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# Comparison of single extraction procedures and the application of an index for the assessment of heavy metal bioavailability in river sediments

1 Sakan, S., Popović, A., Škrivanj, S., Sakan, N., Đorđević, D.  
(2016) Environmental Science and Pollution Research, pp. 1-16.

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## Comparison of single extraction procedures and the applicati...

# Non-Elastic Processes in Atom Rydberg-Atom Collisions: Review of State of Art and Problems

Mihajlov, A.A., Srećković, V.A., Ignjatović,  
L.M., Klyucharev, A.N., Dimitrijević, M.S.,  
2 Sakan, N.M.  
(2015) *Journal of Astrophysics and  
Astronomy*, 36 (4), pp. 623-634.

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## Non-Elastic Processes in Atom Rydberg-Atom Collisions: Review...

# Inverse Bremsstrahlung in Astrophysical Plasmas: The Absorption Coefficients and Gaunt Factors

3 Mihajlov, A.A., Srećković, V.A., Sakan, N.M.  
(2015) *Journal of Astrophysics and Astronomy*, 36 (4), pp. 635-642.

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Inverse Bremsstrahlung in Astrophysical Plasmas: The Absorpt...

	Pollution characteristics and potential ecological risk assessment of heavy metals in river sediments based on calculation of pollution indices				
4	Sakan, S.M., Sakan, N.M., Dordevic, D.S. (2015) Advances in Environmental Research, 41, pp. 63-84.	2015		0	0
	Pollution characteristics and potential ecological risk asse...				
	Risk assessment of trace element contamination in river sediments in Serbia using pollution indices and statistical methods: a pilot study				
5	Sakan, S., Dević, G., Relić, D., Anđelković, I., Sakan, N., Đorđević, D. (2015) Environmental Earth Sciences, 73 (10), pp. 6625-6638.	2015		2 2	2
	Risk assessment of trace element contamination in river sedi...				
	Evaluation of the possibility of using normalization with cobalt in detection of anthropogenic heavy metals in sediments				
6	Sakan, S.M., Sakan, N.M., Dordević, D.S. (2015) Advances in Chemistry Research, 26, pp. 167-183.	2015		1 1	1
	Evaluation of the possibility of using normalization with co...				
	Environmental Assessment of Heavy Metal Pollution in Freshwater Sediment, Serbia				
7	Sakan, S.M., Dević, G.J., Relić, D.J., Anđelković, I.B., Sakan, N.M., Dordević, D.S. (2015) Clean - Soil, Air, Water, 43 (6), pp. 838-845.	2015		0	0
	Environmental Assessment of Heavy Metal Pollution in Freshwa...				

	Evaluation of sediment contamination with heavy metals: the importance of determining appropriate background content and suitable element for normalization								
8	Sakan, S., Dević, G., Relić, D., Anđelković, I., Sakan, N., Đorđević, D. (2014) Environmental Geochemistry and Health, 37 (1), pp. 97-113.	2014	3	2	5			5	
	Evaluation of sediment contamination with heavy metals: the ...								
9	Trace element study in Tisa River and Danube alluvial sediment in Serbia Sakan, S.M., Sakan, N.M., Dordević, D.S. (2013) International Journal of Sediment Research, 28 (2), pp. 234-245.	2013	4		2	6		6	
	Trace element study in Tisa River and Danube alluvial sedime...								
10	Hydrogen Balmer lines for low electron number density plasma diagnostics Konjević, N., Ivković, M., Sakan, N. (2012) Spectrochimica Acta - Part B Atomic Spectroscopy, 76, pp. 16-26.	2012	7	14	12	9	42	1	43
	Hydrogen Balmer lines for low electron number density plasma...								
11	Modeling of the continuous absorption of electromagnetic radiation in dense hydrogen plasma Mihajlov, A.A., Sakan, N.M., Srećković, V.A., Vitel, Y. (2011) Baltic Astronomy, 20 (4), pp. 604-608.	2011	2	1	1		4		4
	Modeling of the continuous absorption of electromagnetic rad...								
12	Modeling of continuous absorption of electromagnetic radiation in dense	2011	1	1			2		2



partially ionized plasmas  
Mihajlov, A.A., Sakan, N.M., Srećković,  
V.A., Vitel, Y.  
(2011) Journal of Physics A: Mathematical  
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Modeling of continuous absorption of  
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The calculation of the photo absorption  
processes in dense hydrogen plasma with  
the help of cut-off coulomb potential  
model

13 Sakan, N.M. 2010 0 0  
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Series, 257 (1)

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The calculation of the photo absorption  
processes in dense h...

