XII SERBIAN CONFERENCE
ON SPECTRAL LINE SHAPES IN ASTROPHYSICS

BOOK OF ABSTRACTS

**Eds. Dragana Ilić, Evgeny Stambulchik,
Andjelka Kovačević and Luka Č. Popović**

Faculty of Mathematics, University of Belgrade

2019

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ACTIVE GALACTIC NUCLEI IN POLARIZED LIGHT

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The importance of applying polarimetry methods to the study of geometry, kinematics, and physical processes in active galactic nuclei (AGN) in polarized light is discussed. Since the central regions of AGNs are geometrically unresolved, polarimetry is an important addition to direct images, spectra and the time series of the variability. The polarimetric methods for the study of AGNs in the broad lines of the hydrogen series are considered in detail. Polarization contains information about the interaction of electromagnetic waves with the environment, so the study of sources in polarized light provides additional information about the physical processes in the central regions of the AGNs. An overview of the mechanisms of polarization formation, their connection with different structures and scales are provided. The technique of polarimetric observations, the difficulties of taking into account the depolarization introduced by different media on the way between the source and the observer, as well as examples of observations of polarization in different types of AGNs are described.

Invited Lecture

LINE SHAPES IN NARROW-LINE SEYFERT 1 GALAXIES: A TRACER OF PHYSICAL PROPERTIES?

M. Berton[1,2], I. Björklund[3], A. Lähteenmäki[2,3], E. Järvelä[2,4], E. Congiu[5] and G. Terreran[6]

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Narrow-line Seyfert 1 galaxies (NLS1s) are a class of active galactic nuclei (AGN) known for their intriguing physical properties. Characterized by low mass black holes (typically below 10^8 $M_\odot$) and high Eddington ratios, they are usually believed to be younger counterparts of classical Seyfert 1 galaxies. The definition of NLS1s is based exclusively on the properties of their emission lines. In particular, the full width at half maximum of Hβ must be lower than 2000 km s^{-1}, and the flux ratio [O III]/Hβ < 3. Furthermore, Fe II multiplets are often, but not always, present. Another striking characteristic is that their permitted line profile, in particular that of Hβ, is well described by a Lorentzian function. However, this is not always the case since in a minority of NLS1s the Hβ line has a Gaussian profile instead. Does this disparity within the NLS1 class correspond to a physical difference between the sources? A preliminary investigation carried out on the largest to date sample of NLS1s from the SDSS suggests that the different line profiles reflect into all of the main physical properties of NLS1s. Black hole mass, Eddington ratio, Fe II strength, [O III] luminosity, and broad-line region geometry seem all to follow different distributions in the Lorentzian and Gaussian samples. In my talk I will present these new interesting results, and put it into the context of our general understanding of this fascinating class of AGN.

Invited Lecture

THE PHYSICS OF IONIZED GAS IN AGN: TESTING PREDICTIONS FROM FIRST PRINCIPLES

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The presence of ionized gas in Active Galactic Nuclei is revealed by the observed emission lines, which imply a wide range of ionization states, densities, geometries and kinematics. Dense, fast gas occurs on sub-pc scales (Broad Line Region), while slow tenuous gas appears at scales from pc to kpc (Narrow Line Region). Despite this varied phenomenology, very clear predictions can be derived from first principles, and directly compared to the observations.

Invited Lecture

SUPERSOFT Be BINARIES IN THE MAGELLANIC CLOUDS

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Supersoft X-ray sources (SSSs) are well known since several decades. The vast majority of the well studied ones are associated with in-shell hydrogen burning white dwarfs. Nevertheless many SSSs are not yet well understood and some of them are likely to be close binary systems, where the primary is a hot giant star with an excretion disk (Be) and the secondary is a white dwarf, a neutron star or even a black hole. Because of their large intrinsic luminosity, spanning from $L_{SX} \sim 10^{40}$ erg s^{-1} for a very short period down to $\sim 10^{34}$ erg s^{-1} when the white dwarf is cooling, these sources can be observed also in external galaxies, like for example the Magellanic Clouds. Here we present recently published results about four supersoft Be binaries (Cracco et al. 2018), three of them detected in the SMC and one in the LMC: XMMU J010147.5-715550, SUZAKU J0105-72, MAXI J0158-744, and XMMU J052016.0-692505. They were spectroscopically observed at the Southern African Large Telescope (SALT) in low resolution mode (RSS spectrograph) and high resolution mode (HRS spectrograph). With the aim to derive some parameters of these binary systems from the variation of their double peaked emission line profiles, we decided to monitor with HRS two of the four sources (XMMU J01 and XMMU J05) that seemed more promising on the basis of the first observations. We present here the results of the preliminary analysis. The monitoring of the other two sources was recently proposed to SALT and we expect to receive new data since next summer when both the Magellanic Clouds become visible again.

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Invited Lecture

MODELLING BROAD EMISSION LINES IN ACTIVE GALACTIC NUCLEI

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Broad Emission Lines are the most characteristic features of Active Galaxies, but the mechanism of creating a medium able to emit these intense lines is not quite clear. Observations clearly indicate that the motion of the material is predominantly Kepelrian, with tracses of inflow and outflow, but this still does not point out whether the lines partially come from the disk surface, or exclusively from the circumnuclear material, and whether this material originates from the disk as a wind, or comes, at least partially, from outside. I review the basic scenarios for the formation of the Broad Line Region, and the recent progress in modelling the physical conditions in the emitting medium.

Invited Lecture

EMISSION LINE VARIABILITY IN THE AGN STORM DATASET

G. De Rosa, G. A. Kriss, B. M. Peterson, M. R. Goad, K. Horne, K. T. Korista and the AGN STORM collaboration

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The AGN Space Telescope and Optical Reverberation Mapping program (AGN STORM) was the first reverberation mapping (RM) study designed to simultaneously probe the kinematics of all the strong UV and optical line-emitting regions in a local AGN. The AGN STORM campaign targeted the Seyfert I galaxy NGC 5548, and was built around a large HST-COS program that executed in 2014. The campaign was supported by intensive monitoring using Swift, and by ground-based spectroscopic and photometric observations. In this talk I will review what we have learned from line variability in this unprecedented campaign, while emphasizing puzzling and unexpected results that challenge our current understanding of the AGN structure.

Invited Lecture

AUTOIONIZATION WIDTHS OF COLD RYDBERG ATOMIC COMPLEXES

M. S. Dimitrijević[1,2], V. A. Srećković[3], A. Abo Zalam[4], K. Miculis[5], N. N. Bezuglov[4] and A. N. Klyucharev[4]

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Autoionization processes in Rydberg collisional complexes were considered in work Gnedin et al. (2009). It showed the important role of the development of the dynamic chaos regime for various ionization phenomena occurred in cold astrophysical environments. As a continuation of those studies, our paper presents novel original results related to the following problems: (i) Analysis of the nontrivial temporal dynamics of the angular momentum $L(t)$ of a Rydberg atom in external electromagnetic fields along with the influence of that dynamic on the ionization efficiency; (ii) The fluorescence spectrum of a Rydberg atom which it emits upon its diffusion ionization stimulated by an external microwave radiation; (iii) Analysis of autoionization widths Γ_N of quasi-molecules formed by two cold Rydberg atoms in different quantum states (N) and subject to the long-range dipole-dipole interaction.

We have obtained new data to control the rate constants of ionization phenomena in cold environments under the presence of both external and internal atomic electromagnetic fields. Using the example of Rydberg alkali metal atoms, it has been demonstrated the possibility of a substantial increase (by orders of magnitude - see Figure 1) of the rates Γ_N of the charged particles formation in cold media due to an optimal selection of quantum numbers $N = (n_d l_d, n_i l_i)$ of two Rydberg atoms participating in the Penning ionization process $A^{**}(n_d l_d) + A^{**}(n_i l_i) \rightarrow A^{**}(n'_d l'_d) + A^+ + e^-$ at the internuclear distance R.

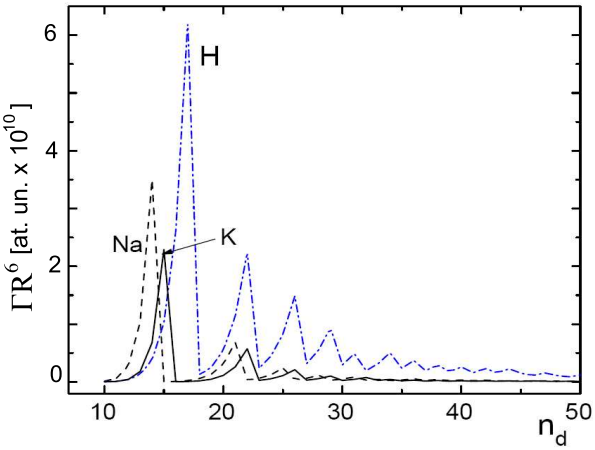

Figure 1: Reduced Penning autoionization widths $\mathrm{R}^6\Gamma_N$ for s-s ($l_i = l_d = 0$) pairs of Na, K and H atoms as functions of the principal quantum number n_d with the fixed $n_i = 50$ quantum number of the ionizing atom.

References

Gnedin, Yu. N., Mihajlov, A. A. et al.: 2009, *New Astron. Rev.*, **53**, 329 (see also Mihajlov, A. A., Ignjatović, L. M., Srećković, V. A., Dimitrijević, M. S.: 2011, *Astrophys. J., Suppl. Ser.*, **2**, 193).

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Invited Lecture

STUDY ENVIRONMENTAL DEPENDENCE OF GALAXY PROPERTIES

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We study the clustering of galaxies as function of redshift in the range $0. < z < 0.8$ using data from observations on 1-m Schmidt Telescope of Byurakan Astrophysical Observatory (Armenia) in 16 medium band (FWHM $\sim$ 250 Å) and 5 broad band (SDSS u,g,r,i,z) filters. The data used in this work homogeneously cover 2.23 sq. deg with accurate photometric redshifts $\sigma z = 0.005(1 + z)$ for all types of galaxies and $\sigma z = 0.002(1 + z)$ for early type galaxies, down to $R_{AB} < 23$. We reconstructed three-dimensional large scale distribution using early type galaxies as born structural elements and build density distribution for all galaxies. We select groups and clusters of galaxies with adaptive kernel as density peaks above twice of the mean density and with Voronoi tessellatation as density peaks above twice the mean density in each redshift with more than of eight same connected cells. The reconstructed overdensity field of the galaxies consists of cluster-like patterns surrounded by void-like regions, extending up to $z \sim 0.8$. Some of these structures are very large, spanning the $\sim 50h^{-1}$ Mpc transverse direction of the field and extending up to $\Delta z \sim 0.05$ in redshift. We begin to study the dependence of star formation properties and morphology on the environments of the galaxies in this field. Results of this investigation and comparison with results from COSMOS and ALHAMBRA surveys are presented in this report.

Invited Lecture

SIGNATURES OF CLOSE BINARIES OF SUPERMASSIVE BLACK HOLES FROM REVERBERATION

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MAHA campaign focus on Monitoring AGNs with Hβ Asymmetry (MAHA) since 2016. I will carry out the latest results of our long-term campaign of reverberation mapping of MAHA campaign, which show promising signatures of close binaries of supermassive black holes from about 30 targets.

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Invited Lecture

BELGRADE NODES OF VAMDC: DATABASES FOR ATOMIC AND MOLECULAR COLLISIONAL AND RADIATIVE PROCESSES NEEDED FOR SPECTROSCOPY

D. Jevremović[1], V. A. Srećković[2], B. P. Marinković[2], V. Vujčić[1], N. Uskoković[2] and S. Ivanović[2]

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Spectroscopy has been crucial for understanding astrophysical phenomena. The interpretation of line spectra with radiative transfer calculations usually requires two kinds of atomic input data such as spectroscopic data (energy levels, statistical weights, transition probabilities, etc.) and collisional data. The major advance in the data access in the last decade is an advent of Virtual Atomic and Molecular Data Center (VAMDC). In this contribution we present a report on two atomic/molecular databases for collisional and radiative processes, BEAMDB and MolD, which are web services at the Serbian Virtual Observatory (SerVO) and nodes within the Virtual Atomic and Molecular Data Center (VAMDC). Within the BEAMDB there are mainly electron scattering cross section data, but having in mind the importance of spectroscopic data obtained by particle collisions, we also provide a number of electron energy loss spectra and threshold electron spectra. Electron loss spectroscopy with its complementarity to the photon absorption data, provides valuable information on the optically forbidden atomic and molecular transitions. The MolD database contains photodissociation cross sections for the individual rovibrational states of the diatomic molecular ions as well as corresponding data on molecular species and molecular state characterizations (rovibrational energy states, etc.). These cross sections can be used for further applications, e.g., obtaining rate coefficients for non-local thermal equilibrium models of early universe chemistry, models of the solar atmosphere, atmospheres of white dwarfs, etc. Also, in this contribution we summarize challenges of atomic/molecular databases and share our experiences.

