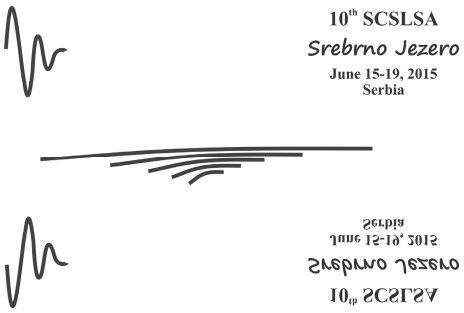

X SERBIAN CONFERENCE
ON SPECTRAL LINE SHAPES IN ASTROPHYSICS

BOOK OF ABSTRACTS

Eds. Luka Č. Popović, Milan S. Dimitrijević and Saša Simić

Astronomical Observatory

Belgrade, 2015

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Progress Report

THE SHIFT OF POLARIZED BROAD LINES IN TYPE 1 ACTIVE GALACTIC NUCLEI

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The broad line region (BLR) of active galactic nuclei (AGN) is a region that emits broad emission lines, and until now, it was not directly observed and resolved even for the nearest AGN. Therefore, the only way to study the BLR is by analyzing the properties of the broad emission lines. The spectro-polarimetric investigations of the BLR give an incredibly important additional information that can help in constraining the geometry, structure, and mechanisms of radiation of the BLR. The high-resolution observations performed with the 6-m telescope of Special Astrophysical Observatory of the Russian Academy of Science using the SCORPIO spectropolarimeter, allow us to analyze in great detail the poralized line profiles - shape, asimmetries and shifth, and make conclusions about the geometry and kinematics of both the BLR and the scattering regions. Here we present the results of the polarized line shifts analysis of the broad Hα line profiles in a number of Type 1 AGNs. Also, we will discuss the nature of the shift in polarized broad lines.

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Progress Report

STARK BROADENING OF HIGH ORDER RADIO RECOMBINATION LINES TOWARDS THE ORION NEBULA: AGREEMENT BETWEEN MEASUREMENTS AND THEORY

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We report the results of observations and analysis of sixty three $\Delta n = 1, ..., 7$ hydrogen radio recombination lines from the Orion nebula (M42) at 6 GHz central frequency with spectral sensitivity of $\approx$1 mJy/beam (channel-to-channel RMS; $T_{\rm RMS} \approx 4$ mK). Observations were conducted at the Australia Telescope Compact Array (ATCA). A 1 GHz bandwidth allowed simultaneous detection of up to eleven spectral lines of equal Δn that were stacked to enable accurate measurement of line widths. Collisional widths in the range of principal quantum numbers n from 100 to 199 are found to be consistent with predictions of electron-impact Stark broadening theory. An Orion nebula model with density inhomogeneities (clumps) and gradients of temperature and density is consistent with our data. We reanalyze data of Smirnov *et al.* and Bell *et al.* and find excellent agreement between all statistically significant measurements and theory. Our findings unambiguously confirm the absence of line narrowing for n range from 100 to 199.

Poster

STARK BROADENING PARAMETERS FOR NEUTRAL OXYGEN SPECTRAL LINES

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Stark broadening parameters for neutral oxygen (OI) lines have been determined within the semiclassical perturbation method. The atomic data are taken from the NIST atomic database. The electron Stark widths and shifts results for 842 OI lines have been calculated. These Stark broadening parameters are calculated for electron density of 10^{16} cm^{-3} and for 6 different electron temperatures in the range of 5000 K to 50000 K.

Stark broadening parameters are compared with our previous results (Ben Nessib *et al.*, Physica Scripta, 1996), where we calculated Stark broadening parameters for only four OI spectral lines. The Stark widths and shifts are also compared with experimental and theoretical data available in the literature. New electron and proton impact line widths and shifts for some transitions have been obtained.

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Poster

IONOSPHERIC DISTURBANCES DUE TO SOLAR FLARES RECORDED BY VLF RECEIVER LOCATED IN TUNIS

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The study of the sun and its effects on the ionosphere is one of the many themes studied by the United Nation's International Space Weather Initiative (ISWI). In this context, new and cheap receivers are shared all over the world. These receivers SID/SuperSID are tuned in the VLF (Very Low Frequency) range allowing the detection of Sudden Ionospheric Disturbances (SID). These SIDs are caused by the solar flares and affect the VLF radio waves propagation in the earth-ionosphere waveguide. We will show a number of results that we found using a new useful and convivial numerical application SIDLab1.0, developed under IgorPro environment at the LSAMA laboratory and dedicated to a fast: detection, identification and classification of these ionospheric disturbances from raw VLF signals.

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Invited Lecture

DYNAMICS RESONANCES IN ATOMIC STATES OF ASTROPHYSICAL RELEVANCE

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Optical methods for the registration and control of parameters of ionized gas media including cold gases of astrophysical relevance have a number of unique properties. Photoionization plasma is created via excitation of the resonance states of atoms with their subsequent ionization. A key role in primary optical excitation is played by the stochastic migration of resonance photons (radiative transfer) in the volume of the absorbing medium in stellar atmospheres Bezuglov et al.(2003). The collision transfer of an atom's electron energy also exhibits features of random (Brownian) motion. For example, in a quasi molecular complex formed by collisions with the participation of Rydberg atoms, the initial state evolves into the final ionization channel accompanied by multiple intersections of intermediate terms and requires that we consider the chaotic migration of excitation along the dense network of highly excited states. Cold collisions favor the development of dynamic chaos, imposing some restrictions on coherent laser control of atoms having resulted, for instance, in the creation of cold plasma in a system of cold Rydberg atoms Park et al.(2011). We should also note the fluorescence that accompanies excitation atoms as a result of spontaneous transitions. Since the distribution of diffused photons over solid angles is of a random character, we must introduce elements of stochastic dynamics to describe the time evolution of radiating quantum systems Bezuglov et al.(2003). The aim of our presentation is to demonstrate the effectiveness of stochastic dynamics along with the formalism of dynamics resonances in describing phase breakdown for a wide variety of processes associated with the physics of creating and subsequently transferring optical excitation. We consider and give the explanation of, in particularly, the abnormal properties of the IR emission spectra of white dwarfs which reveal a gap in the radiation emitted by Rydberg atoms (RA) with values of the principal quantum number of $n \approx 10$ Afanasiev et al.(2006).

This work was supported by Government of RF, Grant 074-U01 and by EU FP7 Centre of Excellence FOTONIKA-LV (REGPOT-CT-2011-285912-FOTONIKA)

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Progress Report

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

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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

TEMPERATURE DEPENDENCE OF ATOMIC SPECTRAL LINE WIDTHS FOR NEUTRAL CHROMIUM

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In this work, temperature dependence of the widths for neutral chromium spectral lines have been studied. Different fitting methods have been analyzed to observe the method that will give the best results. Then this method can be used with more confidence to interpolate and extrapolate the theoretical values with different experimental values.

The line widths for nine neutral chromium spectral lines were analyzed and fitted by the power formula as suggested in the work of Dimitrijević *et al.* 2005 and by the quadratic logarithmic formula (Sahal-Bréchot *et al*, 2014). The second analytic expression showed better result even both are three parameters fitting.

After this fitting analysis, we recommend to use of the quadratic logarithmic formula for interpolating or extrapolating widths when values for temperatures are not directly provided in the literature.

We will extend our study to the proton spectral line widths for the data of Dimitrijević *et al.* 2005. For the shifts we will use a quadratic logarithmic fitting formula for the ratio of the shift to the width. Comparison will be done with other fitting formula.

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Poster

MEASURES OF THE SOFT X-RAY EXCESS AS AN EIGENVECTOR 1 PARAMETER FOR ACTIVE GALACTIC NUCLEI

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We present a preliminary analysis of X-ray spectra of quasars in the context of the 4D Eigenvector 1 parameter space (Sulentic et al. 2000). 4DE1 serves as a surrogate H-R diagram for representing empirical diversity among quasars and identifying the physical drivers of the diversity. The soft X-ray spectral index (Γ_{soft}) was adopted as one of the 4DE1 correlates for contrasting extremes in Type 1 properties. 4DE1 motivated the hypothesis of two quasar populations (A and B) representing sources radiating at $L/L_{EDD} > 0.2$ and $L/L_{EDD} < 0.1$ respectively. Pop A is a largely radio-quiet population with FWHM $H_\beta < 4000$ km/s and often showing a soft X-ray excess. Pop B is a mix of radio-quiet and the majority of RL quasars showing only a hard X-ray power-law SED. The X-ray separation was based upon earlier ROSAT and ASCA data but we now confirm this dichotomy with large samples of X-ray spectra obtained with XMM and SWIFT. One popular idea connects the soft excess in Pop A quasars as a signature of thermal emission from a hot accretion disk in sources radiating close to the Eddington limit.

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Poster

PROPERTIES OF THE [OIII] LINES IN TWO SAMPLES OF RADIO-EMITTING NARROW-LINE SEYFERT 1 GALAXIES

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Flat-spectrum radio-loud Narrow-Line Seyfert 1 galaxies (NLS1) are a recently discovered class of γ-ray emitting Active Galactic Nuclei (AGN), that exhibit some blazar-like properties which are explained with the presence of a relativistic jet viewed at small angles. When blazars are observed at larger angles they appear as radio-galaxies, and we expect to observe an analogue parent population for beamed NLS1s. However, the number of known NLS1s with the jet viewed at large angles is not enough. Therefore we tried to understand the origin of this deficit. A previous study on black hole masses and accretion luminosities revealed that, when the inclination angle increases, a beamed source can appear as a steep-spectrum radio-loud NLS1, or possibly even as a disk-hosted radio-galaxy. It is also possible that, if the jet is young and has not developed radio-lobes yet, when observed at large angles it becomes invisible for present days observatories and it makes the galaxy appear as radio-quiet. Its presence could anyway be revealed by the asymmetries in the [O III] lines profiles, that in some cases are thought to be connected with the existence of jets. We are investigating two samples of radio-emitting NLS1s in order to find out the incidence of blue wings and blue outliers in radio-loud and radio-quiet sources. We are presenting here the preliminary results of our study, that seem to point out a different behaviour between the two samples.

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Invited Lecture

HIGH TEMPERATURE OPTICAL SPECTRA OF DIATOMIC MOLECULES: QUANTUM-MECHANICAL, SEMIQUANTUM AND SEMICLASICAL APPROACH

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We developed a full quantum-mechanical procedure for calculating the absorption spectra of diatomic molecules, based on the Fourier grid Hamiltonian method for determining energies and the corresponding wave functions. A molecule in a box concept enables that all transitions between the bound, free, and quasibound states can be treated as bound-bound transitions. Using the classical FranckCondon principle and the stationaryphase approximation, we developed a semiquantum simulation method of the spectrum. The approximation is in very good agreement with fully quantummechanical calculations, while its consumption of computer time is lower by four orders of magnitude. Coupled channel quantummechanical and semiquantum approaches correctly describe the optical spectra in the case of non-adiabatic mixing. Both methods were tested on the absorption spectra of potassium and rubidium molecules in the red and nearinfrared region. In the case of local thermodynamic equilibrium the spontaneous emission coefficient and the linear absorption coefficient are related by Kirchhoffs law, which enables the semiquantum approximation of the diatomic molecules emission spectra as well. Using the latest ab initio calculations of electronic potentials and dipole moments of cesium molecules, we made a numerical simulation of the red and nearinfrared (600 - 1300 nm) absorption and emission spectrum of a dense cesium vapor for temperatures within the range 600 - 1500 K. The generalized Airy approximation of the canonical oscillating integrals was applied to the semiclassical calculation of thermally averaged spectral profiles of optical transitions of diatomic molecules, where the characteristic difference potential curve has a few critical points. Our study suggests that the semiquantum and semiclassical numerical simulation of the absorption/emission spectra can be an efficient tool for the diagnostics of hot vapors and are suitable for the determination of the number density and temperature of the vapors of diatomic molecules.

