Dimitrijević[4,5]

[1] *GRePAA, École Nationale Supérieure d'ingénieurs de Tunis, University of Tunis, Tunisia*
[2] *GRePAA, Faculté des Sciences de Bizerte, University of Carthage, Tunisia*
[3] *Deanship of Preparotoy Year, Umm Al-Qura University, Makkah, KSA*
[4] *LERMA, Observatoire de Paris, 5 Place Jules Janssen, 92195 Meudon Cedex, France*
[5] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*

E-mail:haelabidi@uqu.edu.sa

Among the ions of astrophysical interests, the argon is very important, where far UV lines of Ar VII for example have been recently discovered in the spectra of very hot central stars of planetary nebulae and in (pre-) white dwarfs (Werner et al. 2007). The authors have showed the importance of the line broadening data for this element in its various ionization stages in the diagnostic and modelling. Argon has also an important role in plasma technological applications and devices (Djurović et al. 2011). We have performed Stark broadening calcualtions for some spectral lines of Ar VII. To the best of our knowledge, there are no results of Stark broadening for this ion. We present our results in a temperature range from 10^4 K to 10^6 K. We present also electron impact excitation collision strengths for Ar VII levels.

We use in the present work the quantum and semiclassical approaches. The quantum mechanical expression for electron impact broadening calculations for intermediate coupling was obtained in Elabidi et al. (2004). This approach has been applied many times (Elabidi et al. 2007, 2008a, 2008b,2009). It has been also used in Elabidi and Sahal-Bréchot (2011) to check the dependence on the upper level ionization potential of electron impact widths, and in Elabidi et al. (2014) to investigate the influence of strong collisions and quadrupolar potential contributions on line broadening. In the semiclassical method (Sahal-Bréchot 1969a,b), the atomic data have been taken from the code SUPERSTRUCTURE of Eissner et al. (1974). We have made a comparison between our quantum and semiclassical results.

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Poster

THE SPECTRAL ANALYSIS OF CW Cep FOR SURROUNDING STRUCTURE

A. Avcı, M. Tanrıver and F. F. Özeren

Erciyes University, Science Faculty, Astronomy and Space Sciences Dept., 38039, Kayseri, Turkey

E-mail: ahmetavci8686@gmail.com, mtariver@erciyes.edu.tr, ozeren@erciyes.edu.tr

In this study, the variation of the equivalent widths (EW) and the full width at half maximum (FWHM) of the H_α and He I (6678,15) lines of CW Cep, which is an early-type, double-lined, eclipsing binary (B0.5V-B0.5V), are examined.

We obtained the reduced spectra from http://basebe.obspm.fr/basebe/. The EW and FWHM values of the H_α and He I (6678,15) lines were determined using the SPLAT spectral analysis program.

The source of the H_α line is the disk surrounding the CW Cep. That is why the emission line is observed. He I (6678,15) is the absorption lines on the surface of the stars.

The EW of the H_α line shows an irregular variation around the zero phase but does not show a large change in the rest of the phase, while the FWHM value reaches maximum values during the eclipsing. The EW of the He I (6678,15) lines reaches maximum values during eclipsing and also shows small variations in FWHM values.

Poster

SPECTRAL WIDTHS AND LINESHAPES OF AUTOIONIZATION RESONANCES IN THE NEON ISOELECTRONIC SEQUENCE

S. Banerjee[1,*], M. Nrisimhamurty[2], G. Aravind[1], P. C. Deshmukh[3], V. Radojević[4] and S. T. Manson[5]

[1] *Department of Physics, Indian Institute of Technology Madras, Chennai, 600036, India*
[2] *Department of Nuclear and Atomic Physics, Tata Institute of Fundamental Research, Mumbai, 400005, India*
[3] *Department of Physics, Indian Institute of Technology Tirupati, Tirupati, 517506, India*
[4] *Institute of Physics, Pregrevica 118, P.O. Box 68, Beograd-Zemun, 11080, Serbia*
[5] *Department of Physics and Astronomy, Georgia State University, Atlanta, 30303, USA*

[*] *E-mail: souravbanrj444@gmail.com*

Studies of Highly Charged Ions are of great interest in astrophysics (Beyer and Shevelko 2016, Bernitt et al. 2012). Their spectra are complex, and often anomalous, and hence challenging to interpret. Recently, our group reported a study of the $2s \rightarrow np$ resonances for a number of members of the Neon isoelectronic sequence (Nrisimhamurty et al. 2015) using the relativistic random phase approximation (RRPA) (Johnson and Lin 1979) and the relativistic multichannel quantum defect theory (RMQDT) (Lee and W. R. Johnson 1980). Asymptotic quantum defects and widths were obtained for a number of members of the Neon isoelectronic sequence and Fano-shape analysis had been employed to analyze the character of the autoionization resonances across the sequence. In the present work, we discuss the spectral widths and line shapes and examine how these are influenced by autoionization and the radiative decay processes.

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Poster

SOLVING THE MISSING MATTER PROBLEM AT GALACTIC SCALES THROUGH A NEW FUNDAMENTAL GRAVITATIONAL RADIUS

V. Borka Jovanović[1], P. Jovanović[2], D. Borka[1] and S. Capozziello[3,4,5]

[1]*Atomic Physics Laboratory (040), Vinča Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, P.O. Box 74, 11060 Belgrade, Serbia*
[3]*Dipartimento di Fisica "E. Pancini", Università di Napoli "Federico II", Compl. Univ. di Monte S. Angelo, Edificio G, Via Cinthia, I-80126, Napoli, Italy*
[4]*Istituto Nazionale di Fisica Nucleare (INFN) Sez. di Napoli, Compl. Univ. di Monte S. Angelo, Edificio G, Via Cinthia, I-80126, Napoli, Italy*
[5]*Gran Sasso Science Institute, Viale F. Crispi, 7, I-67100, L'Aquila, Italy*

E-mail: vborka@vinca.rs, pjovanovic@aob.rs, dusborka@vinca.rs, capozzie@na.infn.it

The role of $f(R)$ gravity, as well as the other modifications of standard Einstein's gravity, is to explain the accelerated expansion and structure formation of the Universe, as well as some other phenomena at extragalactic scales without dark matter hypothesis. Starting from $f(R)$ theories of gravity, we demonstrate the existence of a new fundamental gravitational radius, besides the standard Schwarzschild one, determining the dynamics at galactic scales. We also show that using this new gravitational radius, $f(R)$ theories of gravity are able to explain the observed baryonic Tully-Fisher relation of gas-rich galaxies in a natural way and without need for dark matter hypothesis.