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The contribution of the absorption  
processes to the opacity of DB white  
dwarf atmospheres in UV and VUV  
regions

14 Ignjatović, Lj.M., Mihajlov, A.A.,  
Metropoulos, A., Sakan, N.M., 2010 0 0  
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(2010) AIP Conference  
Proceedings, 1203, pp. 121-126.

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The contribution of the absorption  
processes to the opacity ...

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The dynamic conductivity of strongly non-  
ideal plasmas: Is the Drude model valid?

15 Adamyan, V.M., Mihajlov, A.A., Sakan,  
N.M., Srećković, V.A., Tkachenko, I.M. 2009 2 0 2  
(2009) Journal of Physics A: Mathematical  
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16 Spectroscopic study of hydrogen Balmer 2009 6 1 1 7

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Jovičević, S., Sakan, N., Ivković, M.,  
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Spectroscopic study of hydrogen Balmer lines in a microwave-...

## Rydberg atoms in astrophysics

Gnedin, Yu.N., Mihajlov, A.A., Ignjatović,  
Lj.M., Sakan, N.M., Srećković, V.A.,  
Zakharov, M.Yu., Bezuglov, N.N.,

17	Klycharev, A.N. (2009) <i>New Astronomy Reviews</i> , 53 (7-10), pp. 259-265.	2009	1	2	3	1	1	7	8
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Rydberg atoms in astrophysics

The total and relative contribution of the relevant absorption processes to the opacity of DB white dwarf atmospheres in the UV and VUV regions

Ignjatović, L.M., Mihajlov, A.A., Sakan, N.M., Dimitrijević, M.S., Metropoulos, A. (2009) Monthly Notices of the Royal Astronomical Society, 396 (4), pp. 2201-2210.

18	N.M., Dimitrijević, M.S., Metropoulos, A. (2009) Monthly Notices of the Royal Astronomical Society, 396 (4), pp. 2201-2210.	2009	2	1	2	4	1	8	10
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The total and relative contribution of the relevant absorpti...

## The modeling of the continuous emission spectrum of a dense non-ideal plasma in optical region

Mihajlov, A.A., Sakan, N.M., Srećković, V.A.

19	V.A. (2007) AIP Conference Proceedings, 938, pp. 262-267.	2007	0	0
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The modeling of the continuous emission spectrum of a dense ...

20 The influence of H 2007 5 1 1 2 2 3 9 14

dissociation and  $(H + H^+)$ -  
radiative collisions on the solar  
atmosphere opacity in UV and VUV  
regions

Mihajlov, A.A., Ignjatović, Lj.M., Sakan,  
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(2007) Astronomy and  
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The influence of H  
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Cut-off Coulomb potential as a model  
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21 Sakan, N.M., Mihajlov, A.A., Sreckovic,  
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(2007) 17th Symposium on Physics of  
Switching Arc, FSO 2007, 1, pp. 185-188.

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Cut-off Coulomb potential as a model  
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Optical HF electrical permeability,  
refractivity and reflectivity of dense non-  
ideal plasmas

22 Adamyan, V.M., Grubor, D., Mihajlov,  
A.A., Sakan, N.M., Srećković, V.A.,  
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Optical HF electrical permeability,  
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Electrical conductivity of dense non-ideal  
plasmas in external HF electric field

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Mihajlov, A.A., Sakan, N.M., Ulić, D.,  
Srećković, V.A.

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and General, 39 (17), pp. 4693-4697.