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Invited Lecture

POSSIBLE OBSERVATIONAL SIGNATURES OF SUPERMASSIVE BLACK HOLE BINARIES IN THEIR Fe Kα LINE PROFILES

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In order to study the potential observational signatures of supermassive black hole binaries (SMBHBs) in the Fe Kα line profiles emitted from the relativistic accretion disks around their components, here we simulated such profiles and compared them with those emitted from the accretion disks around single supermassive black holes (SMBHs). We considered two cases of the SMBHBs: a case when the secondary SMBH is embedded in the accretion disk around the primary, causing an empty gap in the disk, and a case with clearly separated components, where the accretion disks around both primary and secondary give a significant contribution to the composite Fe Kα line emission of a such SMBHB. For this purpose, we simulated these Fe Kα line profiles using ray tracing method in Kerr metric. The obtained results showed that both cases of SMBHBs can leave imprints in the form of ripples in the cores of the emitted Fe Kα line profiles. However, in the case of the composite line profiles emitted from two accretion disks, these ripples could have much higher amplitudes and strongly depend on orbital phase of the system, while in the case with empty gap in the disk around primary, the corresponding ripples mostly have lower amplitudes and do not vary significantly with orbital phase. The spectral resolution of the nowadays X-ray detectors, such as those onboard XMM-Newton, Chandra and Suzaku satellites is still not sufficient to detect and study in details these ripple effects in the observed Fe Kα line profiles from the SMBHBs. However, taking into account that the next generation of X-ray observatories (like Advanced Telescope for High Energy Astrophysics - ATHENA) will provide around 100 times higher spectral resolution, it will be possible to detect such signatures in the line profiles from the observed SMBHBs, and to use them as a tool for studying the properties of these objects.

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Invited Lecture

SPECTRAL LINES ISSUES OF HYDROGEN AND IMPURITY EMITTERS IN FUSION PLASMAS

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Plasmas generated in magnetic fusion devices have relatively low electron densities, typically in the range $10^{13} - 10^{14}$ cm^{-3}, exceeding even 10^{15} cm^{-3} in the divertor region under detachment conditions. Their electron temperature covers a wide range extending from few keV in the confined core to about 1 eV in the peripheral regions. The presence of intrinsic as well as injected impurities in addition to the main hydrogen isotope species offers many situations allowing the study of various cases of emission line spectra. Emission lines may be subject to various broadening processes like the Stark effect due to the interaction of the emitter with the plasma charged particles, the Doppler effect as well as the Zeeman effect due to the presence of the magnetic field. The dominant broadening mechanisms depend on the emitter species, the considered line, the magnetic field strength (hence the location of the emission zone), as well as the plasma parameters. We propose here to present a review on the various spectroscopic techniques based on line emission spectra that are used to diagnose magnetic fusion plasmas, their limitations and a reflection on the possible improvements. The similarities with close situations of astrophysical interests will be discussed.

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Invited Lecture

POLARISATION OF AURORAL LINE EMISSIONS ON EARTH: A REVIEW

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In the last 10 years, a lot of efforts have been devoted to measure and model the polarization of the auroral red emission line at 630 nm. This polarization arises due to impact of thermospheric oxygen atoms with magnetospheric precipitating electrons collimated along the geomagnetic field lines and is due to an imbalance between unresolved Zeeman sublevels (Bommier et al., 2011). The theoretical level of polarization can reach $\sim 17\,\%$ but measurements with a steerable photo-polarimeter (SPP) show that the red line emission is polarized only at a level of a few percent (e.g. Lilensten et al., 2008, Barthlemy et al., 2011). The reason is most probably that the polarization is diluted by many competing production mechanisms of the red emission line that are mostly isotropic and therefore do not produce polarization. Also the distribution of pitch-angle of precipitating electrons obviously plays a role as well. In Lilensten et al. (2015), a theory was developed to combine the electron impact theory of Bommier et al. (2011) and an electron transport code called transsolo. This theory enables to compute the distribution of the Degree of Linear Polarisation (DoLP) as a function of height if the flux of precipitating electrons is provided as input as function of the energy and pitch-angle.

The next logical step is then to check whether other auroral emission lines could also be polarized by impact with precipitating electrons. The most intense auroral emission line, the green line at 577.7 nm, cannot be polarized by electron impact because the upper state of the transition has a total kinetic moment J = 0 and therefore has no Zeeman sublevels. Therefore the most promising candidate to display polarization is the third most intense auroral emission line which is the blue line at 427.8 nm and is due to N2+ 1NG. This line/band is created by electron impact only. In order to continue investigating this field, BIRA-IASB (Royal Belgian Institute for Space Aeronomy) and University of Grenoble have partnered to build a spectropolarimeter able to measure the polarization of the full auroral spectrum between 400 and 700 nm. Results for the blue line obtained with this instrument during campaigns carried out in Skibotn, Norway, will be presented. Due to limitations with the experimental concept, very long integration times were needed to obtain adequate S/N ratios. Plans to improve this instrument will be discussed.

Finally, the theory of the red auroral emission line indicates that the Angle of Linear Polarisation (AoLP) should be more or less aligned with the local geomagnetic field.

This would then open the possibility to map for the first time how geomagnetic field lines become twisted when strong geomagnetic storms or substorms occur. We will present an attempt to do that, made by the University of Leiden in collaboration with BIRA-IASB, by building a prototype of an imaging polarimeter using 2 commercial cameras equipped with fixed polarizers tilted at 0 and 90 degrees and using RGB images to estimate the polarisation of respectively the 630.0, 557.7 and 427.8 nm emissions.

References

Bommier, V., Sahal-Bréchot, S., Dubau, J. and Cornille, M.: 2011, *Solar Polarization 6*, **437**, 73.

Barthelemy, M., Lystrup, M. B., Menager, H., Miller, S. and Lilensten, J.: 2011, *Astron. Astrophys.*, **530**, A139.

Lilensten, J., Moen, J., Barthélemy, M. et al.: 2008, *Geophys. Res. Lett.*, **35**, L08804.

Lilensten, J., Bommier, V., Barthélemy, M. et al.: 2015, *Journal of Space Weather and Space Climate*, **5**, A26.

Invited Lecture

ABS- AND EM-LINE PROFILES OF DLA SELECTED GALAXIES: THE SIGNATURE OF DARK MATTER HALO PROFILES

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Damped Lyman-α Absorbers (DLAs) are absorbing clouds with high HI column density and are typically observed at redshifts $z > 1.8$ (the atmospheric cut-off for Lyα). DLAs have been known for almost half a century, and they have been (and still are) our most important tool to study the build-up of metallicity from the highest redshifts to now. It was always assumed that DLAs were associated to galaxies in some way, but the task of finding those galaxies was extremely challenging. The newest generation of instrumentation on the ESO-VLT, as well as ALMA, has changed this and within the past decade we have finally been able to identify samples of DLA host galaxies, thus providing both emission line spectra of the galaxies and absorption line spectra through their Circum Galactic Medium. The DLA host galaxies follow scaling relations akin to those known locally, allowing us to study the evolution of those scaling relations from redshifts 5-6 to the present.

In this talk I will review the state of the field, with special emphasis on scaling relations related to the line-profiles of the DLA hosts seen in both absorption and emission.

Invited Lecture

LABORATORY HYDROGEN LASER-PLASMA AND WHITE-DWARF STARS LINE SHAPES

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Experimental studies of laser-induced plasma in nominal laboratory settings are instrumental for the interpretation of radiation from astrophysical objects. White dwarf (WD) stars reveal a variety of line shapes that are usually measured in absorption. Typical time-resolved laser-plasma investigations show emission profiles that are subsequently correlated with astrophysical records. For the hydrogen beta line, Hβ, of the Balmer series, line width, peak separation, and central dip-shift are indicators of electron density. Of particular interest is Hβ in characterization of WD's with temperature of the order of 30 kK, viz. Sirius B (α CMa B) accompanying the brightest star Sirius A as seen from Earth. However, instead of hydrogen absorption spectra, molecular carbon Swan spectra are recorded for cooler WD's at a temperature of the order of 8 kK, viz. Procyon B (α CMi B), companion of the 5^{th} brightest star Procyon A. In the laboratory, hydrogen alpha emission spectra are also of interest, including determination of temperature using the line-to-continuum ratio. The mass of WD stars is typically of the order of the mass of the Sun ($M_\odot$), but the WD radius is about the size of the Earth, or 1/100 times that of the Sun (0.01 $R_\odot$). Of interest are as well gravitational WD redshifts, especially comparisons with measured transient laser-plasma redshifts and correlation of astrophysical and of laboratory spectra. Current and future research aspects include modeling of WD atmospheres for explanation of the very details of the astrophysical line shapes.

Invited Lecture

THE RESONANCE LINES OF SODIUM AND POTASSIUM IN BROWN DWARF SPECTRA

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The cool atmospheres of brown dwarfs are characterised by the formation of molecules and condensates. The highly wavelength dependent opacity of abundant molecules such as water, methane and ammonia dominate the infrared spectra of these substellar objects, while at shorter wavelengths the spectrum is shaped by the neutral alkali metals as more refractory elements are sequestered in condensate species. In particular the sodium and potassium resonance doublets, centered at 0.59 and 0.77 μm respectively, play a unique role in shaping the spectrum between 0.4-1.0 μm as the high atmospheric densities of H_2 ($<10^{21}$ cm^{-3}) and He collisionally broaden these lines up to $\pm$ 3000 cm^{-3} from the line centre. Using our state-of-the-art 1D radiative-convective equilibrium model ATMO, we are developing a grid of model substellar atmospheres and investigating the impact of Na and K line shapes on predicted brown dwarf spectra. We find that there are large differences between published line shape calculations and this can affect the predicted spectra. Most notably these uncertainties occur in the near-infrared due to the extent of the redwing of the K resonance lines.

New calculations of the alkali line shapes are in progress and will be presented at the conference.

Invited Lecture

SPECTRAL LINES AND SUPERMASSIVE BLACK HOLE MASS MEASUREMENTS

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Supermassive black holes (SMBHs) are supposed to be in the center of galaxies and it seems that they play an important role in their evolution. Therefore investigation of SMBH characteristics and their influence on the host galaxy structure is one of the significant goal in astrophysics today. One of the most important parameters of SMBHs is their mass. The mass measurements of SMBHs are very complex task. Between several methods for SMBH mass measurements, several of them use the spectral lines, which indicate the motion of the emitting/absorbing material around a SMBH. Mostly there is assumption of virialization of line emitting gas in the region close to SMBHs that is used for mass determination. In this talk we will give an overview of methods for the SMBH mass measurements using emission spectral lines. First we will discuss reverberation method, after that the methods which use different lines from single epoch observations, and at the end a new method which uses polarization across the broad lines.

Invited Lecture

MODELING OF HYDROGEN BALMER LINES FOR THE DIAGNOSTIC OF MAGNETIC WHITE DWARF ATMOSPHERES

J. Rosato, I. Hannachi and R. Stamm

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Studies of white dwarf atmospheres have shown that the majority of white dwarfs have an atmosphere of pure hydrogen as a result of gravitational setting, which removes helium and heavier elements from the atmosphere and moves them towards inner layers [1,2]. These atmospheres can be considered as hydrogen plasmas, which are similar to some created in laboratory. Such white dwarfs are classified as of DA type due to the strong hydrogen absorption lines they present. The electron density in a white dwarf atmosphere is high enough (up to 10^{17} cm^{-3}, and higher) so that the line shapes are dominated by Stark broadening and, hence, can serve as a probe for the electron density. In this work, we address the broadening of the first lines in the Balmer series. A selection of problems related to the modeling of spectra is considered. At the atomic level, a proper description of a line shape requires the microfield evolution be accounted for during the time of interest of the transition under consideration (ion dynamics issue). On the other hand, the lines presenting a structure such as Hβ can exhibit an asymmetry due to presence of multipolar interactions, which is significant at high density regimes and must be retained in calculations [3]. Some observed white dwarf spectra also exhibit lines with a Zeeman triplet structure caused by the presence of strong magnetic fields [4,5]. We give a review of these problems and present new spectra calculations. Spectra observed in dedicated laboratory experiments [6,7] will also be discussed.

References

[1] Fontaine, G. and Michaud, G.: 1979, *Astrophys. J.*, **231**, 826.
[2] Rohrmann, R. D.: 2001, *Mon. Not. R. Astron. Soc.*, **323**, 699.
[3] Gomez, T. A. et al.: 2016, *Phys. Rev. A*, **94**, 022501.
[4] Küluebi, B. et al.: 2009, *Astron. Astrophys.*, **506**, 1341.
[5] Kepler, S. O. et al.: 2013, *Mon. Not. R. Astron. Soc.*, **429**, 2934.
[6] Falcon, R. E. et al.: 2015, *Astrophys. J.*, **806**, 214.
[7] Parigger, Ch. G. et al.: 2018, *Atoms*, **6**, 36.