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Invited Lecture

POLARIZATION IN SPECTRAL LINES FORMED BY SCATTERING: FROM THE LINE CENTER TO THE FAR WINGS

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We will present a new theory able to model both resonant scattering and Rayleigh or Raman scattering in a unified formalism. The resonant scattering results from photon absorption by an atom, followed by emission. The upper line level is reached and populated, and the reemission is frequency incoherent with respect to the absorption, but they remain both in the line core. Atom and radiation are fully coupled, the state of the one being able to provide the state of the other one. Alternatively, in the Rayleigh or Raman scattering, the light rebounds on the atom, coherently in frequency. The upper level is not populated, and a virtual level is reached instead. Atom and radiation are then decoupled. This scattering is the one of the line far wings. This was already described in a quantum formalism by Omont, Smith and Cooper (1972, 1973), but for a 2-level atom and in terms of scattering amplitudes. We will present a new formulation able of a multilevel atom, i.e. by including resolution of the statistical equilibrium equations of the atomic density matrix elements. The radiative transfer equation coefficients are also derived. As the density matrix elements are developed on the basis of Zeeman substates, including the off-diagonal elements usually called coherences, the formalism is able of polarization and Hanle effect. Numerical application to the formation of polarization of the sodium D lines observed near the solar limb will be presented. This application includes resolution of the statistical equilibrium equations and integration of the radiative transfer equation.

Invited Lecture

BINARITY IN AGN AND MICROQUASARS

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There are many similarities between micro-quasars and active galactic nuclei (AGN). Both populations show strong emission in all parts of the spectrum, various kinds of activities, outflows, jets and flare-like behaviour. Since all known micro-quasars are found in binary systems, there is an open question whether binarity can produce similar characteristics and behaviour of some AGN.

Poster

SEARCHING FOR A BBH SIGNATURE IN QUASAR SPECTRA: A 4DE1 PERSPECTIVE

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The search for evidence of binary (or multiple) black holes in quasars has become a hot topic. There is a general expectation that quasars grow by accretion and merging, so multiple BH are expected unless an newly arrived BH is quickly eaten by its host. We search for BBH in the context of the 4D Eigenvector formalism which has identified two quasar populations A and B. We test whether variability patterns may support the presence of more than one BH in Population B quasars sources which represent almost 50BH may be associated with all or many of the unusual properties of these sources (very-broad multicomponent Balmer line profiles, weak FeII emission, absences of soft X-ray excess/CIV blueshift, flux variability and frequent radio-loudness).

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Invited Lecture

OPTICAL EMISSION OF HELIUM CRYOPLASMA

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Fluorescence spectroscopy is a powerful tool for obtaining information on microscopic processes taking place in non-equilibrium discharge plasma produced within a dense medium such as high pressure supercritical gas or even liquids. Spectroscopic analysis of light emitted from the ionization zone near the discharge tip electrode can be used to interrogate the local environment around the emitting atoms and molecules. The observed spectral features are sensitive to the dynamic processes taking place during the emission, which makes fluorescence spectroscopy a powerful tool for studying cold nonequilibrium plasmas as a function of pressure and the temperature. In this work, we have measured the current-voltage characteristics and spectral composition of helium cryoplasma initiated by corona discharge in gaseous and liquid helium. The experiments were carried out at a number of fixed temperatures from 300 K down to 4.2 K and pressures varying from 0.1 to 10 MPa, which cover a wide range of helium densities ranging from *ca.* 10^{19} cm^{-3} (gas) up to 2×10^{22} cm^{-3} (liquid).

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Progress Report

GRAVITATIONAL REDSHIFT OF EMISSION LINES IN THE AGN SPECTRA

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Monitoring campaigns permit to study the variabilities in line profiles, including their shifts, widths and fluxes, and therefore to analyse the evolution and structure of galaxies, masses of their central super massive black hole (SMBH), possibility for the binary core, orbital elements of the SMBH path, and many more. Root mean square (rms) profile represent the measure of the variable component of the line profile. Analysing the rms profile can give the information on the SMBH mass, either from reverberation mapping, that gives geometry and inclination dependent virial mass or from the redshift of the variable broad component of the optical emission line in respect to the mean line profile, that can give independent mass of the central black hole. Using these two independent methods for mass estimating, one can derive the inclination angle of the central accretion disk. The detection of the gravitational redshifted emission lines is reported just in a few active galaxies. Here we give a short overview on the studies where the detection of the gravitation redshift has been noticed.

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Invited Lecture

HYBRID MODIFIED GRAVITY AROUND MASSIVE COMPACT OBJECTS

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We investigate the possibility to explain theoretically the stellar motion around the massive compact object using gravitational potentials derived from extended gravity models, but in absence of dark matter. Our aim is to explain galactic and extragalactic dynamics without introducing dark matter. We make the comparisons between the simulated orbits in hybrid modified gravity and astronomical observations. Our simulations resulted in strong constraints on the range of hybrid modified gravity interaction. Also, we show that the hybrid modified gravity potential induces precession of S2 star orbit in the same direction as General Relativity (GR) like in Sanders potential, but with value which is much closer to GR. The future observations with advanced facilities, such as GRAVITY or/and European Extremely Large Telescope, are needed in order to verify these claims.

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Invited Lecture

$f(R)$ GRAVITY AND DYNAMICS OF STELLAR SYSTEMS

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$f(R)$ modified gravity has been shown to successfully fit rotation curves of spiral galaxies without need for a dark matter. Here we study whether this type of modified gravity, especially its power-law version - R^n, is also able to reproduce the stellar dynamics in elliptical galaxies. For that purpose we investigate the possible connection between the parameters of fundamental plane equation (effective radius, central velocity dispersion and mean surface brightness within the effective radius) and those of gravity potential in the case of R^n gravity (characteristic length scale and dimensionless universal constant). For that purpose we compared theoretical predictions for circular velocity in R^n gravity with the corresponding values from the large sample of observed elliptical galaxies. The obtained results indicate that this type of gravity can successfully fit the observed central velocity dispersion of elliptical galaxies, as well as the existence of correlation between their effective radii and characteristic length scale of R^n gravity.

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Invited Lecture

USE OF STARK EFFECT FOR MEASUREMENT OF MACROSCOPIC ELECTRIC FIELD IN LABORATORY PLASMAS

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The emission spectroscopy methods for measuring the macroscopic electric field in laboratory plasma are presented. The occurrence of macroscopic electric filed is a consequence of space charge build up. It is a common feature of discharge sheaths, streamer heads, double layers and can also be found in astrophysical plasma. The methods are based on polarization-dependent Stark splitting and shifting of atomic lines in the presence of a relatively strong electric field. First group of methods is based on Stark effect of hydrogen beta and alpha line. Second group of methods is based on Stark splitting and shifting of several helium lines and their forbidden counterparts. Line fitting procedures were developed that take into account components of a given atomic transitions, provide higher accuracy compared to simple evaluation and enable measurements of lower field values. The shift calculations and fitting procedures were experimentally tested and verified by measuring the field distribution in the cathode fall of a low pressure glow discharge. These methods were then applied as experimental tools in various types of discharges by taking into account specific line broadening processes. Due to their *ab initio* basis the Stark methods can be used for measuring electric field spatiotemporal distributions in diverse plasmas, independently of other plasma parameters and fulfillment of special conditions.

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Poster

FROM QUASARS TO STARS SIMILAR PHENOMENA IN THE SPECTRA OF QUASARS AND HOT EMISSION STARS

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It is well known that in the spectra of hot emission stars (Oe and Be stars) and AGNs we can detect many similarities, such as the very broad and complex profiles and/or the existence of more than one components of some spectral lines.

These effects in both astronomical objects have different origin but are created by similar physical mechanisms that produce the same results, but in different scale. In the case of AGNs these phenomena are mentioned as Broad Absorption Lines (BALs) and Broad Emission Lines (BELs), while in the case of hot emission stars they are called Discrete Absorption Components (DACs) and Satellite Absorption Components (SACs).

In this paper we analyze these similarities and the causes of their common origin and we recommend a method for their common treatment.

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Poster

3C 57, A REJUVENATED QSO

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We present new optical/UV spectroscopic measurements and radio data for the atypical Radio Loud (RL) quasar 3C 57. It is unambiguously RL (log $L_{1415MHz}$ 34,4 erg s^{-1} Hz^{-1} and log R_K 3.0) but falls in the region of the 4DE1 optical plane where almost all the sources are radio quiet (RQ). Our studies confirm hat 3C 57 shows extreme population A optical properties: strong optical FeII emission (RFeII 1) and large CIVλ1549 blueshift -1500 km s^{-1}. It shows an estimated Eddington ratio (log L/L_Edd -0.26) typical of population A quasars and higher than the majority of RL quasars. New radio measures show no evidence for flux change and are consistent with the observed compact steep-spectrum (CSS) SED with a young Lobe-dominated morphology. We suggest that 3C 57 is an evolved RL quasar (i.e. large Black Hole mass) undergoing a rejuvenation likely reflecting a major accretion event. This causes it to show properties typical of the opposite end of the 4DE1 main sequence (higher BLR density, metallicity and accretion disk wind) where younger quasars are found. The CIV wind is either too strong to be disrupted or the new radio outburst is so recent that this disruption has not yet occurred.

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Invited Lecture

DWARF SEYFERT GALAXIES WITH GIANT BROAD LINE REGIONS

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In this invited lecture I will review *Hubble Space Telescope (HST)* spectroscopy of a remarkable popu-lation of dwarf Seyferts with an unusually large broad-line region (BLR). These objects were first identified by Wang & Zhang (2003), and represent a new class of active galactic nuclei (AGN) that have yet to be recognised as such by the astrophysics community. Broad emission lines are a defining characteristic of AGN (Seyfert 1943). They occur in AGNs spanning seven decades in luminosity, from the lowest luminosity Seyferts (Ho et al. 1997) to the highest luminosity quasars. Models proposed to explain the origin of the broad emission lines have one feature in common; fast moving, $\sim$ 5000 km/s, hydrogen gas, located within light-days of a central supermassive black hole (BH, Rees 1977). The models differ only in how the gas achieves its high velocity, be it through inow, outow, spinning in a disk, or attached to stars orbiting close to the BH. Identifying the mechanisms that produce broad emission lines is of paramount importance as only then will we finally be able to understand, and exploit, the physics of the small and as yet, spatially unresolved BLR in AGN. The purpose of this lecture is to highlight an important subset of low luminosity AGNs that are associated with unusually wide Balmer emission lines. These so called dwarf Seyferts (Ho et al. 1997) are remarkable because the width of the Balmer emission lines can, in some cases, rival those seen in the most luminous quasars. Thus, the line widths in these dwarf Seyferts are inconsistent with a simple extrapolation of the BLR size-luminosity relation established by Kaspi et al. (2005) for more luminous AGNs. Rarely does such an obvious dichotomy occur in astronomy, and the result points to a whole new class of AGN. Close inspection with HST reveals emission lines with single peaks, double peaks, and a combination of the two suggesting that the broad emission lines are produced in kinematically distinct regions centered on the BH. Since the gravitational field strength is already known for these objects, by virtue of knowing their BH mass, the relationship between velocity, and radius may be established, given a kinematic model for the BLR gas. In this way, one can determine the inner, and outer radii of the BLRs by modeling the shape of their broad emission line profiles. A remarkable result is the enormous size of the BLRs in some of these dwarf Seyferts. For example, the size inferred for the BLR in the dwarf Seyfert M81 corresponds to an outer radius $\sim$ 1 pc, which rivals the size of the BLR in the luminous quasar, 3C 273, as reported previously by Devereux & Shearer (2007). High quality spectra obtained with the Space Telescope Imaging

Spectrograph will be presented for M81, NGC 3998, NGC 4203, NGC 3227, NGC 4051, and NGC 3516 enabling a determination of the size, structure, and ionization of the BLR in these dwarf Seyfert galaxies.