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- Radiative charge exchange in ion-atom  
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Mihajlov, A.A., Ermolaev, A.M., Ignjatović,  
24 Lj.M., Sakan, N.M. 2004 0 0  
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electric field  
Adamyan, V.M., Djurić, Z., Mihajlov, A.A.,  
25 Sakan, N.M., Tkachenko, I.M. 2004 7 0 7  
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26 Sakan, N.M. 2001 7 0 7  
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partially ionized plasmas  
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Modeling of continuous absorption of  
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	The calculation of the photo absorption processes in dense hydrogen plasma with the help of cut-off coulomb potential model				
13	Sakan, N.M. (2010) Journal of Physics: Conference Series, 257 (1)	2010		0	0
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14	Ignjatović, Lj.M., Mihajlov, A.A., Metropoulos, A., Sakan, N.M., Dimitrijević, M.S. (2010) AIP Conference Proceedings, 1203, pp. 121-126.	2010		0	0
	The contribution of the absorption processes to the opacity ...				
	The dynamic conductivity of strongly non-ideal plasmas: Is the Drude model valid?				
15	Adamyán, V.M., Mihajlov, A.A., Sakan, N.M., Srećković, V.A., Tkachenko, I.M. (2009) Journal of Physics A: Mathematical and Theoretical, 42 (21)	2009	2	0	2
	The dynamic conductivity of strongly non-ideal plasmas: Is t...				
16	Spectroscopic study of hydrogen Balmer	2009	6	1	1
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The total and relative contribution of the relevant absorpti...

## The modeling of the continuous emission spectrum of a dense non-ideal plasma in optical region

19	Mihajlov, A.A., Sakan, N.M., Srećković, V.A. (2007) AIP Conference Proceedings, 938, pp. 262-267.	2007	0	0
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The modeling of the continuous emission spectrum of a dense ...

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dissociation and  $(H + H^+)$ -  
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Document Measuring the electron density in plasmas from the difference of Lorentzian part of the widths of two Balmer series hydrogen lines Authors of Document Yubero, C., García, M.C., Dimitrijevic, M.S., Sola, A., Gamero, A. Year the Document was Publish 2015 Source of the Document Spectrochimica Acta - Part B Atomic Spectroscopy

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Document Discrimination of moist oil shale and limestone using laser induced breakdown spectroscopy Authors of Document Paris, P., Piip, K., Lepp, A., (...), Aints, M., Laan, M. Year the Document was Publish 2015 Source of the Document Spectrochimica Acta - Part B Atomic Spectroscopy

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Document Electron density measurement in atmospheric pressure plasma jets: Stark broadening of hydrogenated and non-hydrogenated lines Authors of Document Nikiforov, A.Yu., Leys, Ch., Gonzalez, M.A., Walsh, J.L. Year the Document was Publish 2015 Source of the Document Plasma Sources Science and Technology

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Document Hydrogen Balmer beta: The separation between line peaks for plasma electron density diagnostics and self-absorption test Authors of Document Ivković, M., Konjević, N., Pavlović, Z. Year the Document was Publish 2015 Source of the Document Journal of Quantitative Spectroscopy and Radiative Transfer

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Document Laser-induced plasma spectroscopy of hydrogen balmer series in laboratory air Authors of Document Swafford, L.D., Parigger, C.G. Year the Document was Publish 2015 Source of the Document Applied Spectroscopy

68 (9), pp. 1016-1020

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Document Hydrogen alpha laser ablation plasma diagnostics Authors of Document Parigger, C.G., Surmick, D.M., Gautam, G., El Sherbini, A.M. Year the Document was Publish 2015 Source of the Document Optics Letters

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Document Study of Non-Thermal DC Arc Plasma of CH<sub>4</sub>/Ar at Atmospheric Pressure Using Optical Emission Spectroscopy and Mass Spectrometry Authors of Document Liao, M., Wang, Y., Wu, H., Li, H., Xia, W. Year the Document was Publish 2015 Source of the Document Plasma Science and Technology