Poster

CASSIS, A VO-TOOL SOFTWARE PACKAGE TO ANALYSE HIGH SPECTRAL RESOLUTION OBSERVATIONS

E. Caux, J.-M. Glorian, M. Boiziot, S. Bottinelli and C. Vastel

IRAP, CNRS-UPS-Université de Toulouse, Toulouse, France
E-mail: emmanuel.caux@irap.omp.eu

CASSIS[1] (Centre d'Analyse Scientifique de Spectres Instrumentaux et Synthtiques) is a standalone VO-Tool software package aimed to speed-up the scientific analysis of high spectral resolution observations, particularly suited for broad-band spectral surveys. CASSIS is written in Java and can be ran on any platform. It has been extensively tested on Mac OSX, Linux and Windows operating systems. CASSIS is regularly enhanced, and can be easily installed and updated on any modern laptop. To read the JPL[2] and CDMS[3] molecular spectroscopic databases and the atomic spectroscopic database NIST[4], it uses either the VAMDC protocol or a fast SQLite access to a local database. The tools available in the currently distributed version (4.2.2) include, among others, a LTE model and the RADEX[5] model connected to the LAMDA[6] molecular collisional database, a module building line lists fitting the various transitions of a given species and producing rotational diagrams from these lists, a complete set of spectral tools, a scripting interface and a SSAP query module.

[1] *http://cassis.irap.omp.eu,* [2] *http://spec.jpl.nasa.gov,* [3] *http://www.astro.uni-koeln.de/cdms/catalog,* [4] *http://physics.nist.gov/asd,* [5] *van der Tak, F.F.S. et al. 2007, A&A 468, 627,* [6] *Schoier, F.L. et al. 2005, A&A 432, 369*

Poster

STARK WIDTHS OF Na IV SPECTRAL LINES

M. S. Dimitrijević[1], Z. Simić[1], A. Valjarević[2] and C. Yubero[3]

[1] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[2] *University of Kosovska Mitrovica, Faculty of Natural Sciences and Mathematics, Department of Geography, Ive Lole Ribara 29, 38220 Kosovska Mitrovica, Serbia*
[3] *Grupo de Física de Plasmas: Diagnosis, Modelos y Aplicaciones (FQM-136),* Universidad de Córdoba, Edificio A. Einstein (C-2), *Campus de Rabanales, 14071 Córdoba, Spain*

E-mail: mdimitrijevic@aob.rs, zsimic@aob.rs, aleksandar.valjarevic@pr.ac.rs, f62yusec@uco.es

Sodium is a very important element for research and analysis of astrophysical, laboratory and technological plasmas but neither theoretical nor experimental data on Stark broadening of Na IV spectral lines are present in literature.

Using the modified semiempirical method (Dimitrijević and Konjević, 1980), here have been calculated Stark widths for 13 Na IV transitions. Na IV belongs to the oxygen isoelectronic sequence and we have calculated Stark widths belonging to singlets, triplets and quintuplets as well as with different parent terms. This is used to discuss similarities within one spectrum with different multiplicities and parent terms.

Additionally, calculated widths will be implemented in the STARK-B database (Sahal-Bréchot et al., 2015 - http://stark-b.obspm.fr) which is also a part of Virtual atomic and molecular data center (VAMDC - http://www.vamdc.org/ - Dubernet et al. 2010).

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Poster

SEMICLASSICAL STARK BROADENING PARAMETERS OF Ar VII SPECTRAL LINES

M. S. Dimitrijević[1,2], A. Valjarević[3] and S. Sahal-Bréchot[2]

[1] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[2] *LERMA, Observatoire de Paris, 5 Place Jules Janssen, 92195 Meudon Cedex, France*
[3] *University of Kosovska Mitrovica, Faculty of Natural Sciences and Mathematics, Department of Geography, Ive Lole Ribara 29, 38220 Kosovska Mitrovica, Serbia*

E-mail: mdimitrijevic@aob.rs, aleksandar.valjarevic@pr.ac.rs, sylvie.sahal-brechot@obspm.fr

Spectral lines of Ar VII have been observed in stellar spectra, for example by Taresch et al. (1997) and Werner et al. (2007) who identified Ar VII lines in some of the hottest known central stars of planetary nebulae, with effective temperatures of 95000 - 110000 K, and in (pre-) white dwarfs, where Stark broadening is very significant. The corresponding Stark broadening data are needed for a reliable analysis and modelling. Since Stark broadening parameters for Ar VII spectral lines are completely missing in the existing literature, we have calculated full widths at half maximum intensity and shifts of 16 spectral lines of Ar VII, for broadening by electron, proton, and He III impacts. For calculations, the semi-classical perturbation approach in the impact approximation has been used (see e.g. Sahal-Bréchot et al. 2014). The atomic structure has been calculated with the Bates and Damgaard approximation (Bates and Damgaard 1949). The results are provided for a set of temperatures varying from 20 000 K to 500 000 K and for a set of electron densities. The obtained results will be included in the STARK-B database (http://stark-b.obspm.fr) which is a part of the Virtual Atomic and Molecular Data Center (VAMDC - http://www.vamdc.org/).

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Poster

NONLINEAR SPECTROSCOPY OF ALKALI ATOMS IN COLD MEDIA

D. K. Efimov[1], N. N. Bezuglov[1], M. S. Dimitrijević[2], A. N. Klyucharev[1], V. A. Srećković[3] and F. Fuso[4]

[1] *Department of Physics, St.Petersrburg State University, 198504, St.Petersburg, Russia*
[2] *Astronomical Observatory, Volgina 7, Belgrade, Serbia*
[3] *University of Belgrade, Institute of Physics, 57, 11001, Belgrad, Serbia*
[4] *Dipartimento di Fisica Enrico Fermi and CNISM, Universit di Pisa, I-56127 Pisa, Italy*

E-mail: vlada@ipb.ac.rs, mdimitrijevic@aob.rs

An interest in the fluorescence spectrum of sodium atoms, incipient in astrophysics during the first analysis of the comets luminosity, has increased after the discovery of the sodium cloud-nebulas in the vicinity of Jupiters Galilean moons - Io and Europe, as well as Jupiter itself. We are concerned here with nonlinear spectroscopy of D2-lines of alkali atoms embedded in cold media. Specifically, we investigate the dynamical aspects of the laser excitation process in the atoms belonging to a cold beam (velocity around 12 m/s) produced out of a modified pyramidal Magneto-Optical Trap (Porfido et al. 2015). Thanks to the long transit time (~ 0.1 ms) through the excitation zone, even a tiny mixture within the Hyper-Fine (HF) sublevels of the resonant $np3/2$ state due to the laser coupling results in essential modifications of the optical pumping effects. In particular, the closed HF transitions become partially open with the simultaneous appearance of asymmetry in the corresponding absorption lines because of the AC Stark shifts of the involved states.

An example of the absorption profile for the closed $6^2s1/2$, $F = 4 \rightarrow^2 p3/2$, $F = 5$ transition in Cs is analysed, showing the expected asymmetrical shape in particular around 20 MHz detuning.