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Invited Lecture

FROM I YUGOSLAV CONFERENCE ON SPECTRAL LINE SHAPES (YuCSLS) TO X SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS (SCSLSA)

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The 1st Yugoslav Conference on Spectral Line Shapes - I YuCSLS, has been organized by Astronomical Observatory in Krivaja, 11 - 14, September, 1995, with the idea to have a conference on this topic here, in Serbia, in the years where there is no International Conference on Spectral Line Shapes (ICSLS), and to give possibility to young researchers to present their results and to discuss with leading international scientists in this field. The II YuCSLS was organized by Faculty of Physics in Bela Crkva, 29. September - 2. October, 1997, and the third by the Novi Sad Faculty of Sciences in Brankovac, Fruška Gora, 4 - 6, October, 1999. Procceedings of the first and second YuCSLS are published in Publications of Astronomical Observatory of Belgrade No. 50 and 57, and of the third in Journal of Research in Physics (Vol. 28, No. 3). The fourth conference has not been organized in 2001 due to different reasons and all later conferences were organized by Astronomical Observatory. The fourth, which changed name in Serbian Conference on Spectral Line Shapes (SCSLS), was in Arandjelovac, 10 - 15, October, 2003, and Procceedings are published in Publ. Astron. Obs. Belgrade No. 76. After this conference we realized that the principal group interested for this series of conferences are astronomers, so that we added "Astrophysics" to the conference name. The V SCSLSA was in Vršac, 6 - 10, June, 2005), and Procceedings are published in Memorie della Societa Astronomica Italiana Supplementi Vol. 7, VI SCSLSA was in Sremski Karlovci, 11 - 15, June, 2007 (Procceedings in AIP Conference Proceedings, Vol. 938), VII SCSLSA in Zrenjanin, 15 - 19, June, 2009 (Procceedings in New Astronomy Reviews, Vol. 53, Issues 7-10), VIII SCSLSA in Divčibare, 6 - 10, June, 2011, (Procceedings in Baltic Astronomy vol. 20, no. 3-4, and Procceedings of the special session "Spectral Lines and Black Holes" in New Astronomy Reviews, Vol. 56, Issues 2-3), and IX SCSLSA in Banja Koviljača, 13 - 17 May, 2013 (Selected papers published in the special issue Advances in Space Research: "SpectralLine Shapes in Astrophysics and Related Phenomena", Vol. 54, Issue 7),

The history of SCSLSA conferences will be presented and discussed here.

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Invited Lecture

STARK BROADENING IN PRE WHITE DWARFS, WHITE DWARFS AND NEUTRON STARS

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As the difference with plasmas in laboratory, plasma conditions in astronomy are more various, and Stark broadening may be of interest for incomparably wider interval of temperatures and electron densities. For example it may be important for interstellar molecular clouds, where typical electron temperatures are around 30 K or smaller, and typical electron densities 2-15 cm-3, or for neutron star atmospheres with temperatures of T=10^6 -10^7 K, and electron densities of 10^{22} - 10^{24} cm^{-3}.

Plasma conditions particularly favorable for Stark broadening are in white dwarf- and pre white dwarf - atmospheres, where this broadening mechanism is dominant. For example in hot hydrogen-deficient pre-white dwarf stars T_{eff} = 75 000 K - 180 000 K and log g = 5.5-8.0, Stark broadening is usually dominant line broadening mechanism in comparison with thermal Doppler broadening, as well as for DO white dwarfs, and for much cooler DA and DB, with typical effective temperatures of 10 000 K - 20 000 K. This is also the case for neutron star atmospheres.

In this review, we will consider Stark broadening of non hydrogenic spectral lines in the impact approximation in pre-white dwarf, white dwarf, and neutron star atmospheres and the corresponding results obtained by members of the Group for Astrophysical Spectroscopy on Belgrade Astronomical Observatory, and their partners from France, Tunisia, Bulgaria, Russia and Canada. Additionally, we will present new results fot the Stark widths and shifts for Xe VI spectral lines, of interest for such plasmas investigations, obtained within the semiclassdical perturbation approach. The obtained Stark broadening parameters, needed for analysis and modelling of the corresponding stellar atmospheres enter in the STARK-B database (http://stark-b.obspm.fr/), where our results of such calculations are included. The database STARK-B enters in the new search facility for such data, Virtual Atomic and Molecular Data Center (VAMDC - http://vamdc.org/) and also has a link in Serbian Virtual Observatory (SerVO - http://servo.aob.rs/).

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Poster

ON THE STARK BROADENING OF NEUTRAL NEON SPECTRAL LINES FOR STELLAR PLASMA RESEARCH

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Stark broadening parameters for 25 spectral lines of neutral neon broadened by collisions with electrons, protons and ionized helium, needed for investigation and modelling of stellar plasma, have been calculated by using the semiclassical perturbation method. The obtained data have been used for consideration of the Stark broadening of Ne I spectral lines in atmospheres of white dwarfs and 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.eu/).

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Poster

STARK BROADENING OF Xe VIII SPECTRAL LINES IN WHITE DWARFS

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Within the semiclassical perturbation approach, using the impact approximation, we have determined theoretically Stark broadening parameters in function of temperature and perturber density for 60 Xe VIII multiplets and particular spectral lines when it is necessary. In addition to electron-impact full halfwidths and shifts, Stark broadening parameters due to proton-, and doubly charged helium ion-impacts have been calculated, in order to provide Stark broadening data for the important charged perturbers in stellar atmospheres. Stark broadening data for Xe VIII are of interest for the problem of investigation of atomic processes at electromagnetically driven strong shock waves. Moreover, such data are of interest and for plasma modelling and determination of chemical abundance of xenon, in white dwarfs, where lines of highly ionized Xe have been observed. The obtained results are also of interest for virtual observatories and will be included in the database STARK-B (http://stark-b.obspm.fr/) and Virtual Atomic and Molecular Data Center VAMDC (VAMDC - http://www.vamdc.eu/).

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Invited Lecture

HOW DO SPECTRAL LINE SHAPES GET ALONG WITH ACCRETING BLACK HOLES?

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I investigate the appearance of spectral lines emitted by accreting black hole systems at different wavebands. The talk presents selected observations and modeling results linking the profile and time evolution of spectral emission and absorption lines to the accretion and ejection paradigm in active galactic nuclei and black hole X-ray binaries. I focus, in particular, on the velocity information contained in the line profile and I investigate agreements and possible contradictions of line observations across different wavebands. Conclusions are drawn on for the flow geometry and dynamics we expect around accreting black holes.

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Poster

DETERMINISTIC CHAOS IN THE X-RAY SOURCES

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The temperature in the hottest parts of the black hole binaries accretion disks often exceeds 10^7 K. Hence we can expect thermal X-Ray emission from disk with power at the order of $10^{37} - 10^{38}$ ergs per seconds. The material in the disk is heated due to turbulent viscous dissipation.

Hardly any of the observed black hole accretion disks exhibits the radiation flux being constant with time. When the local stochastic variations of the disk are correlated with its global structure and occur at specific regions where a resonant behaviour takes place, the coherent vatiations are known as the apperance of quasi-periodic oscillations (QPOs)

Our aim is to tackle a problem of stochastic versus deterministic nature of the black hole binaries radiation, using both the observations and analytical methods.

We explore the ability of the recurrence analysis, a powerful tool for time series analysis used in broad field of application ranging from economy to geophysics or medicine, to reveal important information about the BHXBs, especially to find traces of non-linear, possibly choatic behaviour, on the basis of their X-ray light curves. We study the occurence of long diagonal lines in the recurrence plot of observed data series and compare it to the surrogate series. Especially we follow the dependence of the lenght of the longest diagonal line on the used threshold and compare the estimates of dynamical invariants - e.g. the second order Renyis entropy K_2. We compare our methods and results with similar approaches published on this topic earlier.

For our work, we use the X-Ray data from six X-Ray binaries, in which the radiation pressure instability is considered to occur. These objects are GRS 1915, IGR J17091, GRO 1655-40, XTE J1650-500, XTE J1500-564 and GX 339-4. We extract the time series using *XSELECT*, which is a part of *Heasoft 6.16* high energy astrophysics software package. We adjust the proper binning time to minimize the error and simultanously to not lose the information about oscillations at the scale of several seconds or several tens of seconds.

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Poster

SIMULATION CALCULATIONS OF LINE SHAPES IN PRESENCE OF LANGMUIR TURBULENCE

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An atom immersed in a plasma affected by strong Langmuir turbulence may be perturbed by a sequence of wave packets with a maximum electric field amplitude large compared to the equilibrium plasma microfield (R. Stamm et al., this volume). For such conditions, we propose to calculate the line shape of Lyman alpha with a numerical integration of the Schroedinger equation coupled to a simulation of a sequence of electric fields modeling the effects of the wave packets. Several line profiles will be presented for different maximum amplitude and jumping frequency of the sequence of wave packets.

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Progress Report

LINE SHAPE VARIABILITY IN A SAMPLE OF AGN WITH BROAD LINES

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The spectral variability of active galactic nuclei (AGN) is one of their key features that enables us to study in more details the structure of AGN emitting regions. Especially, the broad line profiles, that vary both in flux and shape, give us invaluable information about the kinematics and geometry of the broad line region (BLR) where these lines are originating from.

We present here the analysis of the line shape variability of a sample of AGN having broad emission lines in their spectra (so called type 1 AGN). The data are taken from the long-term optical monitoring campaign performed with telescopes of SAO (Russia), INAOE and OAN-SPM (Mexico). The main aim is to study the physics and kinematics of the BLR, focusing on the problems of the photoionization heating of the BLR and its geometry.

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Poster

THE METHOD FOR MAPPING ELECTRIC FIELD DISTRIBUTION IN CATHODE FALL REGION OF AN ABNORMAL GLOW DISCHARGE USING NEUTRAL NEON SPECTRAL LINE SHAPES

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The line shapes of several weak and very weak Ar I and Ne I spectral line in spectral range from 500 nm to 550 nm have been recently studied in an abnormal glow discharge of Grimm type (Majstorović *et al.* 2013, Šišović *et al.* 2014). Spectral lines were observed along the axis of a cylindrical glow discharge parallel (side-on) and perpendicular (end-on) to the cathode surface. The end-on recorded line profiles showed not only up to 30negative glow, but also wavy features at the far wings. The phenomena observed in end-on line shapes in Grimm type glow discharge are related quantitatively to dc Stark effect in the cathode fall region and plasma line broadening in negative glow region. Namely, the side-on spectra showed spectral line shifting and sometimes simultaneous shifting and splitting in the cathode fall region of the glow discharge. The results of the measured line shift with available data for the dc Stark effect may be used for estimate electric field strength in the cathode fall region of the glow discharge. The method for mapping electric field distribution in cathode fall region of an abnormal glow discharge will be demonstrated using profiles of spectral line Ne I 534.109 nm.