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Document Anodic luminescence, structural, photoluminescent, and photocatalytic properties of anodic oxide films grown on niobium in phosphoric acid Authors of Document Stojadinović, S., Tadić, N., Radić, N., (...), Grbić, B., Vasilčić, R. Year the Document was Publish 2015 Source of the Document Applied Surface Science

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#### Result 23

Document Temporally resolved electron density of a repetitive, nanosecond pulsed microdischarge Authors of Document Stephens, J., Fierro, A., Dickens, J., Neuber, A. Year the Document was Publish 2014 Source of the Document Journal of Physics D: Applied Physics

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Result 24

Document The influence of the tube diameter on the properties of an atmospheric pressure He micro-plasma jet Authors of Document Jõgi, I., Talviste, R., Raud, J., Piip, K., Paris, P. Year the Document was Publish 2014 Source of the Document Journal of Physics D: Applied Physics

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Document Asymmetric hydrogen beta electron density diagnostics of laser-induced plasma Authors of Document Parigger, C.G., Swafford, L.D., Woods, A.C., Surmick, D.M., Witte, M.J. Year the Document was Publish 2014 Source of the Document Spectrochimica Acta - Part B Atomic Spectroscopy

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Document Liquid sampling-atmospheric pressure glow discharge as a secondary excitation source: Assessment of plasma characteristics Authors of Document Manard, B.T., Gonzalez, J.J., Sarkar, A., (...), Russo, R.E., Marcus, R.K. Year the Document was Publish 2014 Source of the Document Spectrochimica Acta - Part B Atomic Spectroscopy

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Document Carbon swan spectra measurements following breakdown of nitro compound explosive simulants Authors of Document Witte, M.J., Parigger, C.G., Bullock, N.A., Merten, J.A., Allen, S.D. Year the Document was Publish 2014 Source of the Document Applied Spectroscopy

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Document Spectroscopic and electric characterization of an atmospheric pressure segmented gas discharge with micro hollow electrodes Authors of Document Jovović, J., Konjević, N. Year the Document was Publish 2014 Source of the Document European Physical Journal D

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Result 30

Document Characteristics of atmospheric-pressure non-thermal N<sub>2</sub> and N<sub>2</sub>/O<sub>2</sub> gas mixture plasma jet Authors of Document Xiao, D., Cheng, C., Shen, J., (...), Li, J., Chu, P.K. Year the Document was Publish 2014 Source of the Document Journal of Applied Physics

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Document On the determination of electron density in non-thermal plasmas using Balmer series hydrogen lines Authors of Document Yubero, C., García, M.C., Dimitrijević, M.S., Sola, A., Gamero, A. Year the Document was Publish 2014 Source of the Document Proceedings of the IX Bulgarian-Serbian Astronomical Conference: Astroinformatics, BSACA 2014

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Document Stark broadening measurement of Al II lines in a laser-induced plasma Authors of Document Cirisan, M., Cvejić, M., Gavrilović, M.R., (...), Konjević, N., Hermann, J. Year the Document was Publish 2014 Source of the Document Journal of Quantitative Spectroscopy and Radiative Transfer

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Document Development and testing of a self-triggered spark reactor for plasma driven dry reforming of methane Authors of Document Shapoval, V., Marotta, E., Ceretta, C., (...), Schiorlin, M., Paradisi, C. Year the Document was Publish 2014 Source of the Document Plasma Processes and Polymers

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Document Optical emission spectroscopy for quantification of ultraviolet radiations and biocide active species in microwave argon plasma jet at atmospheric pressure Authors of Document Wattieaux, G., Yousfi, M., Merbahi, N. Year the Document was Publish 2013 Source of the Document Spectrochimica Acta - Part B Atomic Spectroscopy

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Document Investigation of water dissociation by Nanosecond Repetitively Pulsed Discharges in superheated steam at atmospheric pressure Authors of Document Sainct, F.P., Lacoste, D.A., Laux, C.O., Kirkpatrick, M.J., Odic, E. Year the Document was Publish 2013 Source of the Document 51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition 2013