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Invited Lecture

CURRENT AND FUTURE DEVELOPMENT OF THE PHOTOIONIZATION CODE CLOUDY

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The interstellar medium (ISM) plays a crucial role in the cycle of matter in every galaxy. In the big bang only hydrogen and helium were created, out of which the first galaxies and stars were formed. In these stars heavier elements were synthesized which were eventually ejected into the ISM at the end of their evolution. This enriched gas then formed molecular clouds and the next generation of stars. These stars could then synthesize additional heavy elements, eventually enabling the creation of planets and life.

The gas and dust that is present in the ISM is usually very far removed from (local) thermodynamic equilibrium, and is some cases may also not be in a steady-state equilibrium with its surroundings. The material in the ISM can be heated by stellar light, but also by shocks, radioactive decay, and cosmic rays. As a result the physics of this material is complex and you need a sophisticated numerical code to model the spectrum emitted by this gas.

For this purpose the open-source photoionization code Cloudy has been available for several decades. It models the physical state of the gas and predicts the spectrum emitted by that gas. It is the only code that can make a self-consistent model of a photoionized region and the neutral and molecular regions beyond the ionization front. Such a code needs a vast amount of atomic and molecular data. Cloudy is continually being developed to improve the treatment of the microphysical processes and the database of fundamental data that it uses. In recent years we have been focusing on improving our predictions at high densities. In my lecture I will discuss the difficulties that exist when modeling high-density gas and how we are developing the code to tackle these issues. I will also discuss the experimental mode in Cloudy to model gas that is not in steady-state equilibrium. Finally I will discuss some aspects of the long-term development of the code.

Invited Lecture

OBSERVATIONAL TESTS OF GENERAL RELATIVITY AND ALTERNATIVE THEORIES OF GRAVITY WITH GALACTIC CENTER OBSERVATIONS USING CURRENT AND FUTURE LARGE OBSERVATIONAL FACILITIES

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Now there are two basic observational techniques to investigate a gravitational potential at the Galactic Center to prove a presence of a supermassive black hole, namely, (a) monitoring the orbits of bright stars near the Galactic Center with the largest telescopes; (b) measuring the size and shape of shadows around black hole giving an alternative possibility to evaluate black hole parameters with the Event Horizon Telescope. We discuss opportunities to test gravity theories with observations of bright stars at the Galactic Center. Recently, the joint LIGO - Virgo team not only discovered gravitational waves and binary black holes but also found an upper limit on graviton mass $m_g < 1.2 \times 10^{-22}$ eV (Abbott et al. 2016). We show that an analysis of bright star trajectories could constrain graviton mass with a comparable accuracy. We discuss opportunities to improve current estimates of graviton mass significantly with subsequent observations of Keck, VLT, GRAVITY, E-ELT and TMT and to reach a graviton mass estimate as low as $m_g < 5 \times 10^{-23}$ eV (Zakharov et al. 2018). We discuss recent GRAVITY results about gravitational redshift for S2 star near the pericenter passage. These results confirmed GR predictions for the Galactic Center. Therefore, such an analysis gives an opportunity to treat observations of bright stars near the Galactic Center as a useful tool to obtain constraints on the fundamental gravity law. We showed that in the future graviton mass estimates obtained with analysis of trajectories of bright stars would be better than current LIGO bounds on the value, therefore, based on a potential reconstruction at the Galactic Center we obtain bounds on a graviton mass and these bounds are comparable with LIGO constraints. Similarly, we could constrain a tidal charge for the black hole (Zakharov, 2018). Analyzing size of shadows around the supermassive black hole at the Galactic Center (or/and in the center of M87) observing with the Event Horizon Telescope one could constrain parameters of different alternative theories of gravity as well (Zakharov, 2019).

References

[1] Abbott, B. P. et al.: 2016, *PhRvL*, **116**, id.061102
[2] Zakharov, A. F., Jovanović, P., Borka, D. and Borka Jovanović, V.: 2018, *JCAP*, **04**, 050.
[3] Zakharov, A. F.: 2018, *Eur. Phys. J.*, C **78**, 689.
[4] Zakharov, A. F.: arXiv:1901.08343 [gr-qc].

Progress Reports

Progress Report

ON THE STARK BROADENING OF SOME Cr II SPECTRAL LINES IN PLASMA

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New electron-impact line widths for some Cr II multiplets have been calculated within the modified semiempirical (MSE) approach. Needed energy levels and radial integrals are calculated by different methods. The Stark widths are obtained as a function of temperature, for perturber density of 10^{17} cm^{-3} and have been compared with recent experimental, approximate formula of Cowley and semiclassical perturbation (SCP) approach results.

The obtained data will be included in the STARK-B database, which is part of the Virtual Atomic and Molecular Data Center VAMDC.

Progress Report

ATOMIC STRUCTURE OF THE CARBON LIKE ION Ca XV

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Energy levels, oscillator strengths and transition probabilities for the multicharged carbon like Ca XV ion have been calculated using the pseudo-relativistic Hartree-Fock (HFR) approach using the new Cowan atomic structure code 2018. Results have been compared with NIST datdabase and other calculated data.

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Progress Report

TIME SCALE VARIATIONS OF C IV AND Si IV P-CYGNI PROFILES IN THE UV SPECTRUM OF THE O-STAR HD 93521

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In this paper we study the UV C IV and Si IV P-Cygni profiles of the O-star HD 93521 in four different periods spanning a time interval of 16 years. Using GR model, we perform multicomponent fits to C IV and Si IV P-Cygni profiles, and we analyze both emission and absorption spectral lines to the individual components they consist of. We therefore resolve and study independently (a) the emission from the adjacent absorption and (b) the different components that compose both the emission and absorption profiles. By measuring the radial velocities, FWHMs, optical depths (at lines centers) and column densities of each individual emission and absorption component we probe the physical conditions, kinematics and time variability of each individual emitting/absorbing cloud in the line of sight. Finally, we examine the variability of the ratios of the column densities between the absorption and emission components that form the P-Cygni profiles. Our main goal is to test the distinction and independence of emission and absorption components indicating that the stellar wind, as in the case of quasar outflows, is not smooth and homogeneous but clumpy, consisting of emitting and absorbing clouds that form the complex P-Cygni profiles. Mutlicomponent fitting of C IV and Si IV P-Cygni profiles is performed using ASTA software built by the Astrophysical Spectroscopy Team of the University of Athens.

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Progress Report

POSSIBLE SUPERMASSIVE BINARY BLACK HOLE SIGNATURES IN SOME AGN

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Supermassive binary black holes (SMBBH) are expected as a final stage of a merging galaxies. Their orbiting in the core of galaxies should be very energetic phenomena, therefore one should expect to trace their signatures in some active galactic nuclei (AGN). By comparing their variability time scales in the observed light curves to expected orbiting time scales for measured black hole masses, in each object, it is possible to identify SMBBH candidates, and examine other the observational effects that could help identifying them in the future.

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Progress Report

X-RAY SPECTRAL PROPERTIES OF NARROW-LINE SEYFERT 1 GALAXIES IN THE 6DFGS

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Narrow-line Seyfert 1 galaxies (NLS1s) are a peculiar member in the active galactic nuclei (AGN) family. They exhibit a fast variability as expected for the small black hole mass and high accretion rate. In the soft X-ray band, NLS1s show strong soft X-ray excesses above the prediction of a single power-law, while in the hard X-ray band, they have steeper intrinsic spectra than BLS1s. Some fraction of NLS1s showing strong spectral variability below 2 keV and evident features around Fe K-shell at 6-8 keV, are classified as complex NLS1s (C-NLS1s), while the others are described as simple NLS1s (S-NLS1s), whose 2-10 keV spectra do not strongly deviate from a single power-law continuum. The difference between simple and complex NLS1s might be related to the X-ray flux state or the presence of the disk wind.

We present a detailed study of 11 NLS1s from the Six-degree Field Galaxy Survey (6dFGS) with the *XMM-Newton* public data, and fit the X-ray spectra with a uniform analysis. These objects have new optical spectroscopy observations by the Las Campanas Observatory (LCO) in Chile. There are four C-NLS1s and four S-NLS1s. The others seem to be intermediate type objects filled the gap between C-NLS1s and S-NLS1s, which show absorption but variability. Our results support the view that the wind from the inner accretion disk is commonly existing in the NLS1s with high accretion rate. The X-ray spectral complexity and variability in C-NLS1s are due to the cool clumps in the slow wind. On the contrary, the wind in S-NLS1s is fast, the cool clumps and even the low ionization material could be blown away, thereby resulting in the X-ray spectral simplicity.

Progress Report

THE IMPACT OF IMPROVED STARK-BROADENING WIDTHS ON THE MODELLING OF DOUBLE-IONIZED CHROMIUM LINES IN EARLY-TYPE STARS

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Stellar atmosphere modeling and chemical abundance determinations require the knowledge of spectral line shapes. Spectral lines of chromium in various ionization stages are common in stellar spectra but detailed data on Stark broadening for them is scarce. Recently we reported on the first calculations of Stark widths for several 4s-4p transitions of double-ionized chromium, employing the Modified Semi-Empirical approach (MSE). In this work we present applications of the data to spectrum synthesis of Cr III lines in the ultraviolet region of early-type stars. The ATLAS9 model atmosphere code and the line-formation code SURFACE were used assuming local thermodynamic equilibrium. The impact of adopting the MSE broadening tables instead of approximate Stark broadening coefficients are investigated for a total of 56 Cr III lines visible in HST/STIS spectra of the B3 subgiant star Iota Hercules and the subdwarf B-star Feige 66.

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Progress Report

STARK BROADENING DATA FOR SPECTRAL LINES OF RARE-EARTH ELEMENTS: EXAMPLE OF Tb II, Tb III and Tb IV

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Strak broadening of rare-earth atom and ion spectral lines is of considerable importance in astrophysics due to rare-earth peak of abundance distribution of chemical elements. Consequently, a lot of spectral lines of these elements have been and will be observed in stellar spectra. The data on Stark broadening of rare-earth elements are scarse. It is worth to note that all existing Stark broadening data for lantanides have been determined by the scientists from Belgrade astronomical observatory. I will give an analysis of actual state of art and review the existing theoretical determination of Stark broadening parameters of spectral lines of rare-earth elements Sc, Y, La, Eu, Nb, Yb and Lu in various ionization stages. Also will be presented and discussed actual possibilities for further determination of Stark broadening parameters and discussed plans for further work in this research field. Additionally, I will discuss te actual state of their implementation in STARK-B database.

As an example I will show the existing experimental energy levels for Tb II, Tb III, Tb IV and Tb V and discuss the possibilities to use them for the calculations of Stark broadening parameters. Finally I will show new calculations of Stark widths of Tb II, Tb III and Tb IV using symplified modified semiempirical method (Dimitrijević and Konjević, 1987).

References

Dimitrijević, M. S., Konjević, N.: 1987, *A&A*, **172**, 345.

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Progress Report

SIMULATION CALCULATIONS OF HYDROGEN LINES SUBMITTED TO OSCILLATING ELECTRIC FIELDS

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The effect of oscillating electric field on spectral line shapes has a long history in plasma spectroscopy [1]. Such fields may be generated by an external source, such as a microwave generator or laser radiation, with the aim of diagnosing or heating the plasma. Oscillating electric fields may also be created in the plasma, since the long range of electric and magnetic fields in a plasma favor collective phenomena such as the development of fluctuations and oscillations. A frequently observed phenomenon is the excitation of a wave, which after amplification by an instability will rise above thermal fluctuations and become a propagating wave able to transport energy and information. As an example, Langmuir waves are ubiquitous in many types of laboratory, fusion, and astrophysical plasmas. Their effect on a spectral line shape has been studied since several decades by using approaches based on kinetic theory and retaining the quantum effects of the emitting particle [1]. For all these situations the effects predicted depend on the plasma conditions, and on the ratio W of the wave energy density to the thermal energy density $W = \varepsilon_0 E_L^2/4N_e k_B T$, with T and N_e the hydrogen plasma temperature and density, E_L the magnitude of the wave, k_B the Boltzmann constant, and ε_0 the permittivity of free space. Depending on such plasma parameters, the existing models predict modifications on the line shape, with changes in the widths or the appearance of satellites [1]. Starting with a plane wave having a random phase, we revisit the role of such waves on hydrogen lines by using a computer simulation [2,3] for averaging the emitter dipole autocorrelation function (DAF) over a set of initial phases and values of the oscillating electric field. We look particularly at how these parameters affect the response of the DAF and line shape at the oscillating frequency and its harmonics. By increasing the ratio W, we can explore the transition region from linear to nonlinear effect of single Langmuir waves. In particular, for conditions with W of the order of one or larger, the Langmuir waves couple with ion sound and electromagnetic waves, with the plane wave model being no longer valid, and one enters the wave collapse regime which requires a specific modeling [2,4]. We will present hydrogen Lyman and Balmer DAF and line shape calculations for plasma conditions found in laboratory plasmas, edge fusion plasmas and stellar envelopes.