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Astronomical Observatory, Belgrade, 2015

Progress Report

MOL-D A COLLISIONAL DATABASE REPOSITORY AND WEB SERVICE WITHIN THE VIRTUAL ATOMIC AND MOLECULAR DATA CENTER

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We present a report on the development of the Belgrade MOL-D database a repository of cross-sections and rate coefficients for specific collisional processes and a web service within the Virtual Atomic and Molecular Data Center (VAMDC, http://www.vamdc.org) and the Serbian Virtual Observatory (SerVO, http://servo.aob.rs). MOL-D database covers photo-dissociation cross-sections for the individual ro-vibrational states of the diatomic molecular ions and rate coefficients for the atom-Rydberg atom chemi-ionization and inverse electron-ion-atom chemi-recombination processes. For the moment it contains data for photodissociation cross-sections of hydrogen H_2^+ and helium He_2^+ molecular ions and the corresponding average thermal photodissociation cross-sections for the relevant temperature range. The importance of such data is highlighted by its use in hydrogen and helium laboratory plasmas research as well as for elaboration of atmosphere models of solar, near solar type stars and helium-rich white dwarf atmospheres. The MOL-D database is e-service making more available to scientific community our results of the investigation of above described collisions processes and this database can be accessed directly at http://servo.aob.rs/mold or through VAMDC portal.

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Progress Report

BLACK HOLE MASS ESTIMATES USING GRAVITATIONAL REDSHIFT OF BROAD EMISSION LINES IN ACTIVE GALACTIC NUCLEI

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Here we present results of black hole mass estimates using gravitational redshift for a sample of 285 type 1 Active Galactic Nuclei (AGN) selected from the Sloan Digital Sky Survey database. The shifts are measured as a difference between the centroids at 5% and 95% of the H_β and Mg II broad line intensities. Obtained masses have been compared with ones estimated from wide accepted virial method (using widths of H_β and Mg II broad lines). We discuss the possibility to use the gravitational redshift for black hole mass estimations in AGN and validity of virialization assumption in the AGN broad lines.

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Invited Lecture

LINE SHIFT IN ACCRETION DISKS - THE CASE OF Fe Kα

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A broad emission line Fe Kα at 6.4 keV has been observed in a number of type 1 Active Galactic Nuclei (AGN), and in most cases its width corresponds to the velocities on the order of tens of thousands kms^{-1}, reaching sometimes even one third of speed of light. Therefore, the line is most likely produced in a very compact innermost region of accretion disk around a central supermassive black hole (SMBH), where the emitting material rotates with relativistic velocities. In addition to its large width due to kinematic effects, another interesting feature of the Fe Kα line is its asymmetric profile with two peaks - a narrow bright blue one and a wide faint red one. Such profile is most likely a result of combination of the following effects: classical Doppler shift (responsible for occurrence of two peaks), special relativistic transverse Doppler shift and Doppler beaming (responsible for much brighter blue peak in respect to the red one), as well as general relativistic gravitational redshift (responsible for smearing the "blue" emission into the "red" one). Besides, in case of SMBH binaries, their Fe Kα line emission could arise from both accretion disks around primary and secondary SMBHs, and hence, the corresponding observed line profiles could be affected by Doppler shifts due to radial velocities of the components in such a binary system. Here we present a short overview and main results of our investigations of the Fe Kα line emission from relativistic accretion disks around single and binary SMBHs, obtained by numerical simulations based on ray-tracing method in Kerr metric. According to these results, both Doppler and gravitational shifts could have significant influence on the profile of the broad Fe Kα line.

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Poster

COMPARATIVE ANALYSIS OF VLF SIGNAL VARIATION ALONG TRAJECTORY INDUCED BY X-RAY SOLAR FLARES

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Comparative qualitative analysis of amplitude and phase delay variations along trajectory of GQD/22.1 kHz and NAA/24.0 kHz VLF signal traces, propagating from Skelton (UK) and Maine (USA) toward Belgrade, induced by four isolated solar X-ray flare events occurred during period from September 2005 to December 2006, was carried out. For monitoring, recording and for storage of VLF data at the Institute of Physics in Belgrade, Serbia, the AbsPAL system was used. For the modeling purposes of propagating conditions along GQD and NAA signal propagation paths, LWPCv21 program code was used. Occurred solar flare events induced lower ionosphere electron density height profile changes, causing perturbations in VLF wave propagation within Earth-ionosphere waveguides. As analyzed VLF signals characterize by different propagation parameters along trajectories from their transmitters to the Belgrade receiver site, their propagation is affected in different way for different solar flare events and even in different way for the same solar flare events.

Poster

EXPLORING IRREGULAR BIVARIATE AGN TIME SERIES

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Variations in continuum and line light curves of AGN may be correlated with time lags associated with some processes in the broad line region. However time delay calculations are technically challenged in three ways: (i) datasets are heterogeneously sampled in time and (ii) space (observatories), and (iii) time is a variable that needs to be reconstructed which introduces additional uncertainties. Practical aspects of application of Gaussian-kernel based estimators of statistical dependecies of such time series is demonstrated on several AGNs datasets.

Progress Report

DIFFERENCES BETWEEN THE UV AND OPTICAL Fe II EMISSION LINES IN THE SPECTRA OF THE AGNs TYPE 1

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We investigate the spectral properties of the Fe II emission lines in the UV ($\lambda\lambda$ 2650-3050 Å) and optical ($\lambda\lambda$ 4000-5500 Å) range in a sample of 293 type 1 AGNs from SDSS database (DR7). Different correlations between the UV and optical Fe II emission lines are explored, as well as between them and other emission lines from the considered spectral ranges. We examine the kinematical properties of the UV and optical Fe II lines and found that their emission regions are probably located close to each other in the AGN structure. The large average systemic redshift found for the UV Fe II lines could imply that UV emission region is asymmetric. We also point out the several correlations which are specific for the optical Fe II lines, and which are not seen for the UV Fe II lines. We try to explain them with possible influence of the starburst activity in one phase of the AGN evolution.

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Progress Report

SPECTROSCOPIC OBSERVATIONS OF UNDETERMINED TYPE γ-RAY ACTIVE GALACTIC NUCLEI

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During its first four years of operations, the *Fermi Large Area Telescope* (*Fermi/LAT*) detected 3033 γ-ray sources above a 4σ significance level. Although most of the extra-Galactic sources are active galactic nuclei (AGN) of the *blazar* class, other families of AGNs are observed too, while a still high fraction of detections ($\sim 30\%$) remains with uncertain association or classification. According to the currently accepted interpretation, the AGN γ-ray emission arises from inverse Compton (IC) scattering of low energy photons by relativistic particles confined in a jet that, in the case of blazars, is oriented very close to our line of sight. Taking advantage of observations carried out at radio and X-ray wavelengths, which provide a much better source localization potential, we focussed our attention on the extra-Galactic γ-ray sources of still undetermined type, starting a campaign of optical spectroscopic observations. The main aims of our investigation include a census of the AGN families that contribute to γ-ray emission and a study of their redshift distribution, with the subsequent implications on the intrinsic source power. We furthermore analyze which γ-ray properties can better constrain the nature of the source, thus helping in the study of objects not yet associated with a reliable low frequency counterpart. In this communication we report on the instruments and techniques used to identify the optical counterparts of γ-ray sources, we give an overview on the status of our work, and we discuss the implications of a large scale study of γ-ray emitting AGNs.

Poster

ANSWERS TO SOME IMPORTANT QUESTIONS ON THE USE OF GR MODEL

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After a decade of using the GR model (Gauss-Rotation model) many interesting questions have been arisen concerning the physics and the mathematical expression of the model, as well as the exact number of components that are required to reproduce the complex absorption and emission profiles and the uniqueness of the calculated values of the parameters (kinematical parameters, the optical depth the Full Width at Half Maximum (FWHM), the column density and the absorbed or emitted energy), which are calculated with this method. In this paper we try to answer some of these basic questions.

Poster

ON THE STARK BROADENING OF Lu III SPECTRAL LINES

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The electron-impact widths for six Lu III spectral lines have been calculated by using the modified semiempirical method. With obtained results, the influence of Stark broadening on Lu III lines has been investigated in the spectra of A-type stars.

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Poster

OBSERVATIONS OF THE Ca II IR TRIPLET IN HIGH LUMINOSITY QUASARS: EXPANDING THE SAMPLE

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We present spectroscopic observations of 10 quasars at intermediate redshift obtained with the Infrared Spectrometer and Array Camera (ISAAC) on the ESO Very Large Telescope, covering the region of OI 8446 and the CaII triplet 8498, 8542, 8662. The new observations almost double the size of the sample described in Martinez-Aldama et al. (2015) that contained almost all CaII observations previously available for intermediate z quasar. The new spectra cover CaII in one of the relatively rare, extreme Population A quasars, and allow for a more refined and statistically significant discussion on low-ionization line formation and recent episodes of star formation in intermediate redshift quasars.

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Invited Lecture

THE MOST POWERFUL QUASARS OUTFLOWS AS SEEN FROM THE CIV λ1549 RESONANCE LINE

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Outflows from quasars may be almost ubiquitous, but there are significant differences on a source-by-source basis. These differences can be organised along the so-called Eigenvector 1 sequence: at low z, only the so-called Population A sources radiating at relatively high Eddington ratio show evidences of prominent high-velocity outflows from the CIV λ1549 line profiles. As the redshift increases and the luminosity of the brightest quasars grows, powerful, high-velocity outflows may become more frequent. Here we discuss, starting from recent observations of high-luminosity sample of Hamburg-ESO quasars, the CIV 1549 emission line profiles and how they are affected by outflow motion. Our sample has the notable advantage that the rest frame has been accurately set by previous Hβ observations in the J, H, and K band, therefore making measurements of inter-line shift accurate and free of systemic biases. We consider cases of extreme sources among Pop. A which are believed to be accreting super Eddington, and whose Eddington ratio may converge toward a limiting value. We then discuss their relevance for a physically-based, Eigenvector 1-oriented definition of "Narrow Line Seyfert 1" sources, and for understanding the so-called Weak Lined Quasars (WLQ) that have emerged in recent years as a new, poorly understood class of quasars.

Progress Report

BLUE OUTLIERS AMONG HIGH REDSHIFT QUASARS

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Several sources qualify as "blue outliers" (i.e., quasars whose [OIII] $\lambda\lambda$4959,5007 lines show large systematic blueshifts with respect to rest frame) in a sample of 50 high luminosity Hamburg-ESO quasars. The prevalence of the "blue outliers" – that are suggestive of a fully outflowing narrow line region – appears to be much larger at intermediate z and high luminosity than at low z and at low luminosity. We discuss major findings on what has become a small but intriguing niche field in active galactic nuclei research, and stress the relevance of "blue outliers" and of outflows deduced from the [OIII] $\lambda\lambda$4959,5007 line profile shifts for feedback and host galaxy evolution.

Invited Lecture

APPLICATIONS OF CAUSTIC CROSSING COUNTS TO THE STUDY OF LENSED QUASARS

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The light curves of lensed quasars keep information about the size and structure of quasars accretion disks, specially at high magnification events (HME) related to caustic crossing. However, the width of an HME is also related to the effective transverse velocity of the lens galaxy. We use an estimate of the lens galaxy velocity obtained from the caustic crossing rate in the lensed quasar Q 2237+0305 to infer some properties of its accretion disk from the profile of a typical HME.