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Poster

THE PROFILES OF LAMOST ARC LINES

H. Feng and J. Chen

National Astronomical Observatories, Chinese Academy of Sciences,
A20 Datun Road, 100012 Beijing, China

E-mail: jjchen@nao.cas.cn

LAMOST is a specially designed 4-meter telescope for spectroscopic survey. Its 5 degree FOV, 4000 fibers and 16 low resolution spectrographs make it one of most efficient spectroscopic survey telescope. LAMOST DR4 releases spectra of more than 7.6 million targets, and gives stellar atmosphere parameters and radial velocity for more than 4 million stars. In this poster, we present the properties of the profiles of LAMOST arc lines, including stability, uniformity, symmetry, etc.

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Poster

THE Hβ LINE PROFILE ALONG THE QUASAR MAIN SEQUENCE

A. García Lopez[1,2], P. Marziani[1], M. D'Onofrio[2] and A. Del Olmo[3]

[1]*INAF, Osservatorio Astronomico di Padova, IT 35122, Padova, Italy*
[2]*Dipartimento di Fisica & Astronomia "Galileo Galilei", Università di Padova, Padova, Italy*
[3]*Instituto de Astrofisíca de Andalucía, IAA-CSIC, E-18008 Granada, Spain*
E-mail: paola.marziani@oapd.inaf.it

The quasar main sequence (MS) appears, at the very least, to be a useful tool to organize quasar diversity in large quasar samples. Several parameters are correlated with the MS defined in the optical plane FWHM (Hβ) versus Fe II prominence, also known as the optical plane of the 4D eigenvector 1 correlation space. The shape of the Balmer line Hβ shows a most intriguing behavior: the ratio FWHM over radial velocity dispersion σ is changing along the sequence. Previous work has shown that profiles are usually well fit by a Lorentz function if FWHM (Hβ) is $\leq$ 4000 km/s (Population A following Sulentic et al. 2000): by a double Gaussian if the lines are broader (Population B). Here we present the preliminary results of a systematic study of the Hβ line profile in bins of 1000 km/s, over four intervals in Fe II prominence (defined by the intensity ratio $R_{\rm Fe\,II}$ between the Fe II blend at λ4570 Å and Hβ). In particular we test which model of the broad Hβ line profile among a Lorentz, a double Gaussian, and a Voigt function provides the best description of the line profile as a function of line width and $R_{\rm Fe\,II}$. Some implication are drawn on the dynamics and geometry of the broad line region.

Poster

STARK WIDTHS OF Ar II SPECTRAL LINES IN THE ATMOSPHERES OF SUBDWARF B STARS

R. Hamdi[1,2], N. Ben Nessib[3], S. Sahal-Bréchot[4] and M. S. Dimitrijević[4,5]

[1]*Deanship of the Foundation Year, Department of Physics, Umm Al-Qura University, Makkah, Kingdom of Saudi Arabia*
[2]*Faculté des Sciences de Bizerte, Université de Carthage, Tunisia*
[3]*Department of Physics and Astronomy, College of Science, King Saud University, PO Box 2455, Riyadh 11451, Saudi Arabia*
[4]*LERMA, Observatoire de Paris, PSL Research University, CNRS, Sorbonne Universities, UPMC Univ., Paris 06, 5 Place Jules Janssen, 92195 Meudon Cedex, France*
[5]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*

E-mail: rfhamdi@uqu.edu.sa, nbennessib@ksu.edu.sa, sylvie.sahal-brechot@obspm.fr, mdimitrijevic@oab.bg.ac.rs

In this work we present Stark widths of Ar II spectral lines calculated using semi classical perturbation approach (Sahal-Bréchot 1969 a,b). Energy levels and oscillator strengths needed for this calculation are carried out using Hartree-Fock method with relativistic corrections (Cowan 1981) and an atomic model including 24 configurations. We are interested on the transitions belonging to the 3d - 4p transition array. In order to check the accuracy of our results, our Stark widths are compared with available experimental results and with semiclassical calculations of Griem (1974). Our Stark widths may be of interest for modelling and investigation of stellar atmospheres since Ar II spectral lines are observed in many kind of stellar atmospheres such as the atmospheres of B-type and subdwarf B stars. Finally, the importance of Stark broadening mechanism is studied in the atmospheric conditions of subdwarf B stars. Electron impact Stark widths are compared to thermal Doppler widths as a function of temperature and optical depth of atmospheric layers.

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Poster

THE SCREENING CHARACTERISTICS OF THE ASTROPHYSICAL PLASMAS: THREE-COMPONENT SYSTEMS

Lj. M. Ignjatović and V. A. Srećković

Institute of Physics, Pregrevica 118, 11080 Zemun, Belgrade, Serbia
E-mail: vlada@ipb.ac.rs, ljuba@ipb.ac.rs

Here, as the object of investigation, astrophysical fully ionized electron-ion plasma is chosen with positively charged ions of two different kinds, including the plasmas of higher non-ideality. The direct aim of this work is to develop, within the problem of the finding of the mean potential energy of the charged particle for such plasma, a new model self-consistent method of describing of the electrostatic screening. Within the presented method such extremely significant phenomena as the electron-ion and ion-ion correlations are included in the used model, and all types of the necessary conditions are clearly defined. The characteristics of the considered plasmas in a wide region of the electron densities and temperatures are calculated. The case of the three-component systems was considered which is especially important since further increase of the number of the ion components did not cause appearance of any new phenomena. We wish to draw attention that developed method is suitable for astrophysical applications. Here we keep in mind that in outer shells of stars the physical conditions change from those which correspond to the rare, practically ideal plasma, to those which correspond to extremely dense non-ideal one. However, the method presented gives a possibility to describe the electrostatic screening of all such outer shells in the same way, by means of the obtained screening characteristics.

Poster

A NEW ANALYSIS OF STARK AND ZEEMAN EFFECTS ON HYDROGEN LINES IN MAGNETIZED DA WHITE DWARFS

N. Kieu[1], J. Rosato[1], R. Stamm[1], J. Kovačević-Dojčinović[2], M. S. Dimitrijević[2], L. Č. Popović[2] and Z. Simić[2]

[1] *Aix-Marseille Université, CNRS, PIIM UMR 7345, 13397 Marseille Cedex 20, France*
[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*

E-mail: joel.rosato@univ-amu.fr

White dwarfs with magnetic field strengths larger than 10 T are understood to represent more than 10% of the total population of white dwarfs (Külebi et al. 2009). The presence of such strong magnetic fields is clearly indicated by the Zeeman triplet structure visible on absorption lines. An analysis of line shapes also yields information on the plasma parameters (density and temperature) in the atmosphere, provided a suitable line broadening model accounting for the plasma microfield (Stark broadening) is used. In this work, we discuss the line broadening mechanisms and focus on the sensitivity of hydrogen lines on the magnetic field. The role of quadratic Zeeman effect on the position of absorption lines is discussed. At strong magnetic field values, the Lorentz electric field $\mathbf{v} \times \mathbf{B}$ is important and it can enter in competition with the plasma microfield. We perform new calculations in conditions relevant to DAH stellar atmospheres using models inspired from magnetic fusion plasma spectroscopy (Rosato et al. 2017). A selection of spectra from the Sloan Digital Sky Survey (SDSS) database (Külebi et al. 2009, Kepler et al. 2013) are analyzed.