References

[1] Lisitsa, V.: 1994, Atoms in plasmas, Springer, Berlin.
[2] Hannachi, I., Stamm, R., Rosato, J., Marandet, Y.: 2016, *EPL*, **114**, 2300.
[3] Hannachi, I., Meireni, M., Génésio, P., Rosato, J., Stamm, R., Marandet, Y.: 2017, *Atoms*, **5**,34.
[4] Hannachi, I., Meireni, M., Rosato, J., Stamm, R., Marandet, Y.: 2018, *Contrib. Plasma Phys.*, **58**, 583.

Progress Report

COLLISONAL CONTRIBUTION TO THE SPECTRAL LINE SHAPE IN MAGNETIZED PLASMAS

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The collisional contribution to the spectral line shape is modified by the presence of the magnetic field, in the case of electron perturbers, the resolution of the stochastic equation is based on the theory of impact of the interaction [1]. In the standard model, the emitter is subjected to a succession of independent collisions carried out by the electrons. The effect of the free electrons is presented by a phenomenological operator of electronic collisions [2], which can be calculated by the method of relaxation. This collision operator $\Phi(v, B)$ must take into account the influence of the magnetic field on the collision: the trajectory of the perturbers is modified in the presence of the magnetic field, as well as the velocity distribution function of the latter. In the standard models of the calculation of the Spectral line shape the influence of the magnetic field on the curvature of the trajectories of the charged particles is neglected, we made a detailed discussion by which we demonstrated, that we presence of magnetic field, this approximation is valid only when one is in the range where the radius of Larmor ω_L is greater than the length of Debye λ_{D} (laboratory plasmas), for the remaining of the cases, especially at densities Ne$<10^{14}$ cm^{-3} and for very strong fields B about 10^5 G (astrophysical plasmas) the influence of the curvature of the trajectories is not negligible and then you have to take it into account. We have therefore proposed a model of the collision operator in the presence of the magnetic field in order to give a more realistic image of the line profiles. Our collision operator model is proposed in the presence of the magnetic field and includes fine structure in the general case in the absence of any approximations. To validate and close this work, we present our computational results with and without the magnetic field. These calculations will provide a useful reference for testing the numerical development for arbitrary spectral line shape to enable the diagnosis of several plasma parameters, also this study makes it possible to specify the domains of validity of the different theories.

References

[1] Nguyen-Hoe, Drawin, H. W., Herman, L.: 1967, *JQSRT*, Vol. **7**, 429-474.
[2] Rosato, J., Marandet, Y., Peiffer, A., Capes, H., Godbert-Mouret, L., Koubiti, M., Stamm, R.: 2014, *Contrib. Plasma Phys.*, **54**, 565.

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Progress Report

MUSE OBSERVATIONS OF THE MERGING AGN SYSTEM NGC6240

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We present 3-D spectroscopic observations of NGC6240 with a spatial resolution of 0.1 arcsec. They were obtained with the MUSE instrument in the Narrow-Field Mode (NFM) and with the four-laser adaptive optics system of ESO's Very Large Telescope. NGC6240 is a merging system containing two active nuclei based on their radio and X-ray observations.

Progress Report

PERIODICITY DETECTION IN THE BROAD LINE AND CONTINUUM LIGHT CURVES OF ACTIVE GALACTIC NUCLEI

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A large number of objects in the Universe, most likely those with accreting processes in the background, can show a pronounced and random variation of brightness. A random nature of the brightness variability hides, and thus makes it difficult to detect possible weak periodic signals. The active galactic nuclei (AGN) are among the most powerful sources of this type, whose periodicity can point on the existence of binary black hole systems, and thus marks a possible origin of the gravitational waves. For that reason, it is needed in modern astrophysics to develop tools for detection of periodic variability in AGN' s emission. Here we will present a new method, which we developed for the purpose of finding periodicity in the broad line and continuum light curves of AGN, which can be also used in the case when periodic variability of the AGN brightness is covered by other, aperiodic, variations. We will show the most interesting results, but we will also mention some challenges we face in this area of research.

Progress Report

EXTENDED IONIZED-GAS STRUCTURES IN SEYFERT 2 GALAXY MRK 78

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A detailed study of extended emission-line regions (EELRs) related to AGNs in early-type galaxies is interesting to probe the history of the AGN ionization activity and also to understand the process of the external gas accretion. In this work, we present the observations of the EELR in Mrk 78 obtained at the 6-m Russian telescope. The gas kinematics and ionization state were considered using the long-slit and 3D spectroscopy data to understand the origin of gas structures.

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Book of Abstracts, Eds. D. Ilić, E. Stambulchik, A. Kovačević and L. Č. Popović
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Progress Report

THE MID-INFRARED AND OPTICAL SPECTRAL LINE PARAMETERS FOR NLS1 AND BLS1 OBJECTS

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Mid-infrared (MIR) spectra from Spitzer Space Telescope and optical spectra from Sloan Digital Sky Survey (SDSS) are used to derive various spectral line parameters that characterize AGNs, such as the policyclic aromatic hydrocarbons (PAH) strength and the parameters of broad and narrow line region of AGN (BLR and NLR, respectively). The connection of optical and MIR data is significant, although not always present, as MIR radiation comes from the torus and NLR, while optical data are from the BLR and NLR. Some parameters show the different correlations for narrow than for broad line AGNs (NLS1 and BLS1). That complements the known list of peculiarities of NLS1s. Here we discuss some assumptions that could describe observed condition, such as black hole growth and the inclination angle of BLR. This is a further step toward the understanding of geometry of AGNs.

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Progress Report

VARIABILITY OF Si IV AND C IV BROAD ABSORPTION AND EMISSION LINES OF WOLF-RAYET STARS, CATACLYSMIC VARIABLES, HOT EMISSION STARS AND QUASARS USING GR MODEL AND ASTA SOFTWARE

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In this paper using GR model and ASTA software, built by the Astrophysical Spectroscopy Team of the University of Athens, we perform multicomponent fits and analyze the complex emission and absorption lines in the spectra of a BAL Quasar, a Hot Emission Star, a Wolf-Rayet and a Cataclysmic Variable. We are thus able to study the radial velocity, the optical depth, the FWHM and the column density of the components that compose the complex absorption and emission spectral lines. Utilizing two epoch spectra of each object we probe the kinematics, physical conditions and time variability of each individual emission and absorption component that contribute to the formation of P-Cygni profiles, ubiquitous in the UV spectra of these objects. We show that the outflows of the studied objects are far from being smooth and homogeneous but instead are clumpy and unstable. Finally, we present the ability of our model and software to resolve the complex P-Cygni profiles of different types of astronomical objects.

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Progress Report

REGULARITIES AND SYSTEMATIC TRENDS ON Lu III STARK WIDTHS

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Regularity and systematic trend analysis has been performed on the Stark widths of 27 Lu III spectral lines calculated elsewhere by modified semiempirical method. Possible correlation of those Stark widths with corresponding effective principal quantum numbers or effective potentials have been also considered and discussed. Results obtained in such a way can be used for quick estimate of some other unknown Stark width data for the ions in the same homologous or isoelectronic sequence, especially if the conditions are not satisfied to use more accurate theoretical methods.

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Progress Report

QUASAR EMISSION LINES AS VIRIAL LUMINOSITY ESTIMATORS

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Quasars accreting matter at very high rates (known as extreme Population A [xA]) may provide a new class of distance indicators covering cosmic epochs from present day up to less than 1 Gyr from the Big Bang. We report on the developments of a method that is based on "virial luminosity" estimates from measurements of emission line widths of xA quasars. The approach is conceptually equivalent to the virial estimates based on early and late type galaxies. The main issues related to the cosmological application of luminosity estimates from xA quasar line widths are the identification of proper emission lines whose broadening is predominantly virial over a wide range of luminosity, and the assessment of the effect of the emitting region orientation with respect to the line of sight. We report on recent developments concerning the use of the AlIIIλ 1860 intermediate ionisation line and of the Hydrogen Balmer line Hβ as "virial broadening estimators."

Progress Report

POLARIZATION EFFECTS IN LASER-INDUCED PLASMA LASERS

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A prominent lasing effect in laser-induced plasmas (LIP) of various species has been recently demonstrated, with the aluminum LIP studied in most detail. It is found that at any resonant pumping of Al atoms from the $3s^2 3p(^2P)$ doublet states, the lasing is observed at either 394.4 nm or 396.2 nm (transitions $3s^2 4s(^2S_{1/2}) \rightarrow 3s^2 3p(^2P_{1/2})$ and $3s^2 4s(^2S_{1/2}) \rightarrow 3s^2 3p(^2P_{3/2})$, respectively). The polarization properties of the lasing light are studied, finding that the polarization degree strongly varies depending on the pumping transition chosen. Furthermore, it is shown that the polarization degree can be reliably controlled by applying a relatively weak ($\sim$0.2 T) external magnetic field. The results of a theoretical modeling closely match the experimentally observed phenomena.

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Progress Report

THE SPECTRAL CHANGES AND BLR KINEMATICS OF ERUPTIVE CHANGING LOOK AGN

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Optical changing look AGN exhibit changes of their spectral type from Sy-1 to Sy-2 or vice versa. Interestingly, these changes may happen on time scales of weeks to months and are often accompanied by outburts in several frequency regimes. However, despite increasing interest in this topic, the cause for the changig look phenomenon is still unknown. Therefore, line profile studies of these eruptive spectral changes offer unique insight into AGN variability and allow – in combination with spectroscopic reverberation mapping – to determine the BLR kinematics. Here we present results of recent spectroscopic variability campaigns for HE 1136-2304 and NGC 1566 which exhibited outbursts in July 2014 and July 2018, respectively.

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Progress Report

A NEW METHOD TO FIT LINE PROFILES FROM PLASMA WITH A SUM OF VOIGT PROFILES

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In recent years, Atomic Emission Spectroscopy techniques have been shown to be an excellent tool to determine plasma characteristic magnitudes. Among atomic emission lines, Hydrogen Balmer series lines are the most used. These lines are the result of the internal processes contributing to the total width of a spectral line in an independent manner. While most of these processes can be described in terms of analytical functions, this is not the case of the Stark broadening of Hydrogen lines, because of joint action of electrons and ions which influence differently due to large difference in masses. To date, analytical functions have been proposed for the Stark profiles of the H_α line and for the H_β line (Díaz-Soriano et al. 2018a,b). These functions are convoluted with those of the other internal processes in order to compare with the experimental profile. However, this procedure requires a large amount of computational effort. In this paper, a new fit procedure for line profiles from plasma has been proposed, based on the presentation of the experimental profile as a sum of Voigt profiles, which are computed by means of the Faddeeva function.

References

Díaz-Soriano, A., Alcaraz-Pelegrina, J. M., Sarsa, A., Dimitrijević, M. S., Yubero, C.: 2018a, A simple and accurate analytical model of the Stark profile and its application to plasma characterization. *J. Quant. Spectrosc. Radiat. Transfer*, **207**, 89.

Díaz-Soriano, A., Dimitrijević, M. S., Alcaraz-Pelegrina, J. M., Sarsa, A., Yubero, C.: 2018b, Simple and analytical function for the Stark profile of the Hα line and its application to plasma characterization, *J. Quant. Spectrosc. Radiat. Transfer*, **217**, 111.

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Progress Report

MAIN TRENDS OF THE MAIN SEQUENCE – THE CRUCIAL EFFECT OF VIRIAL FACTOR

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We address the effect of orientation of the accretion disk plane and the geometry of the broad line region (BLR) in the context of understanding the broad distribution of quasars. We utilize photoionization code CLOUDY to model the BLR in the context of Quasar Main Sequence, incorporating the grossly underestimated virial factor (f). Treating the aspect of viewing angle appropriately, we re-discover the dependence of the RFe sequence on L/LEdd ratio and the related observational trends - as a function of the SED shape, cloud density and composition, verified from prior observations. Sources with RFe in the range 1 – 2 (about 10% of all quasars, the so-called extreme Population A [xA] quasars) are explained as sources of high, and possibly extreme Eddington ratio along the RFe sequence. This result has important implication for the exploitation of xA sources as distance indicators for Cosmology. FeII emitters with RFe > 2 are very rare (<1 % of all type 1 quasars). Our approach also explains the rarity of these highest FeII emitters as extreme xA sources.

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Progress Report

VARIABILITY IN SUPER MASSIVE BLACK HOLE BINARIES

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Super massive black hole binaries (SMBHB) at subpc scale cannot be spatially resolved, therefore, spectroscopic observations of SMBHB candidates is a way to detect such systems. Here we present a study about possibility to detect SMBHB systems using spectral observations in the optical spectral band (around Hβ line). We made a SMBHB model where both components have accretion disks and broad line regions (BLRs) inside the Roche lobes which followed central black hole motion. Additionally, we assume that the system is surrounded with circum binary region which also can emit broad lines.