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Poster

THE INVERSE BREMSSTRAHLUNG IN ASTROPHYSICAL PLASMAS: THE ABSORPTION COEFFICIENTS AND GAUNT FACTORS

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The electron-ion inverse Bremsstrahlung is considered here as a factor of the influence on the opacity of the different stellar atmospheres and other astrophysical plasmas. It is shown that this process can be successfully described in the frames of cut-off Coulomb potential model within the regions of the electron densities and temperatures. The relevant quantum mechanical method of the calculation of the corresponding spectral coefficient processes is described and discussed. The results obtained for the plasmas with the electron densities from 10^{14}cm^{-3} to 10^{20}cm^{-3} and temperatures from $5 \cdot 10^3\text{K}$ to $3 \cdot 10^4\text{K}$ in the wavelength region $200\text{nm} < \lambda < 500\text{nm}$ are presented. Also, these results can be of interest for different laboratory plasmas.

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Invited Lecture

NON-ELASTIC PROCESSES IN ATOM - RYDBERG ATOM COLLISIONS: REVIEW OF STATE OF ART AND PROBLEMS

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In our previous research has been demonstrated that such inelastic processes in atom Rydberg-atom collisions, as chemi-ionization and (n-n') mixing, should be considered together. Here will be reviewed the present state of art and the actual problems will be discussed. In this context will be considered the influence of the (n-n') mixing during a symmetric atom Rydberg-atom collision processes on the intensity of chemi-ionization process. It will be taken into account H(1s) + H*(n) and He($1s^2$) + He*(n) collisional systems, where the principal quantum number n >> 1, as well as A + A*(n) systems, where A denotes one of the alkali metal atoms. It will be demonstrated that the inclusion of (n-n') mixing in the calculation, influences significantly on the values of chemi-ionization rate coefficients, particularly in the lower part of the block of the Rydberg states. Different possible channels of the (n-n') mixing influence on chemi-ionization rate coefficients will be demonstrated. The possibility of interpretation of the (n-n') mixing influence will be considered on the basis of two existing methods for describing of the inelastic processes in symmetrical atom Rydberg-atom collisions.

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Poster

SPECTROSCOPING MONITORING OF AGN AT ROZHEN OBSERVATORY

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We started a program to monitor spectroscopically seleted Type I AGN. The objects are mostly bright and nearby but in the same time – rarely studied. Our goal is mostly twofold: First to study the emission line profile hanges and secondly – to identify suitable for reverberation mapping ampaigns objects. For the later objective, we conduct also a broadband photometric study to reveal the most variable objects. In this poster we present our first results.

Poster

PHOTOIONIZATION ESTIMATES OF BROAD LINE REGION SIZE IN HIGH REDSHIFT QUASARS

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We use a "photoionization method" to estimate the radius of the broad line region ($r_{\rm BLR}$) for eight quasars at $z \sim 3$ using high S/N UV spectra obtained with VLT/FORS. The spectra enable us to analyze in detail the emission features in the rest-frame range 1300-2000 Å (C III]λ1909, Si III]λ1892, Al IIIλ1860, Si IIλ1814, C IVλ1549 and blended Si IVλ1397+O IV]λ1402). Our photoionization method uses the flux ratios Al IIIλ1860/Si III]λ1892, C IVλ1549/Al IIIλ1860, Si IVλ1397+O IV]λ1402)/Si III]λ1892 and Si IVλ1397+O IV]λ1402)/C IVλ1549 to compute the product of ionization parameter and hydrogen number density, and hence the $r_{\rm BLR}$ from the definition of the ionization parameter itself. We compare our results with previous estimates obtained from the $r_{\rm BLR}$ – luminosity correlation customarily employed to estimate black hole masses of high redshift quasars.

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Invited Lecture

LINE PROFILES MASS MEASUREMENTS AND ACCRETION DISKS IN HIGH REDSHIFT AGN

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The fundamental problems in understanding active galactic nuclei (AGN) are related to the nature of their power house, the mass of their central black hole (BH), the spin of the BH, and the mass accretion rate. Most of these parameters can be inferred from spectroscopic observations albeit with large uncertainties. In this talk, I will present an unusual X-shooter/VLT spectroscopic sample of radio-quiet type-I AGN at $z \sim 1.55$ that can be used to derive BH mass from the study of the profiles of four different emission lines: Hα, Hβ, MgIIλ2798 and CIVλ1549. Moreover, the extremely wide wavelength range covered by the observations enables a first of its kind fitting of the spectral energy distribution (SED). This can be used to perform a meaningful test of the suggestion that most AGN are powered by thin or slim accretion disks and to measure the BH spin. The talk will attempt to combine all these new results into a coherent model of the central accretion disk, the surrounding broad emission line gas, and the dusty torus.

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Progress Report

CONTRIBUTION OF Lyα PHOTOIONIZATION TO IONIZATION RATE AND ELECTRON DENSITY CHANGES IN THE IONOSPHERIC D-REGION DISTURBED BY SOLAR X-FLARES

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Lyα radiation has a very important influence on ionization processes in the ionospheric D-region. Practically, it can be taken as the dominant ionization source at altitudes above 70 km during unperturbed conditions. However, sudden large radiation impacts in some other energy domains can significantly influence the ionization rate and, consequently, the rate of other chemical processes. Also, the contribution of various other ionization sources in the ionospheric plasma dynamics can be changed. In this paper, we present a study on contribution of Lyα radiation in the ionization rate and electron density changes when the ionosphere is disturbed by solar X-flares. We give relevant analytical expressions and perform calculations and numerical simulations using data collected by the VLF receiver located in Belgrade, Serbia, during the observation of the low ionosphere using the VLF signal emitted by the DHO transmitter in Germany.

Poster

VARIABILITY OF D-REGION PHOTOIONIZATION INDUCED BY Lyα RADIATION

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The solar Lyα line is one of the most important external influences on chemical processes in the lowest ionospheric layer so called D region. This radiation plays the dominant role in the ionization of the upper part of the D-region under unperturbed conditions. In this paper, we present some of variations in influences of the Lyα radiation on the considered atmospheric layer which are induced by motions of Earth and Moon. The changes in the low ionosphere are detected by the very low frequency signals used as a tool for ionospheric monitoring based on radio wave propagation along given trajectories and registration of time varying physical parameters. In this paper we analyze the 23.4 kHz signal emitted in Germany and recorded in Serbia.

Invited Lecture

LINE SHIFTS IN LABORATORY PLASMA

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Stark spectroscopy and polarization Stark spectroscopy of several types of plasmas produced by electrical discharges will be presented. Special attention will be paid on distinction between Stark shifts produced by charged plasma particles (micro-field) from Stark shifts produced by an electric field in the plasma sheaths region (macroscopic field).

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Invited Lecture

THE RADIO RECOMBINATION LINES OF HYDROGEN; RECENT DEVELOPMENTS

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At the previous conference in this series (SCSLSA9) new calculations were presented for the electron impact widths of the radio recombination lines of hydrogen (Peach 2014). These confirmed previous theoretical results so that a longstanding discrepancy between the observations (see Bell *et al.* 2011, Bell 2012), and theory remained unresolved. There has been some controversy concerning the analysis of the observations made by Bell *et al.* (2011), see Alexander and Gulyaev (2012, 2015), whose results agree qualitatively with the present theory. Therefore in the work to be presented here, the role of proton perturbers is reexamined in more detail using impact theory. This takes into account the fact that in treating the collision processes the masses of the hydrogen atom and its proton perturber are almost the same, see Hartmann, Boulet and Robert (2008).

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Poster

ATOMIC DATA FOR TRANSITIONS IN C I

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In the first part of this work, atomic data for neutral carbon (CI) lines have been calculated using the Cowan suite of atomic structure codes. The pseudo relativistic Hartree-Fock (HFR) approach is used in this suite of codes. The least-squares fitting, fourth code RCE have been used for the fitting of obtained energy levels values with the experimental ones (form NIST atomic database). Then re-run of the third code RCG with these fitted energy levels which gives better oscillator strengths values. The first 8 even configurations ($2s^2$ $2p^2$, $2s^2$ 2p 3p, $2s^2$ 2p 4p, $2s^2$ 2p 5p, $2s^2$ 2p 6p, $2s^2$ 2p 4f, $2s^2$ 2p 5f, $2s^2$ 2p 6f) and 9 odd configurations (2s $2p^3$, $2s^2$ 2p 3s, $2s^2$ 2p 4s, $2s^2$ 2p 5s, $2s^2$ 2p 6s, $2s^2$ 2p 3d, $2s^2$ 2p 4d, $2s^2$ 2p 5d, $2s^2$ 2p 6d) are used in our atomic model.

In the second part of this work, the Thomas-Fermi-Dirac-Amaldi (TFDA) potential have been applied using the AUTOSTRUCTURE code to have the energy levels and oscillator strengths for the CI lines.

The values obtained with these two codes have been compared with other theoretical and experimental ones.

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Poster

THE INTRINSIC BALDWIN EFFECT IN FIVE LONG TERM MONITORED AGNs

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We investigate the intrinsic Baldwin effect (Beff), a negative correlation between the equivalent widths of broad emission lines and the continuum luminosity, in five active galactic nuclei (AGNs): two Sy 1 (NGC 4151 and NGC 5548), two AGNs with double-peaked broad line profiles (3C390.3 and Arp 102B) and one narrow line Sy 1 – NLS1 (Ark 564). The AGNs have been monitored in a period of several years coverning high and low phases of the variability in the broad Hα/Hβ lines and continuum. We found that in all considered AGNs, for some periods, the intrinsic Beff is likely to be present. However, a significant intrinsic Beff can be detected only in NGC 4151 and the slope of the intrinsic Beff in this AGN is changing with time. To explore the nature of the Beff, additionally, using the photoionization code CLOUDY we modeled the broad line region (BLR) of NGC 4151 and found that the changing in the slope of the intrinsic Beff may caused by the distance of the ionized gas from the central continuum source.

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Progress Report

NewCompStar: EXPLORING FUNDAMENTAL PHYSICS WITH COMPACT STARS

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Compact stars, such as neutron stars, strange stars or hybrid stars, are unique laboratories that allow us to probe the building blocks of matter and their interactions at regimes that terrestrial laboratories cannot explore. These exceptional objects have already led to breakthrough discoveries in nuclear and subnuclear physics, QCD, general relativity and high-energy astrophysics. The upcoming generation of observatories and gravitational-wave detectors will continue to nurture innovative and fundamental discoveries complementary to those achieved through the nuclear and subnuclear experimental facilities. The MPNS COST Action MP1304 Exploring fundamental physics with compact stars (NewCompStar) will be presented. The Action was officially started on Nov. 25 2013 and represents the natural evolution of an ESF-funded RPN, CompStar. The new COST Action brings together the leading experts in astrophysics, nuclear physics and gravitational physics to address this fascinating but challenging research area through an interdisciplinary approach. In addition to an innovative and well-defined research agenda, the network will provide a dedicated training program for a new generation of scientists with wide-ranging expertise and multiple skills oriented also towards knowledge transfer and innovation.