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Poster

CONNECTION BETWEEN X-RAY, OPTICAL AND IR SPECTRAL CHARACTERISTICS FOR A SAMPLE OF AGNs

S. Marčeta Mandić[1,2], M. Lakićević[2], S. Bianchi[3], A. De Rosa[4], J. Kovačević-Dojčinović[2] and L. Č. Popović[1,2]

[1]*Department of Astronomy, Faculty of Mathematics, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*
[3]*Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre, via della Vasca Navale 84, 00146 Roma, Italy*
[4]*IAPS/INAF - National Institute for Astrophysics, Via Fosso del Cavaliere I-00133 Roma, Italy*

E-mail: sladjana@aob.rs, lpopovic@aob.rs

AGNs are known as strong X-ray emitters when closest regions to black holes considered such as accretion disk, with broad emission lines in the optical band originating from the fast moving clouds of hot and dens gas surrounding AGNs central area, commonly termed Broad Line Region (BLR) and lastly with prominent emission in IR part of spectra deriving from the dusty torus that encircle the active core of the galaxy. To explore physics of different emission regions in AGNs and their physical interaction, here we investigate spectral characteristics and variability of a sample of AGNs in the wide range of spectra from the X-ray to the IR. The idea is to connect high energy emission characteristics from the central engine area (accretion disk) to the effects noticed in the BLR emission and torus spectra. We confirmed the known correlations between MIR and X-ray luminosities and investigated the connections between x-ray parameters and MIR characteristics obtained using deblendIRS code, and with spectral lines.

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Poster

ESTIMATION OF THE QUASI THERMAL NOISE SPECTRUM AROUND THE PLASMA FREQUENCY

M. M. Martinović

IHIS Techno-experts d.o.o. - Research and Development Center, Belgrade, Serbia
E-mail: mihailo.martinovic@obspm.fr

Quasi-thermal noise (QTN) spectroscopy enables precise determination of plasma density and temperature by analysing the voltage fluctuations spectrum measured at the terminals of an antenna embedded in the plasma. The main characteristic of the QTN spectrum is a noise peak just above the plasma frequency, which allows a very accurate measurement of the electron density. Properties of the peak and, consequently, the quality of measurements, are dependent of both antenna geometry and plasma parameters. In this work, we review both the antenna and the plasma contributions and also give some general remarks on the instrument design requirements. Condition for the peak to be detectable, it is necessary for the dipole antenna arm length to be at least 10^4 times larger than its radius, and at least 2 times larger then the plasma Debye length. For the plasma contribution it turns out that size and shape of the peak are determined by supra-thermal (non-Maxwellian) electrons, where density of the non-thermal particles determines the width, while the peak intensity dominantly depends on their temperature. On the other hand, in the ionosphere and magnetosphere of Earth, where the velocity distribution is Maxwellian, the plasma peak shape is determined by either electrons-to-neutrals collision rate (lower ionosphere) or local magnetic field strength (magnetosphere and higher ionosphere). While collisions damp the plasma oscillations and therefore broaden and reduce the amplitude of the peak, magnetic field affection changes the peak location in the spectrum from the plasma frequency to upper hybrid electron frequency, making density measurements significantly more complicated.

Poster

TIME EVOLUTION OF X RADIATION SPECTRUM DURING A SOLAR X-RAY FLARE

A. Nina[1], V. M. Čadež[2], J. Bajčetić[3], S. T. Mitrović[3] and L. Č. Popović[2]

[1] *Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia*
[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*
[3] *University of Defence, Military Academy, Generala Pavla Jurišića Šturma 33, 11000 Belgrade*

E-mail: sandrast@ipb.ac.rs, vcadez@aob.rs, bajce05@gmail.com, mitar027@beotel.net lpopovic@aob.rs

The influence of solar photons on the ionosphere significantly depends on their wavelength. Namely, the corresponding cross-sections for absorption and ionization processes in the atmosphere can vary by more than a factor of two or, in some cases, by several orders of magnitude. For this reason, knowledge on electromagnetic spectrum entering the terrestrial outer layer is important for plasma dynamic calculations. In quiet conditions, the Lyα photons dominate in ionization processes within the upper D-region. However, sudden processes in the Sun can cause intensive outbursts of other photons whose impact on the ionospheric ionization may significantly exceed the influences existing in an unperturbed state. In this work we analyze the time evolution of the X-radiation spectrum during a solar X-ray fare and present the electron density variations at fixed altitudes in the D-region.

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Poster

TIME DELAYS EVOLUTION AND PERIODICITIES OF THE CONTINUUM AND EMISSION LINES OF 4 TYPE 1 AGN

E. Perez-Hernandez[1], A. Kovačević[2], L. Č. Popović[3], A. I. Shapovalova[4], W. Kollatschny[5] and D. Ilić[2]

[1]*Instituto de Astronomía y Meteorología , Universidad de Guadalajara Av. Vallarta 2602, Col. Arcos Vallarta, 44130, Guadalajara, Jalisco, México*
[2]*Department of Astronomy, Faculty of Mathematics, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia*
[3]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[4]*Astronomical Observatory, Nizhnij Arkhyz, Zelenchukskiy region, Karachai-Cherkessian Republic, Russia, 369167*
[5]*Institut für Astrophysik, Universitat Göttingen, Friedrich-Hund Platz 1, 37077, Göttingen, Germany*

E-mail: whos_i2@hotmail.com

We investigate a specific aspects of variability of the continua and emission lines of type 1 Active Galactic Nuclei (AGN) Arp102b, 3C 390.3, NGC 5548, and E1821+643: periodicity and time delay evolution. The periodogram techniques are very powerful for short and medium periodicities, while in the case of very long light curves possible false alarms can arise. If the noises of two light curves are not correlated (which is possible to assume for AGN), then cross correlation of these light curves would not be contaminated with information from noises. If the same periodicity is presented in both signals it would be clearly seen in their cross correlation function.