We explore spectral variability in H_β line and continuum at $\lambda = 5100\mathring{A}$ for SMBHB taking different parameters of binary systems. We show that most of line variation coming from orbital dynamics of the black holes, and that continuum variability is present only in cases when components have higher masses ($\sim 10^8$). The emitted flux from SMBHB is periodical, but the periodicity can be clearly seen in the case of high signal-to-noise (S/N) ratio.

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Progress Report

VARIABILITY OF EMISSION LINES OF LARGE SAMPLE OF TYPE 1 AGN FROM THE SDSS-RM PROJECT

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Time domain astronomy is highly important in understanding the nature of variable objects. Time variability of spectral characteristics holds essential information about the source physics. Here we present preliminary results of our investigation of spectral characteristics in a large sample of type 1 AGNs taken from the long-term monitoring campaign SDSS-RM project. The special attention of our research is dedicated to intrinsic Baldwin effect, an anticorrelation between the equivalent width of emission line and the flux of underlying continuum. This effect in spite huge amount of effort is still not well understood.

Progress Report

MODELING THE BROAD EMISSION LINE POLARIZATION IN ACTIVE GALACTIC NUCLEI

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Broad emission lines in Active Galactic Nuclei (AGNs) hold important clues to the key parameters that drive nuclear activity. With the current observing technology, it is not possible to directly resolve the central structure of AGNs. Spectropolarimetry of broad emission lines in AGNs allows us to indirectly probe the geometry and kinematics of the central engine as well as independent way of estimating the masses of supermassive black holes. We use 3D radiative transfer code STOKES for modeling scattering induced polarization of Mg II, Hβ and Hα broad emission lines. Several cases of complex motions such as outflows are treated in addition to Keplerian motion.

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Progress Report

THE INTRADAY VARIABILITY OF THE POLARIZATION VECTOR DIRECTION IN AGN S5 0716+714

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The bright radio source S5 0716+714, which is usually classified as a BL Lac object, is one of the most intensively studied blazar. S5 0716+714 demonstrates extremely peculiar properties, such as the shortest time-scale of optical and polarimetric variations observed in blazars. In the given talk, we present the results of a 9-h polarimetric monitoring of S5 0716+714 with a ∼70-s resolution carried out using the 6-m telescope BTA of the SAO RAS. The observation data analysis reveals the variability both in total and polarized light on the 1.5-hour timescales that specifies the size of the unresolved emitting region. The numerical model of polarization in jet with helical structure of magnetic field is suggested, and fitting the model reveals a magnetic field precession with a period T≈15 d.

Progress Report

ON THE SPECTRAL SHAPES OF Ne II LINES RECORDED FROM THE CATHODE FALL REGION OF AN ABNORMAL GLOW DISCHARGE

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We present an iterative kinetic model of the cathode-fall region in an abnormal glow discharge of pure neon, which enables determination of the distribution of electric field strength E, the distribution of the number densities of Ne atoms and Ne^+ ions together with the spectral shapes of Ne I and Ne II lines recorded end-on and side-on at various distances from the cathode. We compare our model predictions with corresponding experimental electric field strength distributions determined from Ne I 515.443 nm line recorded side-on under same experimental conditions. These Ne I line recordings enable experimental determination of the electric field distribution via measurement of the Stark shift $\Delta\lambda$ and by using the Stark shift coefficient C in a well known quadratic relation $\Delta\lambda = -\lambda^2 CE$; the value of C is reported in Ivanović et al. 2017. Furthermore, we compare the model prediction for the shape of Ne II 371.308 nm spectral line which serves as a test for validity of our theoretical model.

References

Ivanović, N. et al.: 2017, *J. Phys. D: Appl. Phys.*, **50**, 125201.

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Progress Report

CHEMI-IONIZATION/RECOMBINATION PROCESSES IN THE BROAD-LINE REGION OF AGNs

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The importance of Chemi-ionization processes in $H^*(n) + H(1s)$ collisions in AGN BLR clouds has been investigated. These processes must have influence on ionization and the populations of hydrogen highly excited atoms in moderately ionized layers of dense parts of the BLR clouds. From the results it follows that these investigated processes are of interest for the research and modelling of such medium. The obtained results could be also useful for modeling of different stellar atmospheres, as well as for the investigation of Rydberg states of hydrogen and for the study of their influence during the cosmological recombination epoch (se e.g. Mihajlov et al. 2011).

References

Mihajlov, A. A., Ignjatović, L. M., Srećković, V. A., Dimitrijević, M. S.: 2011, *ApJS*, **2**, 193.

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Progress Report

TOWARDS A NEW PARADIGM OF DUST STRUCTURE IN AGN: CIRCINUS GALAXY AND BEYOND

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Recent observations which resolved the mid-infrared (MIR) emission of nearby active galactic nuclei (AGN), revealed that their dust emission appears prominently extended in the polar direction, at odds with the expectations from the canonical dusty torus. This polar dust, tentatively associated with dusty winds driven by radiation pressure, is found to have a major contribution to the MIR flux from scales of a few to hundreds of parsecs. When facing a potential change of paradigm, case studies of objects with the best intrinsic resolution are essential. One such source with a clear detection of polar dust is a nearby, well-known AGN in the Circinus galaxy. Motivated by observations across a wide wavelength range and on different spatial scales, we proposed a phenomenological model consisting of a thin dusty disk and a large-scale polar outflow in the form of a hyperboloid shell. With detailed radiative transfer modeling, we demonstrated that such a model is able to explain the peculiar MIR morphology on large scales seen by VLT/VISIR and the interferometric data from VLTI/MIDI which probe the small scales. In contrast, while providing a good fit to the integrated MIR spectrum, the dusty torus model fails to reproduce the spatially resolved interferometric data. Our results call for caution when attributing dust emission of unresolved sources entirely to the torus and warrant further investigation of the MIR emission in the polar regions of AGN. We put forth the disc + wind model of Circinus as a prototype for the dust structure in the polar dust AGN population.

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Progress Report

SATELLITE SPECTRA FOR HYDROGEN PERTURBED BY OSCILLATING FIELDS

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A simple case for studying the effect of oscillating electric field on spectral line shapes in a plasma consists in taking a fixed magnitude E_0 for the perturbing electric field $E_0\cos(\omega t+\varphi)$, with ω and φ the frequency and phase of the field. Such a situation is observed in many laboratory plasmas when the oscillating field is created by external power systems in various electromagnetic frequency bands such as found with microwave generator (VHF, UHF, or microwaves), or laser radiation. For such a field, one expects the observation of a Blochinzew spectra [1], consisting of satellites separated by multiples of the oscillation frequency ω. Using a simple model, we will study on Lyman lines the conditions which are required for observing such a spectra in various plasma conditions.

References

[1] Blochinzew, D. I.: 1933, *Phys. Z. Sov. Union*, **4**, 501.

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Progress Report

THE MULTICOMPONENT NATURE OF Lyα, N V, Si IV, C IV BALS OF J131912.39+534720.5

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In this paper we report the discovery of a Broad Absorption Line (BAL) Quasar whose Lyα, N V, Si IV and C IV BALs consist of the same number of components. Utilizing two epoch spectra of J131912.39+534720.5, from the Sloan Digital Sky Survey (SDSS), we perform multicomponent fits to Lya, N V, Si IV and C IV BALs and BELs forming P-Cygni profiles. We analyze each BAL trough to nine doublets. Our model and the fitting criteria we impose during the fitting process guarantee that the number of doublets, each BAL trough is analyzed into, as well as the calculated physical parameters (radial velocities, optical depths, FWHMs) are uniquely determined. By resolving the high ionization BAL troughs into multiple components we study individually each absorbing system in the line of sight and probe its variability in a time interval of ten years. Finally, we investigate the correlation between BAL and BEL variability. Our results suggest that Lyα, N V, Si IV and C IV BALs arise from the same clumpy gas clouds having similar locations, kinematic structure and physical conditions, indicating that quasar winds are far from being smooth and homogeneous. Finally, our findings suggest that variations exhibited by individual absorption components are due to changes in the ionization state of the outflowing gas.

Progress Report

THE INFLUENCE OF THE MAGNETIC FIELD ON THE ELECTRIC PROPERTIES IN WARM AND HIGH DENSE PLASMA

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We presented the theoretical formulas of longitudinal and transverse permittivities, as well as the dispersion law in the case of high temperature and highly extremely dense plasma. On the other hand, we found the electrical permittivity in a relativistic classical plasma. So we have used the distribution of Maxwell_Juttner that is more accurate for this kind of plasma. We obtained the corresponding dispersion curves. We can say that the imaginary part of our result is in good agreement with existing theoretical results.

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Progress Report

EXPLORING THE POTENTIAL OF ASTA SOFTWARE IN ANALYSING BROAD EMISSION AND ABSORPTION LINES

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In this work we present a method for the analysis of emission lines of various astronomical objects, such as Wolf Rayet, Cataclysmic Variable, O, B, Oe, Be stars and quasars, using ASTA software. We focus on spectra in which emission lines are blended with adjacent broad absorption lines forming P-Cygni type profiles. We highlight the ability of the suggested method not only to deblend the emission from the absorption profiles and study them independently but also to analyze these profiles to the individual components they consist of. We are thus able to study each individual emitting/absorbing system in the line of sight and probe its variability in time. We outline the advantages of the suggested method in investigating the variability of individual absorption and emission components of various astronomical objects compared to current complex profile analysis methods. Our recent research work is focused on: (i) The importance of analyzing both emission and absorption lines by using two new mathematical distributions developed by our team, Rotation (R) and Gauss-Rotation (GR). (ii) a new method of measuring the column density of each individual absorption/emission component and probe its time variability between different epochs. Multicomponent fitting of emission/absorption lines have been carried out using ASTA software, a spectral analysis software for displaying, fitting and analyzing astronomical emission and absorption spectra developed by our team.

Progress Report

EMISSION-LINES OF THE DWARF ELLIPTICAL GALAXY NGC 185

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Here we will present spectral observations of a dwarf elliptical galaxy NGC 185, which, in spite of its classification, exhibits signs of significant amount of gas, dust and recent star formation. Narrow band optical photometry showed presence of 12 emission line objects - PNe, SNR candidates and diffuse ionized gas. Spectral follow-up observations of selected objects were done with the SCORPIO multi-mode spectrograph at the 6-m telescope at Special Astrophysical Observatory of the Russian Academy of Science, both in low (FWHM $\sim$500 km s^{-1}) and high (FWHM $\sim$120 km s^{-1}) resolution modes. We revealed the enhanced [SII]/Hα and [NII]/Hα line ratios in several objects, as well as high expansion velocities of the observed nebulae in the central part of the galaxy, indicating their nature as SNRs.

Posters

XII SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
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Faculty of Mathematics, University of Belgrade, 2019

Poster

QUANTUM-MECHANICAL CALCULATIONS OF Ar XVI LINE WIDTHS

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Stark broadening and atomic data calculations have been developed for the most recent years, especially atomic and line broadening data for highly ionized ions of argon. The Lithium iso-electronic sequence ions are of considerable importance in astrophysical confined plasmas, and many of their emission lines are frequently observed in solar flares [1]. These ions are of additional interest in fusion reactors, such as TEXTOR specially the fifteen-time ionized argon (Ar XVI) [2].

The aim of the present work is to perform calculations of Stark broadening for 10 lines for the Ar XVI ion. Calculations have been performed at electron density $N_e = 10^{20}$ cm^{-3} for electron temperature varying from 7.5×10^5 to 7.5×10^6 K. Calculations have been performed using our quantum mechanical approach [3,4]. No Stark broadening results in the literature to compare with. So, our results come to fill this lack of data.

Along our calculations, radiative atomic data (energy levels, line strengths, oscillator strengths and radiative decay rates) for this ion have been calculated using the University College London (UCL) codes (SUPERSTRUCTURE, DISTORTED WAVE, JAJOM). Our Ar XVI results have been compared with other results and good agreement has been found.

References

[1] Thomas, R. J., Neupert, W. M.: 1994, *Astrophys. J. Suppl.*, **91**, 461.
[2] Rosmej, F. B. et al.: 1999, *Plasma Phys. Control. Fusion*, **41**, 191.
[3] Elabidi, H., Ben Nessib, N., Sahal- Brchot S.: 2004, *J. Phys. B: At. Mol. Opt. Phys.*, **37**, 63.
[4] Elabidi, H. et al.: 2008, *J. Phys. B: At. Mol. Opt. Phys.*, **41**, n^o 025702.