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Poster

THE PRODUCTION OF STRONG BROAD He II EMISSION AFTER THE TIDAL DISRUPTION OF A MAIN-SEQUENCE STAR BY A SUPERMASSIVE BLACK HOLE

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The tidal disruption event (TDE) PS1-10jh lacked strong Balmer lines but showed strong, broad, He II emission both before maximum light and for at least 8 months thereafter. Gezari et al. (2012) interpreted this as evidence for the disruption of a rare hydrogen-deficient star. However, Guillochon et al. (2014) have argued instead that the disrupted star was a normal main-sequence star and that the strength of the He II emission compared with the Balmer lines is a result the emission being similar to the broad-line region (BLR) of an AGN, but lacking the outer, lower-ionization BLR gas. We show that the profile of He II λ4686 in PS1-10jh is similar to the blueshifted profiles of high-ionization lines in AGNs. The similarity of the He II λ4686 emission in PS1-10jh to the emission from the inner BLRs of AGNs supports the idea that the emission after a TDE event is similar to that of normal AGNs.

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Poster

RADIATIVE TRANSFER RECONSIDERED AS A QUANTUM KINETIC THEORY PROBLEM

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We revisit the radiative transfer theory from a first principles approach, inspired from the Bogoliubov-Born-Green-Kirkwood-Yvon (BBGKY) hierarchy of equations. The radiation field is described within the second quantization formalism. The density operator of the total (radiation-matter) system is expanded in a series involving correlations of successive orders between atoms. We focus on the lowest order in correlations and examine the role of coherence on the formation of spectral lines in optically thick media. As an illustration, we perform calculations of absorption lines in stellar atmosphere conditions. Emission lines in laboratory discharges (magnetic fusion) are also examined in a plasma diagnostic context. A link to partial frequency redistribution modeling is established.

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Invited Lecture

MODELING OF STARK-ZEEMAN LINES IN MAGNETIZED HYDROGEN PLASMAS

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We report on recent investigations of Stark-Zeeman hydrogen lines in magnetized plasmas motivated by controlled fusion research. In specific scenarios, the edge plasma in tokamak discharges involve a density sufficiently high (up to a few 10^{15} cm^{-3}) and a temperature sufficiently low (down to $T_e < 1$ eV) so that the hydrogen isotope lines routinely measured for diagnostic purposes are affected by Stark broadening and can be used as a probe of the electron density. An analysis of lines with a low principal quantum number such as Dα requires a careful treatment because the Stark broadening can be of the same order as the Doppler broadening and it can be affected by ion dynamics. Furthermore, the presence of a strong magnetic field (of the order of several teslas) results in an alteration of the energy level structure, which is not straightforward even for hydrogen due to the simultaneous action of the magnetic field and the plasma's microscopic electric field. In this work, we present models and discuss their applicability to the diagnostic of white dwarfs that are subject of an intense magnetic field. The influence of line reabsorption on the interpretation of spectra is also discussed.

Poster

THEORETICAL MODELLING OF POLARIZED BROAD LINE PROFILES OF AGN

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The scattering-induced, velocity-dependent polarization across broad emission lines in AGN may depend on radial and azimuthal motions in an inflow/outflow configuration. We used *STOKES* to compute an exploratory grid of models adjusted to the polarization observations of other Seyfert galaxies. We compared the modelled profile (especially polarization angle) with the observations given in Afanasiev and Popović (2015).

Progress Report

IGNITION AND LUNCHING THE LARGE SCALE GALACTIC WIND

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The phenomenon of a wind blown out by galaxies with a high level of star formation activity is known more than half a century, and the first numerical model of it has been performed 20 years ago. In spite of such a long history neither a good understanding of the phenomenon, nor even a satisfactory quantitative concordance between galactic winds on the sky and in theoretical and numerical models are reached yet, besides only a qualitative similarity of a generic picture. Among others, the most interesting and interesting issues yet obscured are: i) the drivers of the large-scale galactic winds and outflows, ii) the mass loss rates measured observationally and numerically, iii) the amount of x-ray emission from their cones as seen in observations and estimated numerically, iv) spatial distribution of continuum emission and emission/absorption in spectral lines. I will speak on how these issues have been recently addressed, and why we want to go ahead further

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Poster

CONTRIBUTION TO SED OF AGNs INDUCED BY POSSIBLE DENSITY PERTURBATIONS IN COMPLEX GEOMETRY OF BINARY SYSTEMS

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Here we test effects of emission from specific configurations of binary black hole systems, as a source of continuum flux variations of such objects. We consider that rotational motion of BHs in dense environment can induce density perturbation in form of a spiral arms extended from the BH disks. We compute the output of the binary BH emission considering the complex geometry which include the mini accretion disks around each BH and surrounding circumbinary disk.

Progress Report

LINE SHIFTS IN SUPER MASSIVE BINARY BLACK HOLES

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Here we discussed the line shifts that should be present in sub-parsec super-massive binary black holes (SMBBHs) where one or two of the components have a broad line region (BLR). Especially we discuss the possibility to use the line shift to detect an SMBBH. We present the results of our model, and find that the line shift and line shape are depending on dynamical parameters of an SMMBBH system.

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Invited Lecture

MEASURING THE SIZE OF THE BROAD LINE REGION IN QUASARS WITH MICROLENSING-AIDED REVERBERATION MAPPING

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Owing to the advent of large area photometric surveys, the possibility to use broad band photometric data, instead of spectra, to measure the size of the broad line region of active galactic nuclei, has raised a large interest. We will describe a new method using time-delay lensed quasars where one (or several) images are affected by microlensing due to stars in the lensing galaxy. Because microlensing decreases (or increases) the flux of the continuum compared to the broad line region, it changes the contrast between these two emission components. We show that this effect can be used to effectively disentangle the intrinsic variability of those two regions, offering the opportunity to perform reverberation mapping based on single band photometric data. Based on simulated light curves, we show that measurement of the size of the broad line region can be achieved using this method, provided one spectrum has been obtained independently during the monitoring. This method is complementary to photometric reverberation mapping and could also be extended to multi-band data.

Poster

MODELLING LUMINOSITY AND AREA FUNCTIONS OF LYMAN-ALPHA BLOBS

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Lyman-alpha blobs are objects which are very extended ($> 50 - 100$ kpc) and very luminous ($> 10^{43}$ erg s^{-1}) in the Lyman-alpha emission line, and are mostly observed at redshifts $z \sim 2 - 3$. The source of their energy is not well understood. It is expected that different sources of energy are related to each other and it is found that the extended Lyman-alpha emission is closely connected with cold HI gas distribution. In this work we assume that the Lyman-alpha emissivity is proportional to the emissivity from the cold gas accretion rate. We determine luminosity and area functions at redshifts $z \sim 1 - 6$, and compare with observations.

Poster

MODELLING LINE EMISSION FROM SUB PARSEC SPIRAL STRUCTURES AROUND ECCENTRIC ORBITS OF SUPERMASSIVE BINARY BLACK HOLE SYSTEMS

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Variability of active galactic nuclei is not well understood. One possible explanation is existence of supermassive binary black holes (SBBH) in their centres. It is expected that each supermassive black holes of every galaxy eventually finish as a SMBBH system in the core of newly formed galaxy. We model the emission lines from inner spiral structures of inflowing gas around SMBBH systems with eccentric orbits. We assume that that inflowing gas around SMBBH systems is photo ionised by mini accretion disk emission around each black hole. We calculate variations of emission line flux, shifts and shapes for different parameters.

Poster

LINE SHAPES EMITTED FROM SPIRAL STRUCTURES AROUND SYMMETRIC ORBITS OF SUPERMASSIVE BINARY BLACK HOLES

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It is expected that major mergers are common in the Universe. This should result as sub-parsec binary black hole systems (BBHS) in the merger cores, within Hubble time. We model the Balmer line emission of inner spiral structures formed by orbiting motion of symmetric BBHS orbits. We assume that the line emission is produced by photo ionisation of the gas in spiral structures by the each black hole's mini accretion disk radiation. We consider cases with different masses and inclinations for circular orbits.

Progress Report

VLF REMOTE SENSING OF THE LOWER IONOSPHERIC DISTURBANCES CAUSED BY INTENSE SOLAR RADIATION

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The sensitivity of VLF radio propagation to the lower ionosphere makes it an ideal probe for remotely sensing the ambient state and localized perturbations of the ionosphere. AWESOME detection system were put in operation in the Institute of Physics, Belgrade, Serbia, in June 2008 and continuously monitor VLF signal during the period of almost seven years (2008 - 2015). Statistical results show that in large number of examined events, the amplitude perturbation excess of VLF signal is in correlation with intensity of satellite measured stellar (X-ray, UV and etc.) flux. We show and conclude that the VLF technique is reliable detection tool of high-energy astrophysical phenomena.

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Progress Report

REVEALING DIFFICULTIES FOR OBTAINING THE DUST COVERING FACTOR OF AGNs FROM IRON K_α LINE AND THE RATIO OF L_{IR}/L_{AGN} LUMINOSITIES

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The ratio of re-processed infrared emission (L_{IR}) to intrinsic nuclear bolometric luminosity of active galactic nucleus (L_{AGN}) has been commonly used as a proxy of the covering factor of the dust surrounding the central engine. The dust covering factors obtained in such way are often used to infer fraction of obscured AGNs as a function of luminosity and redshift and thus have an important role in studying AGN evolution. The narrow component of the iron K_α line, an ubiquitous feature in the X-ray spectra of AGNs, is believed to originate in the same dusty torus, implying a connection between the Fe K_α equivalent width (EW) and the physical properties of the torus. In a sample of 24 type 1 AGNs we have found such a correlation between Fe K_α EW and the dust covering factor derived from IR SEDs with a slope consistent with the expected value, but of a low statistical significance. In an effort to better constrain the dust covering factor, we used Monte Carlo radiative transfer simulations to calculate a grid of the dusty tori SEDs for a range of bolometric luminosities, opening angles and other torus parameters. We compared the true covering factors with the ones obtained from the model luminosity ratios. From our analysis we found that the relation between the covering factor and the L_{IR}/L_{AGN} ratio is far from simple, due to the anisotropic emission of both the disk and the torus. Apart from well know difficulties for obtaining the correct L_{AGN}, the biggest obstacle is the fact that the deviation of the L_{IR}/L_{AGN} from the true value depends strongly and non-linearly on the covering factor itself. However, our results offer a way to correct L_{IR}/L_{AGN} ratio so that it more closely corresponds to the true covering factor.

Invited Lecture

ION DYNAMICS AND EFFECTS OF MICROFIELD ROTATION

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Lineshapes of atomic radiative transitions broadened by plasma is a complex problem lacking a general analytic solution, and several models have been suggested to treat it (Gigosos 2014). Lyman-α is the simplest transition, but paradoxically, calculating plasma broadening of this spectral line ends up in a large spread between results of different models (Stambulchik 2013, Ferri *et al.* 2014).

In this presentation, we discuss influence of the microfield rotations on the Stark lineshape formation. The first quantitative analysis of this phenomenon was performed long ago (Demura *et al.* 1977) and recently became a subject of study again (Demura and Stambulchik 2014, Calisti *et al.* 2014). We show that the Lyman-α broadening changes from the impact regime to another, also dynamical in nature, "rotational" broadening, in which the line width depends only on the typical frequency of the plasma microfield rotation and is independent both of the microfield magnitudes and the atomic properties of the transition. A simple universal expression is suggested interpolating between the two asymptotic regimes, applicable unchanged to broadening due to electrons and ions alike. Comparison to results of accurate computer simulations shows a good agreement over a very large range of plasma parameters.