Our idea is to get candidate periods from periodogram techniques and then validate periods by means of cross correlation of the light curves. If the signal of same period is presented in both curves it must be revealed in the periodic appearance of cross correlation function. The result of detected periodicity in the continuum and Hβ line of NGC 5548 by means of cross correlation, confirming that it is not a consequence of red noise process. Rather, it originates from the orbital motion of two phenomena (of any kind). Moreover, we constructed time delay curve of this object, using segmentation of the continuum and Hβ emission line. By application of cross correlation, we detected the same period in the time delay curve as in the case of its light curves. Such time delay evolution of NGC 5548 suggests possible changes of dimension of its BRL. As for other objects, it was not possible to get time delay curves due to characteristics of their data sets. The results of our periodicity analysis of the data of 4 type 1 AGN give a new information about the origin of detected periodic signals that they are not a consequence of red noise process, rather these periodicities arise due to real periodic phenomena in these objects.

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Poster

THE RELATIVISTIC Fe Kα LINE IN TYPE 1 AGN: REASONS FOR THE LACK OF DETECTION

M. A. Pursiainen[1,2], P. Jovanović[2] and L. Č. Popović[2]

[1] *Physics and Astronomy, University of Southampton, Southampton, SO17 1BJ, UK*
[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*

E-mail: m.a.pursiainen@soton.ac.uk, pjovanovic@aob.bg.ac.rs, lpopovic@aob.rs

The relativistically broadened Fe Kα line, originating from the accretion disc in a close vicinity of a super massive black hole, is observed in only less than 50% of type 1 AGN. In this study we investigate could this lack of detections be explained by the effects of certain parameters of the accretion disc and the black hole, such as the inclination and the inner radius of the disc. First we simulated several thousand fully relativistic accretion discs and corresponding Fe Kα line profiles in order to determine how these parameters affect the shape of the line profile. Additionally we analyzed X-ray spectra of 12 type 1 AGN, for which the line has previously been detected, taken with *XMM-Newton*. We detected the broad line in all 12 sources and found average values for inclination $i = (31 \pm 3)^\circ$ and for inner disc radius $R_{\rm in} = 9.26 \pm 2.95 R_{\rm g}$. Based on comparisons of the simulated and observed line profiles, we conclude that the lack of detections could, at least partially, be explained by the effects of the disc parameters and low observational quality of the data. Some crucial parts of the line profile could be hidden causing the line to appear to be originating further from the black hole and thus the line would be classified as broad but non-relativistic. The Fe Kα line can also be completely obstructed and thus not detected at all.

Poster

SPECTROSCOPIC DIAGNOSTICS OF THE ELECTRON DENSITY IN CORONA DISCHARGES

J. Rosato[1], N. Bonifaci[2] and R. Stamm[1]

[1]*Aix-Marseille Université, CNRS, PIIM UMR 7345, 13397 Marseille Cedex 20, France*
[2]*Laboratoire G2Elab CNRS and Grenoble University, 25 rue des Martyrs, 38042 Grenoble, France*

E-mail: joel.rosato@univ-amu.fr

Experiments have been carried out in gaseous He at the fixed temperature of 300 K and different pressures in the cell from 0.1 MPa up to 2 MPa. A corona discharge (ionization of gaseous He) has been performed at the vicinity of a tip electrode under high voltage. The discharge domain (ionization zone) has a volume less than an inter-electrode space (drift zone). The corona current has been measured for different pressures in a space-charge-limited regime. Spectroscopic observations of the light can be used to determine information of the local environment of the emitting atoms or molecules. The optical emission spectrum from impurities, like hydrogen, can also be used. In this work, we report on an investigation of hydrogen and helium spectral profiles and their dependence on the discharge current and pressure. It is shown that the electron density can be inferred from the Stark broadening of these lines.

Poster

THE APPLICATION OF THE CUT-OFF COULOMB MODEL POTENTIAL FOR THE CALCULATION OF BOUND - BOUND STATE TRANSITIONS

N. M. Sakan[1], V. A. Srećković[1], Z. Simić[2], and M. S. Dimitrijević[2,3]

[1]*Institute of Physics, Pregrevica 118, 11080 Zemun, Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[3]*LERMA, Observatoire de Paris, UMR CNRS 8112, UPMC, 92195 Meudon Cedex, France*

E-mail: nsakan@ipb.ac.rs, vlada@ipb.ac.rs, zsimic@aob.rs, mdimitrijevic@aob.rs

In this contribution we present results of bound state transition modeling using the cut-off Coulomb model potential. The cut-off Coulomb potential has proven itself as a model potential for the dense hydrogen plasma (see Mihajlov et al. 2011,2015). The main aim of our investigation include a further steps of improvement of the usage of model potential. The presented results cover a wide region of the plasma electron densities and temperatures. Such plasmas are of interest from both the laboratory and the astrophysical aspect. Here, we keep in mind the plasma of the inner layers of the solar atmosphere, as well as of partially ionized layers of other stellar atmospheres, for example the atmospheres of DA and DB white dwarfs with effective temperatures between 10 000 K and 25 000 K (Srećković et al. 2014). It is expected that such approach would lead towards the inclusion of bound state transition photo-absorption process within the frame of the presented Coulomb cut-off potential model.

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Poster

THE CROSS SECTIONS AND THE RATE COEFFICIENTS OF THE FREE-FREE ABSORPTION PROCESSES IN STELLAR ATMOSPHERES

V. A. Srećković[1], M. S. Dimitrijević[2,3], Z. Simić[2] and N. M. Sakan[1]

[1]*Institute of Physics, Pregrevica 118, 11080 Zemun, Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*
[3]*LERMA, Observatoire de Paris, UMR CNRS 8112, UPMC, 92195 Meudon Cedex, France*

E-mail: vlada@ipb.ac.rs, mdimitrijevic@aob.rs, nsakan@ipb.ac.rs

The contribution of free-free electron-ion processes to the total absorption in stellar atmospheres increases with density, and for very dense plasmas it becomes dominant. Consequently, it is of interest to investigate the role of such processes in deeper layers, and to examine its influence on radiative transfer through such layers. In this contribution we present the free-free i.e. electron-ion characteristics for the case of the various models of stelar atmospheres where such plasma characteristics as plasma density and temperature change in wide region. It is shown that determination of these characteristics such as the cross-sections and the rate coefficients can be successfully performed in the whole diapason of electron densities and temperatures which is relevant for the corresponding non-ideal, dense astrophysical plasma. The Cut-off form of Coulomb potential is used to approximate the shielding effect in order to derive the cross-sections and the rate coefficients. We used quantum mechanical method of the calculation of the investigated characteristics (see Mihajlov et al. 2015). The results are obtained for the DB White dwarf models (Koester 2015 private communication) and for the solar model of Vernazza et al. (1981) in the wavelength region 10 nm $< \lambda <$ 3000 nm. Also, these results can be of interest and use in investigation of different laboratory non-ideal, dense plasmas.