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Poster

ON THE ATOMIC AND COLLISIONAL STRUCTURE OF THE ION Sc XVI

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We present the main results of our investigations of the atomic and collisional structure of the Sc XVI ion. The results have been theoretically determined by the Thomas-Fermi-Dirac-Amaldi potential (TFDA) approach using the AUTOSTRUCTURE atomic structure code. We have calculated energy levels, oscillator strengths and collisional strengths of the carbon-like Sc XVI ion. Our calculations are compared with other theoretical and experimental results. Trends of these parameters according to the ion charge are also studied.

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Poster

DETERMINATION OF THE ION TEMPERATURE IN A HIGH-ENERGY-DENSITY PLASMA USING THE STARK EFFECT

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We present experimental determination of the ion temperature in a neon-puff Z-pinch. The diagnostic method is based on the effect of ion coupling on the Stark lineshapes. It was found, in a profoundly explicit way, that at stagnation the ion thermal energy is small compared to the imploding-plasma kinetic energy, where most of the latter is converted to hydromotion. The method here described can be applied to other highly non-uniform and transient high-energy-density plasmas.

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Poster

AGN FEEDBACK IN OPTICAL LINES: [O III] PROPERTIES IN FLAT-SPECTRUM RADIO QUASARS AND NARROW-LINE SEYFERT 1

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Blazars are a well-known class of active galactic nuclei (AGN) which harbors a relativistic jet pointed toward Earth, and source of electromagnetic emission from radio to γ rays. Blazars are divided into two classes, BL Lacertae objects (BL Lacs) and flat-spectrum radio quasars (FSRQs). This division, from a physical point of view, corresponds to an efficient accretion mechanism onto the black hole and a dense circumnuclear environment in FSRQs, and inefficient accretion and sparse environment in BL Lacs. The gas- and photon-rich environment of FSRQs produces prominent emission lines, very similar to those observed in other type 1 AGN. Finally, a third class of blazars is that of flat-spectrum radio-loud narrow-line Seyfert 1 (NLS1s). Identified as γ ray emitters after the launch of the Fermi Satellite, they are commonly believed to be a small-scale and low-power version of FSRQs.

One of the most prominent optical emission lines is the [O III]λ5007 line. This line can provide important information about the physics of the narrow-line region (NLR), and about its interaction with the relativistic jet. Usually, the [O III] line can be efficienly modeled with two gaussian components. The first one represents the line core, that is the ionized gas at the same redshift as the host galaxy. The second one, called blue wing, represents instead an outflow component. In some cases, the whole line is shifted toward lower wavelength by more than 150 km s^{-1}, indicating the presence of a bulk outflowing motion in the NLR. Such sources, known as blue outliers, are fairly common among NLS1s. But what about FSRQs?

To study the presence of blue outliers among FSRQs and the [O III] kinematics, we selected a sample of γ-ray FSRQs whose spectrum is included in the SDSS, and analyzed their optical spectra. We also compared the results with a similar study carried out on NLS1s. Our results show that the NLRs of FSRQs and NLS1s are significantly different. In particular, blue outliers are much more common among NLS1s. In this poster we will present this and other results of our analysis, and provide a physical explanation that accounts for the observed properties.

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Poster

PROBLEMS OF AUTOMATIC IDENTIFICATION OF EXTREME ACCRETING SOURCES

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Quasars that are found to radiate close to their Eddington limit might be used as distance indicators detectable at higher redshifts. We call them extreme Population A quasars (xA). These quasars show extremely strong FeII emission. On the other hand, there are quasars with strong contribution of stellar populations in its host galaxy that can mimic the FeII emission. Here we identify and discuss the properties of sources whose spectra mimic xA spectra to the point of creating problems in automatic identification procedures of xA sources. The risk is that they may be included in the sample of xA sources, and therefore mislead the inferences from true xA sources in cosmology studies.

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Poster

ON SOME ASPECTS OF GALACTIC FEATURELESS-SPECTRUM SOURCES

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The problem of direct detection of a black hole event horizon still remains unresolved. Isolated stellar-mass black holes could be ideal objects for solving this problem, since the event horizon would not be screened by the surrounding interstellar plasma due to its low accretion rate. Theories predict that isolated black holes should exhibit featureless flat spectra covering the entire electromagnetic range. Sources classified as DC dwarfs, which demonstrate featureless spectra with no lines, are among such galactic sources, and they constitute a good sample for searching for possible black hole candidates among them. We analyze sources with available spectral, photometric, and proper motion data which fit the selection criteria to further differentiate between truly featureless spectra and low signal-to-noise ratio spectra with possible lines in order to distinguish between actual white dwarfs and isolated stellar-mass black hole candidates. We discuss how excluding the possibility of lines in the spectrum can point to sources of interest and use several examples to demonstrate the selection criteria for possible black hole candidates.

Poster

STARK BROADENING OF B I SPECTRAL LINES

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Calculations of the Stark broadening parameters of neutral boron spectral lines have been presented. The work is based on the semi-classical theory developed in Sahal-Bréchot (1969a,b). Experimental values of energy levels in Kramida amd Ryabtsev (2007) have been applied.

References

Sahal-Bréchot, S.: 1969a, Impact theory of the broadening and shift of spectral lines due to electrons and ions in a plasma, *A&A*, **1**, 91-123.

Sahal-Bréchot, S.: 1969b, Impact theory of the broadening and shift of spectral lines due to electrons and ions in a plasma (continued), *A&A*, **2**, 322-354.

Kramida, A. E., and Ryabtsev, A. N.: 2007, A critical compilation of energy levels and spectral lines of neutral boron, *Phys. Scr.*, **76**, 544557.

Poster

STARK BROADENING OF SPECTRAL LINES WITHIN $3s^5S^o$-$3p^5P$ MULTIPLET OF NEUTRAL OXYGEN

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Theortetical and experimental consideration of Stark broadening of spectral lines within O I $3s^5S^o$-$3p^5P$ transition important for plasma diagnostic will be presented. The theoretical calculations are performed on the basis of the semi-classical theory developed in Sahal-Bréchot (1969a,b).

References

Sahal-Bréchot, S.: 1969a, Impact theory of the broadening and shift of spectral lines due to electrons and ions in a plasma, *A&A*, **1**, 91-123.

Sahal-Bréchot, S.: 1969b, Impact theory of the broadening and shift of spectral lines due to electrons and ions in a plasma (continued), *A&A*, **2**, 322-354.

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Poster

THE (n-n')-MIXING PROCESSES IN THE HYDROGEN CLOUDS IN BROAD-LINE REGION OF AGNs

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The role of $(n - n')$-mixing processes (Mihajlov et al. 2011) in $H^*(n) + H(1s)$ collisions in AGN BLR clouds has been investigated. Our investigation indicates that these processes must have influence on the populations of hydrogen highly excited atoms in moderately ionized layers of dense parts of the BLR clouds. From the results it follows that the investigated $(n - n')$-mixing processes are of interest for the research and modelling of such medium. The obtained results could be also useful for modeling of different stellar atmospheres, as well as for the investigation of hydrogen Rydberg states.

References

Mihajlov, A. A., Ignjatović, L. M., Srećković, V. A., Dimitrijević, M. S.: 2011, *ApJS*, **2**, 193.

Poster

ON THE SEMICLASSICAL PERTURBATION STARK SHIFTS OF Ar II SPECTRAL LINES

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Using semiclassical perturbation approach in impact approximation, Stark shifts for singly charged argon (Ar II) spectral lines have been calculated as a function of temperature for 300 spectral lines for collisions with electrons, protons, singly charged helium and singly charged argon. Energy levels and oscillator strengths needed for this calculation were determined using Hartree-Fock method with relativistic correction (HFR). We compared our results with experimental values for 175 spectral lines. In this contribution we will present and discuss a part of these results as an example. This work extends our previous one (Hamdi et al. 2018).

References

Hamdi, R., Ben Nessib, N., Sahal-Brchot, S., Dimitrijević M. S.: 2018, *MNRAS*, **475**, 800.

Poster

PHOTOIONIZATION OF THE Li_2^+, Na_2^+ and $LiNa^+$ MOLECULAR IONS IN ALKALI GEO-COSMICAL PLASMAS

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Opacities of the solar and other stellar atmospheres are naturally caused by a large number of radiative processes. For the development of more sophisticated stellar atmosphere models, it is needed further investigation of the known processes and the inclusion of all processes not considered before. Here, the strict quantum-mechanical method was used for the determination of the average cross-section for the photodissociation of the three alkali molecular ions Li_2^+, Na_2^+ and $LiNa^+$. We present the results of calculation in the tabulated form easy for further use with a particular accent to the applications for astrophysical plasma research and low temperature laboratory plasma created in gas discharges, where plasma conditions may be favorable for processes investigated here.

Poster

THE BROAD LINE REGION PHYSICS IN ACTIVE GALAXIES: ATOMIC PROCESSES IN THE SUPERMASSIVE BLACK HOLE VICINITY

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Active Galactic Nuclei (AGNs) are an ideal laboratory to study the physics of the ionized gas in extreme conditions that are hardly reproduced on Earth. Notwithstanding the fact that AGNs are known and studied since several decades, the physics of the ionized gas, and in particular of the BLR, is still poorly understood. In order to develop and improve diagnostic methods needed for the estimation of the physical conditions in the particular parts of AGNs the investigation of the influence of various relevant atomic and molecular collisional processes is needed. This is particularly significant for better estimate of the hydrogen Balmer lines fluxes, which usage for effective temperature diagnostics in astrophysical plasma is limited by errors from the line formation models and uncertainties in used atomic data of hydrogen atom and inelastic collisions. The aim of this contribution is to go deep in the physics of AGN, to investigate some atomic ionization and excitation processes and revise their role.

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Poster

MACHINE LEARNING AND THE QUASAR EMISSION LINE PROPERTIES

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Quasars are extremely bright objects with rapidly accreting supermassive black hole at their center. They exhibit a wide range of spectral characteristics and by studying them we can learn about the physical conditions in these extreme environments. Surveys of large number of quasars showed that there is a correlation between some of their spectral parameters. The parameter space with the strongest correlation found between parameters is called Eigenvector 1, where many properties correlate with the strength of optical iron and [OIII] emission. These correlations were found using mathematical tools such as principal component analysis (PCA) which is an unsupervised machine learning algorithm. One of the results obtained by applying PCA was the existence of the quasar "main sequence" which shows a strong correlation between FWHM of Hβ line and equivalent width of FeII emission line. It is thought that the driving force behind this correlation is the accretion rate. PCA and other machine learning algorithms can be applied on the data from widely available databases such as Sloan Digital Sky Survey. In this contribution we will apply different machine learning algorithms on large quasar spectral data sets with a goal to find possible correlations between spectral parameters and potentially describe a physical mechanism behind these correlations.

Poster

THE HIDDEN BROAD LINE REGION IN SPECTRA OF SEYFERT 2 GALAXIES

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We applied the Spectral Principal Component Analysis (SPCA) decomposition to the large sample of the Seyfert 2 galaxies, taken from Sloan Digital Sky Survey (SDSS) database, with S/N>20. After applying the SPCA, in the case of 48 objects, we found that beside stellar and AGN type 2 spectra, there are also hidden Broad Line AGN spectra, with continuum luminosity of 5-15 % of the total continuum luminosity and with very broad emission lines (average width $\sim$ 13000 km/s). We investigated the possibility that these weak broad emission lines represent the emission from hidden Broad Line Region, observed edge-on through clumpy torus structure.

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Poster

THE UV AND OPTICAL Fe II SEMI-EMPIRICAL MODELS AND THEIR APPLICATION FOR AGN TYPE 1 SPECTRA

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Here we presented our optical Fe II (4000-5500 Å) and the improved UV Fe II semi-empirical model in 2600-3200 Å range and discussed their application for AGN type 1 spectra. We compared our Fe II semi-empirical models with other empirical and theoretical UV and optical Fe II templates from literature, and analysed their differences. We tested how application of different Fe II templates affects to Hβ + optical Fe II and Mg II + UV Fe II decomposition, and consequently to obtained pure Hβ and Mg II shapes, after Fe II removing. We found that differences are small in the case of obtained Hβ profiles, while in the case of the Mg II line, they are larger, since the differences between considered UV Fe II templates are more significant.

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Poster

UNDERSTANDING OF THE STANDARD MODEL OF AGN THROUGH THE OPTICAL AND MID-INFRARED SPECTROSCOPY

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Some authors suggested that the difference between Narrow and Broad line Seyfert 1 galaxies might be only the consequence of the inclination angle of the Broad Line Region (BLR). We investigate the connection of various spectral optical and mid-infrared parameters with the inclination angle of active galactic nuclei (AGN), calculated on the basis of the standard model. The sample are close, well-explored AGNs, where the size of BLR is measured by the reverberation mapping. The black hole mass is estimated using methods other than the virial method. Other efforts to understand Narrow line Seyfert 1s are discussed as well.