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Document Ari and Ne i spectral line shapes for an abnormal glow discharge diagnostics Authors of DocumentLjMajstorović, G., Ivanović, N.V., Šišović, N.M., Djurović, S., Konjević, N. Year the Document was Publish 2013 Source of the DocumentPlasma Sources Science and Technology

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Document Stark broadening of Mg i and Mg II spectral lines and Debye shielding effect in laser induced plasma Authors of DocumentCvejić, M., Gavrilović, M.R., Jovičević, S., Konjević, N. Year the Document was Publish 2013 Source of the DocumentSpectrochimicaActa - Part B Atomic Spectroscopy

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Document Local thermodynamic equilibrium considerations in powerchip laser-induced plasmas Authors of DocumentMerten, J.A., Smith, B.W., Omenetto, N. Year the Document was Publish 2013 Source of the DocumentSpectrochimicaActa - Part B Atomic Spectroscopy

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Result 42

Document Improvement of selenium analysis during laser-induced breakdown spectroscopy measurement of CuIn<sub>1-x</sub>Ga<sub>x</sub>Se<sub>2</sub> solar cell films by self-absorption corrected normalization Authors of DocumentIn, J.-H., Kim, C.-K., Lee, S.-H., Lee, H.-J., Jeong, S. Year the Document was Publish 2013 Source of the DocumentJournal of Analytical Atomic Spectrometry

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Document Atomic and molecular emissions in laser-induced breakdown spectroscopy Authors of DocumentParigger, C.G. Year the Document was Publish 2013 Source of the DocumentSpectrochimicaActa - Part B Atomic Spectroscopy

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**The influence of H<sub>2</sub> +photo-dissociation and (H + H<sup>+</sup>)-radiative collisions on the solar atmosphere opacity in UV and VUV regions**  
**Mihajlov A.A., Ignjatovic Lj.M., Sakan N.M., Dimitrijevic M.S.**  
**2007, Astronomy and Astrophysics, (2) 749-754**  
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Document State-to-state vibrational kinetics of H<sub>2</sub> and H<sub>2</sub><sup>+</sup> in a post-shock cooling gas with primordial composition Authors of DocumentCoppola, C.M., Mizzi, G., Bruno, D., (...), Palla, F., Longo, S. Year the Document was Publish 2016 Source of the DocumentMonthly Notices of the Royal Astronomical Society

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Result 2

Document Role of the H<sub>2</sub><sup>+</sup> channel in the primordial star formation under strong radiation field and the critical intensity for the supermassive star formation Authors of DocumentSugimura, K., Coppola, C.M., Omukai, K., Galli, D., Palla, F. Year the Document was Publish 2016 Source of the DocumentMonthly Notices of the Royal Astronomical Society

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Document State resolved data for radiative association of h and H+ and for photodissociation of H<sub>2</sub> Authors of DocumentBabb, J.F. Year the Document was Publish 2015 Source of the DocumentAstrophysical Journal, Supplement Series

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Document Ion-atom radiative processes in the solar atmosphere: Quiet Sun and sunspots Authors of DocumentSrećković, V.A., Mihajlov, A.A., Ignjatović, L.M., Dimitrijević, M.S. Year the Document was Publish 2014 Source of the DocumentAdvances in Space Research

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### Result 9

Document Ten years of the scientific society "Isaac Newton" and of "Yugoslavia" branch of the international astronomical institute Isaac Newton of Chile Authors of DocumentDimitrijević, M.S. Year the Document was Publish 2012 Source of the Document VIII Serbian-Bulgarian Astronomical Conference, SBAC 2012

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Document Modeling of continuous absorption of electromagnetic radiation in dense partially ionized plasmas Authors of Document Mihajlov, A.A., Sakan, N.M., Srećković, V.A., Vitel, Y. Year the Document was Publish 2011 Source of the Document Journal of Physics A: Mathematical and Theoretical