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Poster

RADIATIVE AND COLLISIONAL MOLECULAR DATA AND VIRTUAL LABORATORY ASTROPHYSICS: STATE OF ADVANCEMENT AND PERSPECTIVES

V. A. Srećković[1], Lj. M. Ignjatović[1], D. Jevremović[2], V. Vujčić[2,3] and M. S. Dimitrijević[2,4]

[1]*Institute of Physics, Belgrade University, Pregrevica 118, Zemun, 11080 Belgrade, Serbia*
[2]*Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia*
[3]*Faculty of Organizational Sciences, University of Belgrade*
[4]*LERMA, Observatoire de Paris, UMR CNRS 8112, UPMC, 92195 Meudon Cedex, France*

E-mail: vlada@ipb.ac.rs, ljuba@ipb.ac.rs, darko@aob.rs, veljko@aob.rs, mdimitrijevic@aob.rs

Spectroscopy has been central to the development of our understanding of physical and chemical phenomena. The interpretation of interstellar line spectra with radiative transfer calculations usually requires two kinds of molecular input data: spectroscopic data such as energy levels, statistical weights, and etc. and collision data. This poster describes how such data are collected, stored, and which limitations exist. Also, here we summarize challenges of atomic/molecular databases and point out our experiences, problems and etc. which we are facing with. We present overview of future developments and needs in the areas of radiative transfer and molecular data.

Poster

SOLAR X RAY FLARES AND THEIR IMPACT ON THE IONOSPHERE

V. A. Srećković[1] and D. M. Šulić[2]

[1] *Institute of Physics, Belgrade University, Pregrevica 118, Zemun, 11080 Belgrade, Serbia*
[2] *University Union - Nikola Tesla, 11000 Belgrade, Serbia*
E-mail: vlada@ipb.ac.rs, desankasulic@gmail.com

Very low frequency (VLF, 3-30 kHz) and low frequency (LF, 30-300 kHz) radio signals are powerful tool for long-range remote sensing of the ionospheric D-region. Propagation of VLF/LF signals emitted by man-made transmitters takes place in the Earth-ionosphere waveguide and strongly depends on the electrical properties of the ionosphere. Changes in the D-region electron density cause changes in the received amplitude and phase on VLF/LF signals (Šulić & Srećković, 2014, Nina et al., 2011). The focus of this contribution is on the study of the narrowband VLF/LF perturbations induced by solar X-ray flares in order to deeply understand processes in the perturbed D-region. During occurrence of solar flare the altitude profile of ionospheric conductivity changes, a VLF/LF signal reflects from lower height and these changes result that VLF/LF propagation is performed with more discrete modes than in normal ionospheric condition (Šulić et al., 2016). Amplitude and phase perturbations on different VLF/LF signals observed at Belgrade have sensitive dependence on: X-ray flare intensity, solar zenith angle, and geophysical characteristics of path.

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XI SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
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Poster

DETAILED INVESTIGATION OF THE ELECTRIC DISCHARGE PLASMA BETWEEN COPPER ELECTRODES IMMERSED INTO WATER

R. Venger[1], T. Tmenova[1,2], F. Valensi[2], A. Veklich[1], Y. Cressault[2] and V. Boretskij[1]

[1] *Taras Shevchenko National University of Kyiv, Faculty of Radio Physics, Electronics and Computer Systems, 64, Volodymyrs'ka st., Kyiv, Ukraine*
[2] *Universitè de Toulouse, UPS, INPT, LAPLACE (Laboratoire Plasma et Conversion d'Energie), 118 route de Narbonne, F-31062, Toulouse Cedex 9, France*
E-mail: venger.roman@icloud.com

A phenomenological picture of pulsed electrical discharge in water is produced by combining electrical, spectroscopic, and imaging methods. The discharge is generated by applying 250 μs long 100 to 220 V pulses (values of current from 400 to 1000 A, respectively) between the point-to-point copper electrodes submerged into water. Plasma channel and gas bubble occur between the tips of the electrodes, which are initially in contact with each other. The study includes detailed experimental investigation of plasma parameters of such discharge using the correlation between time-resolved high-speed imaging, electrical characteristics, and optical emission spectroscopic data. Detailed analysis of obtained spectra of atomic copper, hydrogen and oxygen lines is performed. Spectroscopic methods, i.e. Boltzmann plots of copper lines' intensities, and widths of H_α and H_β hydrogen lines, exposed to the Stark mechanism of spectral lines' broadening, are used to determine the radial profiles of temperature and electron density, and composition of such plasma. Estimations of the electrodes' erosion rate and bubble's size depending on the electrical input parameters of the circuit are presented. Experimental results of this work may be valuable for the advancement of modeling and the theoretical understanding of the pulse electric discharges in water.

11th SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS

21-25, Avgust 2017, Šabac, Serbia

Monday, August 21

16-17h Arrival and registration

17-19h Poster presentation

19-21h Welcome cocktail

Tuesday, August 22		
Chair: L. Č. Popović		**Opening and plenary talks**
8:50 – 9:00	Opening ceremony	
9:00 – 9:30	Evgeny Stambulchik	A STUDY OF SUPERSONIC TURBULENCE IN STAGNATING PLASMAS
9:30 – 10:00	Maja Vučković	IRRADIATION EFFECTS IN SPECTRA OF CLOSE BINARY SYSTEMS
10:00 – 10:30	Jian-Min Wang	SUPER-EDDINGTON ACCRETING MASSIVE BLACK HOLES IN ACTIVE GALACTIC NUCLEI
10:30 – 11:00	Coffee break	
Chair: M. S. Dimitrijević		**Spectral line phenomena in extragalactic objects**
11:00 – 11:30	Wolfram Kollatschny	OPTICAL SPECTROSCOPY OF THE CHANGING LOOK AGN HE1136-2304
11:30 – 12:00	Alberto Rodríguez-Ardila	FEEDBACK IN THE CENTRAL PARSECS OF ACTIVE GALACTIC NUCLEI MAPPED FROM HIGH-IONIZATION LINE
12:00 – 12:20	Sergei Kotov	ACTIVE GALACTIC NUCLEI SEARCH
12:20 – 12:40	Dmitry Oparin	KINEMATICS OF IONIZED GAS OUTFLOWS CAUSED BY STAR FORMATION
12:40 – 13:00	Marko Stalevski	REVEALING THE STRUCTURE OF AGN IN CIRCINUS
13:00 – 15:00	Working lunch	