Poster

THE CONNECTION BETWEEN BROAD Hβ RED ASYMMETRY AND GRAVITATIONAL REDSHIFT IN AGN TYPE 1

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Here we investigate connection between red asymmetry of the broad Hβ emission lines and gravitational redshift for the sample of 97 Type 1 Active galactic Nuclei (AGN). The spectra of these objects were obtained from SDSS DR12, with respect to following characteristics: wide range of object luminosity and remarkable red asymmetry of the broad Hβ emission line profiles. Also, we ensured to include in the sample only objects with the sigma (σ) value of host galaxy stellar component estimated in the literature. Since the spectral parameters, as the full width at half maximum (FWHM) of the broad Hβ and the σ of stars in a host galaxy, are indicators of the mass of a super-massive black hole nested in the very center of an AGN, we wanted to explore if there is correlation of these parameters with the broad Hβ red asymmetry, which is expected if the red asymmetry is related with the gravitational redshift mechanism. We found a strong correlation of the broad Hβ red asymmetry with the FWHM, and a weak correlation with the σ of stars. These results imply that the broad Hβ red asymmetry is probably connected with the gravitational redshift.

XII SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
June 3-7, 2019, Vrdnik, Serbia
Book of Abstracts, Eds. D. Ilić, E. Stambulchik, A. Kovačević and L. Č. Popović
Faculty of Mathematics, University of Belgrade, 2019

Poster

STARK BROADENING PARAMETERS USING SEMICLASSICAL METHOD OF SEVERAL S II MULTIPLETS

N. Milovanović and M. S. Dimitrijević

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Stark broadening of spectral lines is the dominant pressure broadening mechanism in hot, early-type, stars and white dwarf atmospheres. We present electron-, proton-, and helium-ion-impact broadening parameters for several S II multiplets occuring in stellar spectra using semiclassical method. Comparison of semiclassical method, modified semiclassical method, *ab inition* atomic parameters calculations using Cowan code and experimantal data are given.

Poster

HYDROGEN BALMER SPECTRAL LINES IN SPECTROSCOPY OF UNDERWATER ELECTRIC SPARK DISCHARGE PLASMA

A. Murmantsev[1], A. Veklich[1], V. Boretskij[1] and K. Lopatko[2]

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The behavior of the Balmer series spectral lines profiles in the underwater electric spark discharge plasma between copper granules is investigated. Specially developed pulse power source is used to initiate a discharge between copper granules immersed into the deionized water. Typical values of voltage are of [40, 200] V, current is up to 150 A and pulse frequency is in the range of [0.2, 2] kHz. The voltage, applied to electrodes, caused a current flow along the chain of closely arranged granules in the stochastic switching mode. Optical emission spectroscopy methods are used for diagnostics of such discharge plasma. Profiles of Hα and Hβ hydrogen lines, exposed to the Stark mechanism of spectral lines' broadening, are used to determine electron density. The Boltzmann plot of copper lines' intensities are used to determine the plasma temperature additionally.

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Faculty of Mathematics, University of Belgrade, 2019

Poster

X-RADIATION SPECTRA IMPORTANT FOR THE D-REGION IONIZATION DURING SOLAR X-RAY FLARES

A. Nina[1], V. Čadež[2], M. Lakićević[2] and L. Č. Popović[2]

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The terrestrial ionosphere is permanently exposed to solar radiation whose influence on processes in ionospheric plasma is space and time dependent. Namely, the radiation spectra, absorption in higher layers, total ionization cross-sections and ionospheric properties are not uniform in time and space. The resulting effects of the solar line and continuum radiation on the ionospheric plasma are very complex which requires studies based on adequate modeling and application of specific numerical tools in solving multi-parameter equations.

In this work we present a procedure for determination of time evolution of the X-radiation spectrum and influences of photons dominating in ionization processes in the ionospheric D-region during solar X-ray flares. We use real observational data obtained by the GOES satellite and very low frequency radio signal emitted in Germany and recorded in Serbia.

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Poster

VARIATIONS IN SAR AND GNSS SIGNAL PROPAGATIONS IN THE LOW IONOSPHERE DUE TO INCREASE IN INTENSITY OF SPECTRAL LINES AND CONTINUUM DURING SOLAR X-RAY FLARES

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Characteristics of the solar hydrogen Lyα and X lines, and X radiation continuum are very important for properties of the terrestrial ionosphere. Keeping in mind that these domains of the electromagnetic radiation can significantly affect electric properties of this atmospheric layer it is clear that variations in the incoming relevant radiation intensity affects propagation of electromagnetic waves including telecommunication and satellite signals.

In this study we analyze the influence of X-radiation increase on propagation of SAR (Synthetic aperture radar) and GNSS (Global Navigation Satellite System) signals within the ionospheric D-region during occurrence of solar X-ray flares. These signals play very important role for different types of practical applications including positioning, Earth observations etc. For this reason research of variation of spectral characteristic of solar radiation due to this astrophysical phenomenon is important not only for scientific studies but for life of people and their everyday activities to commercial applications.

Poster

SPECTRAL VARIABILITY OF THE SEYFERT 1 GALAXY WPVS 48

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Reverberation mapping is one of the most famous tools in the research on Active Galactic Nuclei (AGN). This method is based on the high variability of the AGN's continuum and its response in the emission lines on timescales of days and weeks to years. As the origins of the contributions from the continuum and the emission lines lie in different regions of the AGN, properties of the internal structure and the mass of the central black hole can be inferred. However, this method is very time-consuming, considering the amount of observation time required in order to receive robust data. Hence, reverberation mapping was applied to only some dozen galaxies. With this in mind, any additional application will support a profound understanding of AGN. In this case, optical data from the galaxy of type Seyfert 1 'WPVS 48' were taken at SALT during a campaign from November 2013 till June 2014. The continuum was observed in the wavelengths ranging from 4300Å to 7400Å. This includes the important emission lines Hα and Hβ. The results of this analysis will be presented.

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Poster

INFLUENCE OF SPIN-ORBIT INTERACTION ON LONG-RANGE POTENTIAL CURVES OF Cs_2, Rb_2 AND Rb-Cs MOLECULES

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We have studied the long-range interaction potentials of homonuclear and heteronuclear alkali metal dimers Cs_2, Rb_2 and Cs-Rb for molecular states which dissociate into one atom in the ground $n_0S_{1/2}$ state and the other in one of the excited $nS_{1/2}$ or $nP_{1/2,3/2}$ states.

Dominant electrostatic interaction of neutral atoms in the region of large interatomic distances is the dipole-dipole interaction which gives resonance contribution in the case of homonuclear dimers with asymptote $n_0S_{1/2}$ +$nP_{1/2,3/2}$ and van der Waals contribution in all other cases. Various cases were analyzed by Movre and Beuc (1985), Marinescu et al. (1994) and Marinescu and Dalgarno (1995). In all these calculations, atomic radial wave functions dependent on principal and angular quantum numbers (n, l) has been used. Hundred years ago Rasetti (1924) noticed the anomaly in the dipole oscillator strengths in the cesium and rubidium principal series. Fermi (1930) explained the anomaly as a consequence of spin-orbit interaction and suggested an atomic radial wave function dependent on the total angular momentum j.

The aim of our research was to determine the influence of spin-orbit interaction, correctly included in the radial wave function, on the resonance and van der Waals interaction of alkali dimers. In our calculations we use effective valence electron potential described by empirical l- and j- dependent pseudo potential (Hafner and Schwarz, 1978). The energy and wave functions of valence electrons are determined by diagonalization of Hamiltonian on the grid (Vrinceanu and Dalgarno, 2008).

References

Movre, M., Beuc, R.: 1985, *Phys. Rev. A*, **31**, 2957-2967.
Marinescu, M., Sadeghpour, H. R., Dalgarno, A.: 1994, *Phys. Rev. A*, **49**, 982.
Marinescu, M. and Dalgarno, A.: 1995, *Phys. Rev. A*, **52**, 311.
Rasetti, F.: 1924, *Nuovo Cimento*, **1**, 115.
Fermi, E.: 1930, *Z. Phys.*, **59**, 680.
Hafner, P., Schwarz, W. H. E.: 1978, *J. Phys. B*, **11**, 217-233.
Vrinceanu, D., Dalgarno, A.: 2008, *J. Phys. B*, **41**, 215202 (8pp).

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Poster

FITTING THE Hβ LINE IN TYPE 1 AGNs

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Here we present a complete procedure to measure continuum and emission lines flux from the spectra taken from the Sloan Digital Sky Survey Database, which is fitting the Hβ line region of type 1 active galactic nuclei. The procedure is written in Python and includes: calibration of spectra, removal of host galaxy contribution, continuum subtraction, and modeling of Hβ and the region around the line.

Poster

THE COLLISIONAL ATOMIC PROCESSES: RYDBERG ALKALI ATOMS

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The rate coefficients for the chemi-ionization (CI) processes in $Na^*(n)$+Na, $Li^*(n)$+Na, $Li^*(n)$+Li and $H^*(n)$+Li collisions are presented for a wide region of temperatures and principal quantum numbers. The presented values of the rate coefficients are very useful for the improvement of modelling and analysis of different layers of weakly ionized plasmas in atmospheres of various stars (photosphere of Sun, lithium stars, etc) where these and other CI processes could be important and could change the optical characteristics (Mihajlov et al 2011; Srećković et al. 2014). Also, the results are of interest in spectroscopy of low temperature laboratory plasma created in gas discharges, for example in microwave-induced discharges at atmospheric pressure, where such plasma conditions may be favorable.

References

Mihajlov, A. A., Ignjatović, L. M., Srećković, V. A., Dimitrijević, M. S.: 2011, *ApJS*, **2**, 193.

Srećković, V. A., Mihajlov, A. A., Ignjatović, L. M. and Dimitrijević, M. S.: 2014, *Adv Space Res*, **54**, 1264.

Poster

SPAMM
SPECTRAL PROPERTIES OF AGNs MODELED WITH MCMC

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AGN spectra suffer from blending of multiple emission and absorption components that arise from physically distinct sources at a variety of distance scales from the central BH (e.g. accretion disk, host galaxy, narrow and broad emission lines). Blended features in AGN spectra can lead to biases that can affect BH mass measurements by more than an order of magnitude. Using spectral decomposition, a model is defined that attempts to simultaneously reproduce all AGN components. Most spectral decomposition techniques use best-fit optimization algorithms that are extremely inefficient in sampling the parameter space and do not provide robust estimates of the uncertainties and correlations between different spectral components. These approaches also rely on assumptions that some spectral regions are affected by one component only, and can be used to "fix" the parameters for those components. Our innovative code, SPAMM, addresses all of these issues. SPAMM is an open-source Python package that uses a Bayesian approach and MCMC techniques to perform spectral decomposition on AGN spectra while providing a full description of uncertainties in the models.

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Poster

PHOTOMETRIC REVERBERATION MAPPING OF AGNs AT $0.1 < z < 0.8$

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We present the investigation of the characteristic sizes of the broad-line region (BLR) in active galactic nuclei (AGN) based on photometric reverberation mapping for the improvement of the correlation between BLR size and luminosity $L(\lambda)$ on the 5100 Å. We use a homogeneous sample of AGN at the redshifts cover $0.1 < z < 0.8$ located near the sky north pole that allows us to monitor the objects throughout the year. Regular observations are needed to obtain the data of light curves in the broad hydrogen line (Hα or Hβ) and the optical continuum near the line with the 250 Å-band filters. The time delay between two curves corresponds to the linear size of the BLR which is unresolved geometrically. The observations are carried out with the 1-meter Zeiss telescope of the Special Astrophysical Observatory of Russian Academy of Science (SAO RAS). In the given poster, the observational technique of the photometry with unstable atmosphere, the choice of the local standards in the fields and first results are presented.

Poster

THE INFLUENCE OF SOLAR RADIATION FLUX ON POSSIBLE STATIONARY AND LOCALIZED STRUCTURES IN IONOSPHERE

M. Vukčević[1], A. Nina[2], V. Čadež[1] and L. Č. Popović[1]

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The structure and characteristics of the ionosphere vary in time depending mostly on the solar activity. Since the ionosphere has characteristics of plasma, densities of electrons and ions are very sensitive to electromagnetic disturbances coming from the Earth and outer space, affecting human activities. Ionospheric parameters are strongly influenced by variations of electromagnetic radiation, including variations in intesities of both, spectral lines and continuum. For this reason, theoretical models of the ionosphere are of great importance in understanding and predicting the resulting turbulent regions of the ionosphere. In this work, we develop nonlinear kinetic theory for weakly magnetized electron-ion plasma and discus possibility to obtain a time stationary, coherent, localized solution. Analyzing general conditions typical for ionosphere, we can make conclusion on the dispersive properties of the considered region, as well as on the possible nonlinearities that could be balanced by dispersion, creating such structures.