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Document Chemi-ionization in solar photosphere: Influence on the hydrogen atom excited states population Authors of Document Mihajlov, A.A., Ignjatović, L.M., Srećković, V.A., Dimitrijević, M.S. Year the Document was Publish 2011 Source of the Document Astrophysical Journal, Supplement Series

Number of Documents that reference this Document 5

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Document The contribution of the absorption processes to the opacity of DB white dwarf atmospheres in UV and VUV regions Authors of Document Ignjatović, Lj.M., Mihajlov, A.A., Metropoulos, A., Sakan, N.M., Dimitrijević, M.S. Year the Document was Publish 2010 Source of the Document AIP Conference Proceedings

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Document Semiempirical models of the solar atmosphere. III. Set of non-LTE models for far-ultraviolet/extreme-ultraviolet irradiance computation Authors of Document Fontenla, J.M., Curdt, W., Haberreiter, M., Harder, J., Tian, H. Year the Document was Publish 2009 Source of the Document Astrophysical Journal

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Document Activities of participants of the project 146001 "influence of collisional processes on the astrophysical plasma spectra" - 2006-2007 Authors of Document Dimitrijević, M.S. Year the Document was Publish 2008 Source of the Document VI Serbian-Bulgarian Astronomical Conference, SBAC 2008

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#### **The total and relative contribution of the relevant absorption processes to the opacity of DB white dwarf atmospheres in the UV and VUV regions**

**Ignjatovic L.M., Mihajlov A.A., Sakan N.M., Dimitrijevic M.S., Metropoulos A. (2009) Monthly Notices of the Royal Astronomical Society, 396 (4) , pp. 2201-2210.**

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Document The virtual atomic and molecular data centre (VAMDC) consortium Authors of Document Dubernet, M.L., Antony, B.K., Ba, Y.A., (...), Zeippen, C.J., Zwölf, C.M. Year the Document was Publish 2016 Source of the Document Journal of Physics B: Atomic, Molecular and Optical Physics

Number of Documents that reference this Document 1

#### Result 2

Document Absorption non-symmetric ion-atom processes in helium-rich white dwarf atmospheres Authors of Document Ignjatović, L.M., Mihajlov, A.A., Srećković, V.A., Dimitrijević, M.S. Year the Document was Publish 2014 Source of the Document Monthly Notices of the Royal Astronomical Society

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Document Helium-rich white dwarf atmospheres: The non-symmetric ion-atom absorption processes Authors of Document Srećković, V.A., Mihajlov, A.A., Ignjatović, L.M., Dimitrijević, M.S. Year the Document was Publish 2014 Source of the Document Journal of Physics: Conference Series

Number of Documents that reference this Document 0

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Document The ion-atom absorption processes as one of the factors of the influence on the sunspot opacity Authors of Document Ignjatović, L.M., Mihajlov, A.A., Srećković, V.A., Dimitrijević, M.S. Year the Document was Publish 2014 Source of the Document Monthly Notices of the Royal Astronomical Society

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### Result 5

Document The role of molecular quadrupole transitions in the depopulation of metastable helium Authors of Document Augustovičová, L., Kraemer, W.P., Špirko, V., Soldán, P. Year the Document was Publish 2014 Source of the Document Monthly Notices of the Royal Astronomical Society

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Document Excitation and deexcitation processes in atom-Rydberg atom collisions in helium-rich white dwarf atmospheres Authors of Document Srećković, V.A., Mihajlov, A.A., Ignjatović, L.M., Dimitrijević, M.S. Year the Document was Publish 2013 Source of the Document Astronomy and Astrophysics

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Document Investigations of the influence of collisional processes on the astrophysical plasma spectra at astronomical observatory (period 2008-2009) Authors of Document Dimitrijević, M.S. Year the Document was Publish 2010 Source of the Document VII Serbian-Bulgarian Astronomical Conference, SBAC 2010

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**Rydberg atoms in astrophysics**

**Gnedin Yu.N., Mihajlov A.A., Ignjatovic Lj.M., Sakan N.M., Sreckovic V.A., Zakharov M.Yu., Bezuglov N.N., Klycharev A.N.**