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Invited Lecture

LINE BROADENING IN PRESENCE OF STRONG LANGMUIR TURBULENCE

R. Stamm, I. Hannachi, H. Capes, L. Godbert-Mouret, M. Koubiti, Y. Marandet and J. Rosato

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In a linear regime three types of waves are observed in a fully ionized unmagnetized plasma: Langmuir, ion sound and electromagnetic waves. These waves couple in a nonlinear regime, observed as the amplitude of the waves is growing. Many different phenomena may then occur, but the focus in this work will be on strong Langmuir turbulence, first described by the Zakharov equations (V.E. Zakharov, Sov. Phys. JETP 35, 980 (1972)). These equations predict the development in the plasma of both density depressions and electric field maxima. If enough energy is injected into the plasma, many wave packets will form, collapse, dissipate, then reform. This wave packet cycle has been observed in space and laboratory plasmas, and analysed with the Zakharov equations and numerical simulations (P. A. Robinson, Rev. Mod. Phys. 69, 507(1997)). The electric field generated by the wave packet cycle can reach values up to two orders of magnitude larger than the Holtsmark field. The lifetime of a cycle takes values much larger than one in units of the inverse electron plasma frequency. If we consider an emitting atom immersed in such a plasma, its energy levels will be strongly modified by the electric field of the wave packets located in the vicinity. Line shapes of atoms and ions in such a plasma may thus be significantly affected. We propose a stochastic model using probability density functions (PDFs) for the lifetime of a wave packet cycle, and for the values of the electric field in the wave packets. We assume that the Langmuir field applied on an emitter is a sequence of oscillating field with random amplitude and phase, and obtain the emitter dipole correlation function by a numerical integration. Calculations of Lyman alpha profiles will be performed for different plasma and wave packet conditions.

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Progress Report

MULTICOMPONENT ANALYSIS OF Si IV AND C IV BROAD ABSORPTION AND EMISSION PROFILES OF BALQSOs. ANSWERING SOME IMPORTANT QUESTIONS

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As we know, BAL quasars present broad and complex absorption and emission profiles of high ionization lines such as Si IV and C IV. Many researchers propose that these profiles are the synthesis of a number of individual doublets of resonance lines of Si IV and C IV. These doublets are produced by individual density enhancements that intercept the continuum along the line of sight. In order to analyze the complex Si IV and C IV spectral regions we use the Danezis et al. 2009 method. The application of this method in the study of quasars may give rise to some basic questions that concern the results of spectral fitting. Some of these questions are: i) the physics that underlies this method, ii) the mathematical expression of the physical model, iii) the exact number of components that are required to reproduce the complex absorption/emission profiles, iv) the uniqueness of the calculated values of the parameters that this method is able to measure. In this paper, we answer to the previous questions and we give an application of this method, in the case of two BALQSOs.

Invited Lecture

EXPLORING RADIO-LOUD QUASARS WITH OPTICAL-UV SPECTROSCOPY

J. Sulentic

Instituto de Astrofísica de Andalucía (CSIC), Granada, España
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The mystery of why only 8remains with us since their discovery in 1963. We have been exploring ways of more precisely defining the radio-loud (RL) parent population in the context of 4DE1 space. The best defined RL population (showing double-lobe structure) show a restricted range of optical/UV spectroscopic properties suggesting that they show below average Eddington ratios and above average black hole masses. The 4DE1 context also shows us that claims of a RL population of narrow line Seyfert 1 (NLSy1) sources is spurious.

Invited Lecture

REVIEWING LINE SHIFTS IN QUASARS

J. Sulentic

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We have recently passed the 50th anniversary of the discovery of quasars. A short time after their discovery, as their numbers increased, we began to find velocity discrepancies between different lines (broad/narrow emission as well as broad/narrow absorption) in the same sources. We have even found them in X-ray lines. This can make estimation of an individual source rest frame quite uncertain. It also raises the question of cause. Three classes of mechanisms have been discussed over the years: Doppler, gravitation and scattering. When none of the above will do, non-Doppler shifts of unknown origin have been proposed – although this explanation is now out of favour. We review some of the most studied kinds of line shifts observed in optical, UV and X-ray spectra of quasars along with ideas about their origin.

Poster

STARK BROADENING OF SPECTRAL LINES WITHIN SODIUM ISOELECTRONIC SEQUENCE

I. Tapalaga and I. Dojčinović

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This paper analyses Stark broadening of spectral lines within sodium like elements (Na I, Mg II, Al III, Si IV and P V). Strong correlation exists between Stark broadening and the upper level ionization potential. A functional dependence of Stark broadening on rest core charge of the emitter has been observed.

Invited Lecture

X-RAY VIEW OF ACTIVE GALACTIC NUCLEI

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X-ray observations provide us with unique information on the central engines of active galactic nuclei (AGNs). I will present a review of (1) the cosmological evolution of AGNs revealed by X-ray surveys and (2) X-ray constraints on the structure of AGNs including prospects for future observations with the ASTRO-H mission.

X SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
June 15-19, 2015, Srebrno jezero, Serbia
Book of Abstracts, Eds. L. Č. Popović, M. S. Dimitrijević and S. Simić
Astronomical Observatory, Belgrade, 2015

Progress Report

SPECTROSCOPIC DATA OF W I, Mo I AND Cr I SPECTRAL LINES: SELECTION AND ANALYSIS

A. N. Veklich, A. V. Lebid and T. A. Tmenova

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Composite materials on a base of copper with addition of refractory metals are widely used as electrode or contact materials in electrotechnical industrial applications (e.g. relays, commutators, circuit breakers etc.). The emission spectra of plasma of electric arc discharge between such materials contain spectral lines of Cu (which are well-studied) and refractory metals (W, Mo and Cr). So, such plasma can be used as spectroscopic instrument for analysis and selection of WI, MoI and CrI spectral lines and their spectroscopic data. The main aim of this paper is selection of WI, MoI and CrI spectral lines and appropriate spectroscopic data for the purposes of plasma diagnostic. Electric arc discharge plasma between composite Cu-W, Cu-Mo and Cu-Cr electrodes were studied. Original user interface were used for emission spectra registration and interpretation. Abel inversion for obtaining of local values of spectral intensity was used because of side-on (lateral) observation of plasma object. Obtained radial profiles of intensity were corrected in accordance to setup spectral sensitivity. Spectroscopic data (oscillator strengths) values for WI, MoI and CrI from various sources are significantly different. So, it was decided to use Boltzmann plot method as instrument for WI, MoI and CrI spectral lines and their spectroscopic data selection. If plasma is in local thermodynamic equilibrium, then the slope of Boltzmann plot lines corresponding to each spectroscopic plasma components must be the same. This slope depends on the excitation temperature of thermal plasma. Values of oscillator strength for WI, MoI and CrI spectral lines, which are best satisfy to the slope for CuI energy levels were chosen.

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Poster

IMPULSIVE ELECTRON EVENTS AND LANGMUIR WAVES ASSOCIATED WITH TYPE III SOLAR RADIO BURSTS

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Energetic electron beams, ejected and accelerated from the Sun by some violent processes - usually solar flares, interact with the interplanetary plasma and produce Langmuir waves which then convert into radio emissions called type III radio bursts. Understanding of the energy conversion mechanisms in these processes is an important problem in plasma astrophysics. Using data provided by instruments onboard Wind spacecraft, a set of 19 events where Langmuir waves, type III radio bursts and electron beams are observed simultaneously is selected. A model of power-law relation between (1) locally generated Langmuir waves associated with type III solar radio bursts, (2) electron beam energies and (3) electron fluxes is examined. A strong power-law dependence between two of these three physical quantities is found: between electron beam energies and energetic electron fluxes. The value of power-law index, γ, is found to be -2.47 ± 0.06 which is in good agreement with previous investigations. Because of this strong dependence, the model given in the same form (power-law), including all three quantities, is highly unstable numerically. Observational results of Langmuir waves power at given electron energies shown here, support some simulations of electron beam propagation from the Sun to the Earth in weak turbulent regime.

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Invited Lecture

IS AN ORDINARY SUPERMASSIVE BLACK HOLE AT THE GALACTIC CENTER?

A. F. Zakharov

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Now there are two basic observational techniques to investigate a gravitational potential at the Galactic Center, namely, a) monitoring the orbits of bright stars near the Galactic Center to reconstruct a gravitational potential; b) measuring a size and a shape of shadows around black hole giving an alternative possibility to evaluate black hole parameters in mm-band with VLBI-technique. At the moment one can use a small relativistic correction approach for stellar orbit analysis (however, in the future the approximation will not be not precise enough due to enormous progress of observational facilities) while now for smallest structure analysis in VLBI observations one really needs a strong gravitational field approximation. We discuss results of observations, their conventional interpretations, tensions between observations and models and possible hints for a new physics from the observational data and tensions between observations and interpretations. We will discuss an opportunity to use a Schwarzschild metric for data interpretation or we have to use more exotic models such as Reissner – Nordstrom or Schwarzschild – de-Sitter metrics for better fits.

Programme of 10th SCSLSA

Sunday, June 14, 2015

19:00	***Arrival of participants***	
20:00	***Registration and Welcome Cocktail***	

Monday, June 15, 2015

Chair: L. C. Popovic

9:00 - 9:10	***Opening ceremony***	
9:10 - 9:30	***Milan S. Dimitrijevic***	*From I Yugoslav Conference on Spectal Line Shapes (YuCSLS) to X Serbian Conference on Spectral Line Shapes in Astrophysics (SCSLSA)*
9:30 - 10:00	***Hagai Netzer***	*Line profiles, mass measurements and accretion disks in high redshift AGNs*
10:00 - 10:30	***Gillian Peach***	*The radio recombination lines of hydrogen; recent developments*
10:30 - 11:00	***Coffee break***	

Chair: H. Netzer

11:00 - 11:30	***Yoshihiro Ueda***	*X-ray view of AGNs*
11:30 - 12:00	***Paola Marziani***	*The most powerful quasar outflows as seen from the C IV 1549 resonance line*
12:00 - 12:15	***Dragana Ilic***	*Line shape variability in a sample of AGN with broad lines*
12:15 - 12:30	***Yuri Shchekinov***	*Ignition and launching the large scale galactic wind*
12:30 - 12:45	***Giovanni La Mura***	*Spectroscopic observations of undetermined type γ-ray Active Galactic Nuclei*
13:00 - 15:00	***Lunch time***	

Chair: E. Danezis

15:00 - 15:30	***Dominique Sluse***	*Measuring the size of the broad line region in quasars with Microlensing-reverberation mapping*
15:30 - 16:00	***Andrei Klyucharev***	*Dynamics Resonances in Atomic States of Astrophysical Relevance*
16:00 - 16:30	***Coffee break***	

Chair: S. Sahal-Brechot

16:30 - 17:00	***Nikola Cvetanovic***	*Use of Stark Effect for Measurement of Macroscopic Electric field in Laboratory Plasmas*
17:00 - 17:15	***Vladimir Sreckovic***	*VLF Remote Sensing of the Lower Ionospheric Disturbance Caused by Intense Solar Radiation*

17:30 - 19:00 **- Silver lake cruise -**

Tuesday, June 16, 2015

Chair: E. Stambulchik

9:30 - 10:00	***Roland Stamm***	*Line broadening in presence of strong Langmuir turbulence*
10:00 - 10:30	***Veronique Bommier***	*Polarization in spectral lines formed by scattering: from the line center to the far wings*
10:30 - 11:00	***Coffee break***	

Chair: R. Stamm

11:00 - 11:30	***Evgeny Stambulchik***	*Ion dynamics and Effects of Microfield Rotation*
11:30 - 12:00	***Anatolij A. Mihajlov***	*Non-elastic processes in atom - Rydberg atom collisions: Review of state of art and problems*
12:00 - 12:15	***Aleksandra Nina***	*Contribution of Lya photoionization to ionization rate and electron density changes in the ionospheric D-region disturbed by solar X-flares*