PROGRAMME

12th Serbian Conference on Spectral Line Shapes in Astrophysics, Vrdnik 2019

Monday, June 3

15:30 – 17:00 Arrival and registration

17:00 – 17:30 *Opening ceremony with coffee&tea*

SPECTRAL LINE SHAPES IN GENERAL Chair: Evgeny Stambulchik

17:30 – 18:00 **Christian Parigger**: Laboratory hydrogen laser-plasma and white-dwarf stars line shapes
18:00 – 18:30 **Peter van Hoof**: Current and future development of the photoionisation code CLOUDY
18:30 – 19:00 **Hervé Lamy**: Polarisation of Auroral line emissions on Earth: a review

19:00 – 21:00 *Welcome reception*

Tuesday, June 4

SPECIAL SESSION: AGN VARIABILITY, DEDICATED TO ALLA I. SHAPOVALOVA Chair: Sergei Dodonov

9:00 – 9:30 **Luka Č. Popović**: Spectral lines and supermassive black hole mass measurements
9:30 – 10:00 **Pu Du**: Signatures of close binaries of supermassive black holes from reverberation
10:00 – 10:20 Saša Simić: Variability in super massive black hole binaries
10:20 – 10:40 Edi Bon: Possible SMBBH signatures in some AGN broad emission lines
10:40 – 11:00 Wolfram Kollatschny: MUSE observations of the merging AGN system NGC 6240

11:00 – 11:30 *Coffee&tea break*

SPECIAL SESSION: AGN VARIABILITY, DEDICATED TO ALLA I. SHAPOVALOVA Chair: Dragana Ilić

11:30 – 12:00 **Bozena Czerny**: Modelling broad emission lines in active galactic nuclei
12:00 – 12:30 **Victor L. Afanasiev, Elena Shablovinskaia**: Active galactic nuclei in polarized light
12:30 – 13:00 **Gisella De Rosa**: Emission line variability in the AGN STORM dataset
13:00 – 13:20 Anđelka Kovačević: Periodicity detection in the broad line and continuum light curves of active galactic nuclei
13:20 – 13:40 Nemanja Rakić: Variability of emission lines of large sample of type 1 AGN from the SDSS-RM project

13:40 – 15:00 *Lunch break*

SPECTRAL LINE PHENOMENA IN DWARF STARS Chair: Milan S. Dimitrijević

15:00 – 15:30 **Gillian Peach**: The resonance lines of sodium and potassium in brown dwarf spectra
15:30 – 16:00 **Joel Rosato**: Modeling of hydrogen Balmer lines for the diagnostic of magnetic white dwarf atmospheres
16:00 – 16:20 Dimitrios Tzimeas: Exploring the potential of ASTA software in analysing broad emission and absorption lines
16:20 – 16:40 Antonios Antoniou: Time scale variations of C IV and Si IV P-Cygni profiles in the UV Spectrum of the O-star HD 93521

16:40 – 17:00 *Coffee&tea break*

12th Serbian Conference on Spectral Line Shapes in Astrophysics, Vrdnik 2019

SPECTRAL LINES IN ASTROPHYSICAL AND LABORATORY PLASMA Chair: Anđelka Kovačević

17:00 – 18:30 Poster session (**3min** presentations)

Wednesday, June 5

SPECTRAL LINE PHENOMENA IN EXTRAGALACTIC OBJECTS Chair: Bozena Czerny

9:00 – 9:30 **Stefano Ciroi**: Supersoft Be binaries in the Magellanic clouds

9:30 – 10:00 **Sergei Dodonov, Aleksandra Grokhovskaya**: Study environmental dependence of galaxy properties

10:00 – 10:20 Paola Marziani: Quasars emission lines as virial luminosity estimators

10:20 – 10:40 Swayamtrupta Panda: Main Trends of the Main Sequence – the crucial effect of Virial Factor

10:40 – 11:00 Martin Ochmann: Spectral changes and BLR kinematics of eruptive changing look AGN

11:00 – 11:30 *Coffee&tea break*

SPECTRAL LINE PHENOMENA IN EXTRAGALACTIC OBJECTS Chair: Gisella De Rosa

11:30 –12:00 **Palle Møller**: Abs- and em-line profiles of DLA selected galaxies: the signature of dark matter halo profiles

12:00 – 12:20 Elena Shablovinskaya: Intraday variability of the polarization vector direction in AGN S5 0716+714

12:20 – 12:40 Evangelia Lyratzi: Variability of Si IV and C IV broad absorption and emission lines of Wolf-Rayet stars, cataclysmic variables, hot emission stars and quasars using GR model and ASTA software

12:40 – 13:00 Dimitrios Stathopoulos: Multicomponent nature of Lyα, N V, Si IV, C IV BALs of J131912.39+534720.5

13:00 – 14:00 *Lunch break*

14:00 *Conference excursion*

Thursday, June 6

COLLISIONS AND SPECTRAL LINE SHAPES Chair: Gillian Peach

9:00 – 9:30 **Mohammed Koubiti:** Spectral lines issues of hydrogen and impurity emitters in fusion plasmas

9:30 – 10:00 **Andrei N. Klyucharev**: Autoionization widths of cold Rydberg atomic complexes

10:00 – 10:20 Vladimir A. Srećkovlć: Chemi-ionization/recombination processes in the broad-line region of AGNs

10:20 – 10:40 Antonio Ortiz-Mora, Milan S. Dimitrijević: A new method to fit line profiles from plasma with a sum of Voigt profiles

10:40 – 11:00 Lev Nagli: Polarization Effects in Laser Induced Plasma Lasers (LIPL)

11:00 – 11:30 *Coffee&tea break*

12th Serbian Conference on Spectral Line Shapes in Astrophysics, Vrdnik 2019

SPECTRAL LINE PHENOMENA IN EXTRAGALACTIC OBJECTS Chair: Evangelia Lyratzi

11:30 –12:00 **Stefano Bianchi**: Physics of ionized gas in AGN: testing predictions from first principles
12:00 – 12:30 **Marco Berton**: Line shapes in narrow-line Seyfert 1 galaxies: a tracer of physical properties?
12:30 – 12:50 Maša Lakićević: Mid-infrared and optical spectral line parameters for NLS1 and BLS1 objects
12:50 – 13:10 Sina Chen: X-ray spectral properties of NLS1s in the 6DFGS
13:10 – 13:30 Daria V. Kozlova: Extended ionized-gas structures in Seyfert 2 galaxy Mrk 78

13:30 – 15:00 *Lunch break*

ATOMIC PARAMETERS AND SPECTRAL LINE SHAPES Chair: Sylvie Sahal-Bréchot

15:00 – 15:30 **Darko Jevremović**: Belgrade nodes of VAMDC: Databases for atomic and molecular collisional and radiative processes needed for spectroscopy
15:30 – 15:50 Đorđe Spasojević: On the spectral shapes of Ne II lines recorded from the cathode fall region of an abnormal glow discharge
15:50 – 16:10 Ibtissem Hannachi: Simulation calculations of hydrogen lines submitted to oscillating electric fields
16:10 – 16:30 Roland Stamm: Satellite spectra for hydrogen perturbed by oscillating fields
16:30 – 16:50 Kamel Ahmed Touati: Collisonal contribution to the spectral line shape in magnetized plasmas
16:50 – 17:10 Mohammed Tayeb Meftah: The influence of the magnetic field on the electric properties in warm and high dense plasma

17:10 – 17:30 *Coffee&tea break*

STARK EFFECT AND SPECTRAL LINE SHAPES Chair: Roland Stamm

17:30 – 17:45 Nebil Ben Nessib: On the stark broadening of some Cr II spectral lines in plasma
17:45 – 18:00 Nebil Ben Nessib: Atomic structure of the carbon like ion Ca XV
18:00 – 18:20 Abishek Chougule: The impact of improved Stark-broadening widths on the modelling of double-ionized chromium lines in early-type stars
18:20 – 18:40 Zlatko Majlinger: Regularities and systematic trends on Lu III Stark widths
18:40 – 19:00 Milan S. Dimitrijević: Stark broadening data for spectral lines of rare-earth elements: example of Tb II, Tb III and Tb IV

20:00 *Conference Dinner*

Friday, June 7

SPECTRAL LINE RESEARCH: NEW FRONTIERS Chair: Vladimir Srećković

10:00 – 10:30 **Alexander Zakharov**: Observational tests of general relativity and alternative theories of gravity with galactic center observations using current and future large observational facilities
10:30 – 11:00 **Predrag Jovanović**: Possible observational signatures of supermassive black hole binaries in their Fe Kα line profiles

11:00 – 11:30 *Coffee&tea break*

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SPECTRAL LINE RESEARCH: NEW FRONTIERS Chair: Paola Marziani

11:30 – 11:50 Marko Stalevski: Towards a new paradigm of dust structure in AGN: Circinus galaxy and beyond
11:50 – 12:10 Đorđe Savić: Modeling the broad emission line polarization in active galactic nuclei
12:10 – 12:30 Milica Vučetić, Dragana Ilić: Emission-lines of the dwarf elliptical galaxy NGC 185

SPECTRAL LINE RESEARCH: SUMMARY Chairs: Evgeny Stambulchik, Dragana Ilić

12:30 – 13:00 Conference Summary
13:15 – 13:30 *Official closing of the conference*

13:30 – 14:30 *Lunch break*

14: 30 *Bus departure*

Posters

1. R. Aloui, H. Elabidi, S. Sahal-Bréchot: QUANTUM-MECHANICAL CALCULATIONS OF Ar XVI LINE WIDTHS
2. A. S. Altowyan, H. Elabidi, N. Ben Nessib: ON THE ATOMIC AND COLLISIONAL STRUCTURE OF THE ION Sc XVI
3. D. Alumot, E. Kroupp, E. Stambulchik, A. Starobinets, I. Uschmann, Y. Maron.: DETERMINATION OF THE ION TEMPERATURE IN A HIGH-ENERGY-DENSITY PLASMA USING THE STARK EFFECT
4. M. Berton, F. Gabrielli, S. Ciroi, G. La Mura: AGN FEEDBACK IN OPTICAL LINES: [O III] PROPERTIES IN FLAT-SPECTRUM RADIO QUASARS AND NARROW-LINE SEYFERT 1
5. N. Bon, P. Marziani, E. Bon: PROBLEMS OF AUTOMATIC IDENTIFICATION OF EXTREME ACCRETING SOURCES
6. E. Chmyreva, G. Beskin: ON SOME ASPECTS OF GALACTIC FEATURELESS-SPECTRUM SOURCES
7. M. Christova, M. S. Dimitrijević, S. Sahal-Bréchot: STARK BROADENING OF B I SPECTRAL LINES
8. M. S. Dimitrijević, A. Bultel: STARK BROADENING OF SPECTRAL LINES WITHIN $3s^5S°$-$3p^5P$ MULTIPLET OF NEUTRAL OXYGEN
9. M. S. Dimitrijević, V. A. Srećković, Lj. M. Ignjatović: THE (n-n')-MIXING PROCESSES IN THE HYDROGEN CLOUDS IN BROAD-LINE REGION OF AGNs
10. R. Hamdi, N. Ben Nessib, S. Sahal- Bréchot, M. S. DimitrijevIć: ON THE SEMICLASSICAL PERTURBATION STARK SHIFTS OF Ar II SPECTRAL LINES
11. Lj. M. Ignjatović, V. A. SrećkovIć, M. S. Dimitrijević: PHOTOIONIZATION OF THE Li_2^+, Na_2^+ AND $LiNa^+$ MOLECULAR IONS IN ALKALI GEO-COSMICAL PLASMAS

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12. D. Ilić, S. Ciroi, V. A. Srećković, M. S. Dimitrijević, L. Č. Popović: THE BROAD LINE REGION PHYSICS IN ACTIVE GALAXIES: ATOMIC PROCESSES IN THE SUPERMASSIVE BLACK HOLE VICINITY

13. I. Jankov, D. Ilić: MACHINE LEARNING AND THE QUASAR EMISSION LINE PROPERTIES

14. J. Kovačević-Dojčinović, M. Lakićević, L. Č. Popović: THE HIDDEN BROAD LINE REGION IN SPECTRA OF SEYFERT 2 GALAXIES

15. J. Kovačević-Dojčinović, L. Č. Popović: THE UV AND OPTICAL Fe II SEMI-EMPIRICAL MODELS AND THEIR APPLICATION FOR AGN TYPE 1 SPECTRA

16. M. Lakićević, L. Č. Popović, J. Kovačević-Dojčinović: UNDERSTANDING OF THE STANDARD MODEL OF AGN THROUGH THE OPTICAL AND MID-INFRARED SPECTROSCOPY

17. S. Marčeta-Mandić, J. Kovačevć-Dojčinović, L. Č. Popović, M. Lakićević: THE CONNECTION BETWEEN BROAD Hβ RED ASYMMETRY AND GRAVITATIONAL REDSHIFT IN AGN TYPE 1

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