Chair: J. Rosato		**Spectral line shapes phenomena in plasma**
15:00 – 15:30	Aleksandar Milosavljević	HIGH-RESOLUTION SOFT X-RAY SPECTROSCOPY OF DILUTE SPECIES (SOME FOR ASTROPHYSICS) AT THE PLEIADES BEAM LINE
15:30 – 15:45	Cristina Yubero	ON THE GAS TEMPERATURE DETERMINATION IN Ar PLASMA AT ATMOSPHERIC PRESSURE FROM BROADENINGS OF ATOMIC EMISSION LINES
15:45 – 16:00	Jose Muñoz	DETERMINATION OF GAS TEMPERATURE IN MICROWAVE DISCHARGES SUSTAINED IN ARGON-NEON MIXTURES BY USING PRESSURE BROADENED SPECTRAL LINES
16:00 – 16:30	Coffee break	
Chair: V. L. Afanasiev		**Spectral line shapes phenomena in plasma**
16:30 – 17:00	Paola Marziani	BLACK HOLE MASS ESTIMATES FROM HIGH-IONIZATION LINES: BREAKING A TABOO?
17:00 – 17:20	Maša Lakićević	THE CONNECTIONS BETWEEN THE MID-INFRARED AND OPTICAL SPECTRAL LINE AND CONTINUUM CHARACTERISTICS OF AGNs: AGN VS. STARBURST EMISSION
17:20 – 17:40	Giovanni LaMura	MODELS OF EMISSION LINE PROFILES AND SPECTRAL ENERGY DISTRIBUTIONS TO CHARACTERIZE THE MULTIPLE FREQUENCY PROPERTIES OF ACTIVE GALACTIC NUCLEI
17:40 – 18:00	Dimitris Stathopoulos	LONG TERM VARIABILITY OF SI IV AND C IV BROAD ABSORPTION TROUGHS OF 10 BALQSOs

Wednesday, August 23		
Chair: R. Stamm		***Special session:*** **Line shapes in astrophysics and fusion plasma research: Common challenges**
9:30 – 10:00	Joël Rosato	LINE SHAPE MODELING FOR MAGNETIC WHITE DWARF AND TOKAMAK EDGE PLASMAS: COMMON CHALLENGES
10:00 – 10:20	Ibtissem Hannachi	EFFECT OF TURBULENCE ON LINE SHAPES IN ASTROPHYSICAL AND FUSION PLASMAS
10:20 – 10:40	Milan Dimitrijević	STARK BROADENING OF Se IV, Sn IV, Sb IV AND Te IV SPECTRAL LINES
10:40 – 11:10	Coffee break	
Chair: J-M. Wang		**Spectral line phenomena in extragalactic objects (line variability)**
11:10 – 11:30	Patricia Rojas Lobos	REVERBERATION OF OPTICAL POLARIZATION IN AGN
11:30 – 11:50	Saša Simić	LONG-TERM MONITORING SUPER-MASSIVE BINARY CANDIDATES: VARIABILITY IN THE BROAD LINES AND CONTINUUM
11:50 – 12:10	Edi Bon	TESTING A BINARY BLACK HOLE HYPOTHESIS FOR THE CASE OF NGC 5548
12:30 –	Excursion	Visiting ‘Sirmium’

Thursday, August 24		
Chair: G. Peach		***Collisions and spectral line shapes*** ***(in honor of Milan S. Dimitrijević's 70th birthday)***
9:30 – 10:00	Sylvie Sahal-Bréchot, Nikola Konjević, Gillian Peach, Luka Popović	SCIENTIFIC CONTRIBUTION OF M. S. DIMITRIJEVIĆ AND SCIENTIFIC COLLABORATION
10:00 – 10:30	Roland Stamm	STARK BROADENING FROM IMPACT THEORY TO SIMULATIONS
10:30 – 11:00	Coffee break	
Chair: E. Stambulchik		***Collisions and spectral line shapes*** ***(in honor of Milan S. Dimitrijević's 70th birthday)***
11:00 – 11:30	Vladimir Srećković	ATOM-ATOM AND ION-ATOM COLLISIONAL PROCESSES: MODELING OF STELLAR ATMOSPHERES
11:30 – 11:50	Antonios Antoniou	TIME-SCALE VARIATION OF THE COMPONENTS THAT FORM THE C IV AND Si IV DACs IN THE UV SPECTRUM OF THE O-STAR HD 93521
11:50 – 12:10	Zlatko Majlinger	REGULARITIES AND SYSTEMATIC TRENDS ON Zr IV STARK WIDTHS
12:10 – 12:30	Nenad Milovanović	CALCULATION OF STARK BROADENING PARAMETERS OF S II MULTIPLETS AND STELLAR MODELS ANALYSIS
12:30 – 13:00	Milan Dimitrijević and Norbert Przybilla	ON THE STARK BROADENING OF Si III SPECTRAL LINES IN B TYPE STARS
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Chair: E. Danezis		**Spectral line shapes in astrophysics: databases**
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15:30 – 16:00	Robert Beuc	SPECTRA OF DIATOMIC MOLECULES: FROM COLD TO HOT
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17:30 – 17:50	Kamel Ahmed-Touati	DOPPLER BROADENING OF SPECTRAL LINE SHAPES IN RELATIVISTIC PLASMAS
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19:30 – 24:00	CONFERENCE DINNER	

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10:30 – 11:00	Marko Krčo	FAST TELESCOPE CAPABILITIES, AND THE UPCOMING MULTI-BEAM SURVEY
11:00 – 11:30	Coffe break	
Chair: P. Jovanović		***Spectral line phenomena in extragalactic objects***
11:30 – 11:50	Alla Shapovalova	PROGRESS REPORT ON THE SAO OPTICAL MONITORING OF TYPE 1 AGN
11:50 – 12:10	Nemanja Rakić	SPECTRAL LINE CHARACTERISTICS OF AGNs IN THE FRAME OF THE INTRINSIC BALDWIN EFFECT
12:10 – 12:30	Elena Shablovinskaya	PHOTOMETRIC AND POLARIMETRIC INTERPRETATION OF BLAZAR AO 0235+164 BEHAVIOUR
12:30 – 12:50	Djordje Savić	SUPER-MASSIVE BINARY BLACK HOLE AND POLARIZATION IN THE BROAD LINES
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LIST OF PARTICIPANTS

Viktor Afanasiev
Specical Astrophysical Observatory of Russian Academy of Sciences, Russia
vafan@sao.ru

Rihab Aloui
Ecole National Supérieure d'Ingénieurs de Tunis, University of Tunis, Tunisia
rihabaloui88@gmail.com

Antonios Antoniou
National and Kapodistrian University of Athens, Greece
ananton@phys.uoa.gr

Sourav Banerjee
IIT Madras, Chennai, India
souravbanrj444@gmail.com

Robert Beuc
Institute of Physics, Croatia
beuc@ifs.hr

Edi Bon
Astronomical Observatory Belgrade, Serbia
ebon@aob.rs

Nataša Bon
Astronomical Observatory Belgrade, Serbia
nbon@aob.rs

Duško Borka
Vinča Institute of Nuclear Sciences, Serbia
dusborka@vinca.rs

Vesna Borka Jovanović
Vinča Institute of Nuclear Sciences, Serbia
vborka@vinca.rs