12:15 - 12:30	***Tetiana Tmenova***	*Spectroscopic data of W I, Mo I and Cr I Spectral Lines: Selection and Analysis*
12:30 - 12:45	***Mohammed Meftah***	*Contribution of Lienard-Wiechert Potential in the Electron Broadening of Spectral Line Shapes in Plasmas*
12:45 - 13:00	***Conference photo***	
13:00 - 15:00	***Lunch time***	

SPECIAL SESSION: Line Shifts in Astrophysical and Laboratory plasma

Chair: D. Ilic

15:00 - 15:20	***Jack Sulentic***	*Reviewing Line Shifts in Quasars*
15:20 - 15:40	***Predrag Jovanovic***	*Line shift in accretion discs – the case of Fe Kalpha*
15:40 - 15:50	***Natasa Bon***	*Gravitational redshift of emission lines in the AGN spectra*
15:50 - 16:00	***Sasa Simic***	*Line shifts in super massive binary black holes*
16:00 - 16:30	***Coffee break***	

SPECIAL SESSION: Line Shifts in Astrophysical and Laboratory plasma

Chair: J. Sulentic

16:30 - 16:45	***Sanja Jonic***	*Gravitational redshift - Black hole mass estimates*
16:45 - 17:00	***Victor Afanasiev***	*The shifts of polarized broad lines in type 1 active galactic niclei*
17:00 - 17:30	***Bratislav Obradovic***	*Line shifts in laboratory plasma*

Chair: N. Ben Nessib

17:30 - 19:00 **POSTER PRESENTATION Part I - (P01 - P15)**

Wednesday, June 17, 2015 EXCURSION (plan)

10:00	***Departure***	*Visiting VIMINACIUM*
11:30 - 12:00	***Jack Sulentic***	*On the Structure of the Roman Aqueduct in Viminacium*
12:00 - 12:30	***Milan Dimitrijevic***	*Coins of the Colony of Roman Citizens Viminacium*
13:30 - 15:30	***Lunch***	*Roman menu*
15:30 - 18:00	***Viminacium***	*Visiting archeological site*
19:00	***Arrival***	

Thursday, June 18, 2015

Chair: R. Goosmann

9:30 - 10:00	***Jack Sulentic***	*Exploring radio-loud quasars with optical-UV spectroscopy*
10:00 - 10:30	***Joel Rosato***	*Modeling of Stark-Zeeman lines in magnetized hydrogen plasmas*
10:30 - 11:00	***Coffee break***	

Chair: D. Sluse

11:00 - 11:30	***Nick Devereux***	*Dwarf Seyfert Galaxies with Giant Broad Line Regions*
11:30 - 12:00	***Rene Goosmann***	*How do spectral line shapes get along with accreting black holes?*
12:00 - 12:15	***Marko Stalevski***	*Revealing Difficulties for Obtaining the Dust Covering Factor of AGN from Iron Kα line and the Ratio of L_{IR}/L_{AGN} Luminosities*
12:15 - 12:30	***Jelena Kovacevic - Dojcinovic***	*Difference between UV and Optical Fe II Emission lines in the Spectra of the AGNs type 1*
12:30 - 12:45	***Dimitris Stathopoluos***	*Multicomponent analysis of Si IV and C IV Broad Absorption and Emission Profiles of BALQSOs. Answering some important questions*
12:45 - 13:00	***Paola Marziani***	*Blue Outliers Among High Redshift Quasars*
13:00 - 15:00	***Lunch time***	

SPECIAL SESSION: Spectral Lines and Compact Stars

Chair: P. Jovanovic

15:00 - 15:10	***Luciano Rezzola***	*COST Action MP1304: Exploring fundamental physics with compact stars (NewCompStar)*
15:10 - 15:30	***Alexander Zakharov***	*Is an Ordinary Supermassive Black Hole at the Galactic Center*
15:30 - 15:50	***Duško Borka***	*Hybrid gravity around compact objects*
15:50 - 16:20	***Coffee break***	

SPECIAL SESSION: Spectral Lines and Compact Stars

Chair: A. F. Zakharov

16:20 - 16:40	***Milan S. Dimitrijevic***	*Stark Broadening in Pre White Dwarfs, White Dwarfs and Neutron Stars*
16:40 - 17:00	***Edi Bon***	*Binarity in AGN and Microquasars*
17:00 - 17:20	***Vesna Borka Jovanovic***	*f(R) Gravity and dynamics of stellar systems*

Chair: N. Ben Nessib

17:20 - 19:00 **POSTER PRESENTATION Part II - (P16 - P30)**

20:00 - 24:00 ***CONFERENCE DINNER***

Friday, June 19, 2015

Chair: G. Peach

10:00 - 10:30	***Nelly Bonifaci***	*Optical spectroscopy of cryogenic plasma in helium*
10:30 - 11:00	***Robert Beuc***	*High temperature optical spectra of diatomic molecules: quantum–mechanical, semiquantum and semiclassical approach*
11:00 - 11:30	***Coffee break***	

Chair: A. Klyucharev

11:30 - 11:45	***Sergei Gulyaev***	*Stark Broadening of High Order radio Recombination Lines Towards the Orion Nebula: Agreement between measurements and Theory*
11:45 - 12:00	***Veljko Vujcic***	*MOL-D A Collisional Database Repository and Web Service Within theVirtual Atomic and Molecular Data Centre*
12:00 - 12:15	***Nabil Ben Nessib***	*Temperature Dependence of Atomic Spectral Line Widths for Neutral Chromium*
12:15 - 12:25	***Closing ceremony***	
14:00 -	***Departure to Belgrade***	

***** List of posters *****

P01:	N. Alonizan, R. Qindeel, N. Ben Nessib, S. Sahal-Brechot and M. S. Dimitrijevic	*Stark broadening parameters for neutral oxygen spectral lines*
P02:	A. Ammar and H. Ghalila	*Ionoshperic disturbances due to Solar flares recorded by VLF receiver located in Tunis*
P03:	K. Bensch, A. del Olmo, J. Sulentic	*Measures of the soft X-ray excess as an eigenvector 1 parameter for Active Galactic Nuclei*
P04:	E. Bon, P. Marziani, J. Sulentic, N. Bon	*Searching for a BBH Signature in Quasar Spectra: A 4DE1 Perspective*
P05:	E. Danezis, D. Stathopoulos, E. Lyratzi, A. Antoniou, D. Tzimeas	*From Quasars to Stars. Similar Phenomena in the Spectra of Quasars and Hot Emission Stars*
P06:	M. S. Dimitrijevic, Z. Simic, A. Kovacevic, S. Sahal-Brechot	*On the Stark broadening of Xe VIII spectral lines in White Dwarfs*

P07:	M. S. Dimitrijevic, Z. Simic, A. Kovacevic, S. Sahal-Brechot	*On the Stark broadening parameters of spectral lines of Neutral Neon*
P08:	A. del Olmo, J. Sulentic, P. Marziani, M. A. Martinez-Carballo, K. Bensch	*3C 57, A rejuvenated QSO*
P09:	R. V. Munoz-Dimitrova, R. Bachev	*Spectroscopic monitoring of AGN at Rozhen observatory*
P10:	I. Tapalaga, I. P. Dojcinovic	*Stark broadening of spectral lines within sodium isoelectronic sequence*
P11:	M. Grzedzielski, P. Sukova, A. Janiuk	*Deterministic chaos in the X-ray sources*
P12:	I. Hannachi, T. Meftah, J. Rosato, R. Stamm	*Simulation Calculations of Line Shapes in Presence of Langmuir Turbulence*
P13:	N. Ivanovic, G. Lj. Majstorovic, N. M. Sisovic	*The method for mapping electric field distribution in cathode fall region of abnormal glow discharge using neutral Neon spectral line shapes*
P14:	A. Kolarski and D. Grubor	*Comparative analysis of VLF signal variation along trajectory induced by X-ray solar flares*
P15:	A. Kovacevic, L. C. Popovic, A. I. Shapovalova, D. Ilic	*Exploring irregular bivariate AGN time series*
P16:	G. La Mura, D. Bastieri, M. Berton, G. Chiaro, S. Ciroi, V. Cracco, P. Rafanelli	*Properties of the [OIII] lines in two samples of radio-emitting Seyfert 1 galaxies*
P17:	E. Lyratzi, D. Stathopoulos, E. Danezis, A. Antoniou, D. Tzimeas	*Answers to some important questions on the use of GR model*
P18:	Z. Majlinger, Z. Simic, M. S. Dimitrijevic	*On the Stark broadening of Lu III spectral lines*
P19:	A. A. Mihajlov, N. M. Sakan and V. A. Sreckovic	*The Inverse bremsstrahlung in astrophysical plasmas: The absorption coefficients and Gaunt factors*
P20:	M. L. Martinez-Aldama et al.	*Observations of the Ca II Ir triplet in high luminosity Quasars: Exploring the sample*
P21:	C. A. Negrete, P. Marziani, D. Dultzin, J. W. Sulentic	*Photoionisation estimates of broad line region size in high redshift Quasars*
P22:	A. Nina, V. M. Cadez, J. Bajcetic, M. Andric	*Variability of D-region photoionisation induced by Lyα radiation*
P23:	R. Qindeel, N. Alonizan, N. Ben Nessib	*Atomic data for transitions in neutral Carbon*
P24:	S. Simic and E. Bon	*Contribution to SED of AGNs induced by possible density perturbations in complex geometry of binary systems*
P25:	M. Smailagic and E. Bon	*Modelling Line Emission from Sub Parsec Spiral Structures around Eccentric Orbits of Supermassive Binary Black Hole Systems*
P26:	M. Smailagic and E. Bon	*Line Shapes Emitted from Spiral Structures around Symmetric Orbits of Supermassive Binary Black Holes*
P27:	M. Smailagic	*Modeling luminosity and area functions of Lyman-alpha blobs*
P28:	S. Vidojevic	*Impulsive electron events and Langmir waves*
P29:	J. Rosato	*Radiative transfer reconsidered as quantum kinetic theory problem*
P30:	Dj. Savic, L. C. Popovic, R. W. Goosmann and V. L. Afanasiev	*Theoretical modeling of polarized broad line profiles of AGN*
P31:	P. A. Rojas Lobos and C. M. Gaskell	*The production of strong broad He II emission after the tidal disruption of a main-sequence star by a supermassive black hole*
P32:	N. Rakic, G. La Mura, D. Ilic, A. I. Shapovalova, W. Kollatschny, L. C. Popovic	*The intrinsic Baldwin effect in five long term monitored AGNs*

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CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд

52-355.3(048)
533.92:537.228.5(048)
539.184.27(048)

SERBIAN Conference on Spectral Line Shapes in Astrophysics (10 ; 2015 ; Srebrno jezero)
Book of Abstracts / X Serbian Conference on Spectral Line Shapes in Astrophysics, June15-19, 2015, Srebrno jezero, Serbia ; Eds. Luka Č. Popović, Milan S. Dimitrijević and Saša Simić. - Belgrade : Astronomical Observatory, 2015 (Kragujevac : Knjigovezačka radnja Kostić,). - 85 str. ; 24 cm

Tiraž 100. - Registar.

ISBN 978-86-80019-70-3

1. Popović, Luka Č., 1964- [уредник]
a) Астрофизика - Апстракти b) Плазма - Спектрална анализа - Апстракти
c) Штарков ефекат - Апстракти
COBISS.SR-ID 215461388