Emmanuel Caux
DR1 CNRS - Directeur adjoint de l'IRAP Institut de Recherche en Astrophysique et Planétologie IRAP-UPS/CNRS, UMR, France
emmanuel.caux@irap.omp.eu

Jianjun Chen
National Astronomical Observatories, Chinese Academy of Sciences, China
jjchen@nao.cas.cn

Emmanuel Danezis
National and Kapodistrian University of Athens, Greece
edanezis@phys.uoa.gr

Milan S. Dimitrijević
Astronomical Observatory Belgrade, Serbia
mdimitrijevic@aob.bg.ac.rs

Sergei Dodonov
Special Astrophysical Observatory of Russian Academy of Sciences, Russia
dodo@sao.ru

Alan Andrés García López
Universita degli Studi di Padova - Osservatorio Astronomico di Padova, Italy
alan61013@gmail.com

Rafik Hamdi
Umm al Qura University, Kingdom of Saudi Arabia
hamdi.rafik@gmail.com

Ibtissem Hannachi
University Batna 1, PRIMALAB, Batna, Algeria
Aix-Marseille University and CNRS, PIIM, 13397 Marseille, France
ibtissem.hannachi@univ-amu.fr

Dragana Ilić
Faculty of Mathematics, University of Belgrade, Serbia
dilic@matf.bg.ac.rs

Predrag Jovanović
Astronomical Observatory Belgrade, Serbia
pjovanovic@aob.rs

Wolfram Kollatschny
Institut fuer Astrophysik, Goettingen, Germany
wkollat@astro.physik.uni-goettingen.de

Nikola Konjević
Serbian Academy of Sciences and Arts, Belgrade, Serbia
Faculty of Physics, University of Belgrade, Serbia
nikola.konjevic@phy.bg.ac.rs

Sergei Kotov
Specical Astrophysical Observatory of Russian Academy of Sciences, Russia
sss.kotov@mail.ru

Andjelka Kovačević
Faculty of Mathematics, University of Belgrade, Serbia
andjelka@matf.bg.ac.rs

Marko Krčo
National Astronomical Observatories, Chinese Academy of Sciences, China
marko@mkastro.net

Giovanni La Mura
University of Padua, Italy
giovanni.lamura@unipd.it

Maša Lakićević
Astronomical Observatory Belgrade, Serbia
masha.lakicevic@gmail.com

Evangelia Lyratzi
National and Kapodistrian University of Athens, Greece
elyratzi@phys.uoa.gr

Zlatko Majlinger
Faculty of Humanities and Social Sciences, University of Rijeka, Croatia
zlatko.majlinger@gmail.com

Sladjana Marčeta Mandić
Faculty of Mathematics, University of Belgrade, Serbia
sladjana.mandic@gmail.com

Bratislav Marinković
Head of Laboratory for Atomic Collision Processes, Serbia
marinkov@ipb.ac.rs,
bratislav.marinkovic@ipb.ac.rs

Mihailo Martinović
Department of Astronomy, Faculty of Mathematics, University of Belgrade, Serbia
mihailo.martinovic@obspm.fr

Paola Marziani
INAF Osservatorio Astronomico di Padova, Italy
paola.marziani@oapd.inaf.it

Med Tayeb Meftah
Departement of Phyics, University of Ouargla, Algeria
mewalid@yahoo.com

Nenad Milovanović
Astronomical Observatory Belgrade, Serbia
nmilovanovic@aob.rs

Aleksandar Milosavljević
"PLÉIADES beamline, Synchrotron SOLEIL, France
milosavljevic@synchrotron-soleil.fr

Aleksandra Nina
Institute of Physics, University of Belgrade, Serbia
sandrast@ipb.ac.rs

Dmitriy Oparin
Specical Astrophysical Observatory of Russian Academy of Sciences, Russia
doparin2@gmail.com

Ferhat Fikri Özeren
Erciyes University, Science Faculty, Astronomy and Space Sciences, Turkey
ozeren@erciyes.edu.tr

Gillian Peach
Department of Physics and Astronomy, University College London, The UK
g.peach@ucl.ac.uk

Luka Č. Popović
Astronomical Observatory Belgrade, Serbia
lpopovic@aob.rs

Piero Rafanelli
University of Padua, Italy
piero.rafanelli@unipd.it

Nemanja Rakić
Faculty of Science, University of Banjaluka, R. Srpska BiH
nemanja.rakic@unibl.rs

Alberto Rodríguez Ardila
Laboratório Nacional de Astrofísica, Brazil
aardila@lna.br

Patricia Andrea Rojas Lobos
Observatoire Astronomique de Strasbourg, France
parltest@gmail.com

Joël Rosato
Aix-Marseille University, France
joel.rosato@univ-amu.fr

Sylvie Sahal-Bréchot
LERMA, Observatoire de Paris, France
sylvie.sahal-brechot@obspm.fr

Nenad Sakan
Institute of Physics, Belgrade, Serbia
nsakan@ipb.ac.rs

Djordje V. Savić
Astronomical Observatory Belgrade, Serbia
djsavic@aob.rs

Elena Shablovinskaya
Saint Petersburg State University, Special Astrophysical Observatory, Russia
aerlind09@gmail.com

Alla Shapovalova
Specical Astrophysical Observatory of Russian Academy of Sciences, Russia
ashap@sao.ru

Saša Simić
Department of Physics, Faculty of Sciences, University of Kragujevac, Serbia
ssimic@kg.ac.rs

Zoran Simić
Astronomical Observatory Belgrade, Serbia
zsimic@aob.rs

Miloš Skočić
Faculty of Physics, University of Belgrade, Serbia
skocic@ff.bg.ac.rs

Vladimir Srećković
Institute of Physics, Belgrade, Serbia
vlada@ipb.ac.rs

Marko Stalevski
Astronomical Observatory Belgrade, Serbia
mstalevski@aob.rs

Evgeny Stambulchik
K.B. Weissman Institute of Physical Sciences, Israel
Evgeny.Stambulchik@weizmann.ac.il

Roland Stamm
PIIM, Aix-Marseille University, France
roland.stamm@univ-amu.fr

Dimitris Stathopoulos
National and Kapodistrian University of Athens, Greece
dstatho@phys.uoa.gr

Dimitrios Tzimeas
University of Athens, Greece
dtzimeas@phys.uoa.gr

Roman Venger
Faculty of Radio Physics, Electronics and Computer Systems, Taras Shevchenko National University of Kyiv, Ukraine
venger.roman@icloud.com

Sonja Vidojević
State University of Novi Pazar, Serbia
sonja@matf.bg.ac.rs

Maja Vučković
Instituto de Física y Astronomía, Facultad de Ciencias, Universidad de Valparaíso, Chile
maja.vuckovic@uv.cl

Jian-Min Wang
Institute of High Energy Physics, Chinese Academy of Scineces, China
wangjm@ihep.ac.cn

AUTHOR INDEX

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