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Document Anomalies in radiation-collisional kinetics of Rydberg atoms induced by the effects of dynamical chaos and the double Stark resonance Authors of Document Bezuglov, N.N., Klyucharev, A.N., Mihajlov, A.A., Srećković, V.A. Year the Document was Publish 2014 Source of the Document Advances in Space Research

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Document High-resolution resonance-enhanced multiphoton-ionization photoelectron spectroscopy of Rydberg states via spectral phase step shaping Authors of Document Zhang, S., Zhu, J., Lu, C., (...), Qiu, J., Sun, Z. Year the Document was Publish 2013 Source of the Document RSC Advances

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Document Prediction of 2D Rydberg energy levels of 6Li and 7Li based on very accurate quantum mechanical calculations performed with explicitly correlated Gaussian functions Authors of Document Bubin, S., Sharkey, K.L., Adamowicz, L. Year the Document was Publish 2013 Source of the Document Journal of Chemical Physics

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Document Experimental and theoretical study of the chemi-ionization in thermal collisions of Ne Rydberg atoms Authors of Document O'Keeffe, P., Bolognesi, P., Avaldi, L., (...), Srećković, V.A., Ignjatović, Lj.M. Year the Document was Publish 2012 Source of the Document Physical Review A - Atomic, Molecular, and Optical Physics

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Document The Chemi-Ionization Processes in Slow Collisions of Rydberg Atoms with Ground State Atoms: Mechanism and Applications Authors of Document Mihajlov, A.A., Srećković, V.A., Ignjatović, Lj.M., Klyucharev, A.N. Year the Document was Publish 2012 Source of the Document Journal of Cluster Science

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Document Influence of inelastic Rydberg atom-atom collisional process on kinetic and optical properties of low-temperature laboratory and astrophysical plasmas Authors of Document Klyucharev, A.N., Bezuglov, N.N., Mihajlov, A.A., Ignjatović, Lj.M. Year the Document was Publish 2010 Source of the Document Journal of Physics: Conference Series

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**Jovicevic S., Sakan N., Ivkovic M., Konjevic N.**

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Document Energetic ion, atom, and molecule reactions and excitation in low-current H<sub>2</sub> discharges: H $\alpha$  Doppler profiles Authors of Document Petrović, Z.L., Phelps, A.V. Year the Document was Publish 2009 Source of the Document Physical Review E - Statistical, Nonlinear, and Soft Matter Physics  
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Document Influence of thin porous Al<sub>2</sub>O<sub>3</sub> layer on aluminum cathode to the H $\alpha$  line shape in glow discharge Authors of Document Steflekova, V., Šišović, N.M., Konjević, N. Year the Document was Publish 2009 Source of the Document Journal of Applied Physics  
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**Dynamic characteristics of non-ideal plasmas in an external high frequency electric field**

Adamyany V.M., Djuric Z., Mihajlov A.A., Sakan N.M., Tkachenko I.M.

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Document Modeling of continuous absorption of electromagnetic radiation in dense partially ionized plasmas Authors of DocumentMihajlov, A.A., Sakan, N.M., Srećković, V.A., Vitel, Y. Year the Document was Publish 2011 Source of the DocumentJournal of Physics A: Mathematical and Theoretical  
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Document Electrical conductivity of dense non-ideal plasmas in external HF electric field Authors of DocumentTkachenko, I.M., Adamyany, V.M., Mihajlov, A.A., (...), Ulić, D., Srećković, V.A. Year the Document was Publish 2006 Source of the DocumentJournal of Physics A: Mathematical and General  
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Document Optical HF electrical permeability, refractivity and reflectivity of dense non-ideal plasmas Authors of Document Adamyan, V.M., Grubor, D., Mihajlov, A.A., (...), Srećković, V.A., Tkachenko, I.M. Year the Document was Publish 2006 Source of the Document Journal of Physics A: Mathematical and General Number of Documents that reference this Document 2

**High-frequency characteristics of weakly and moderately non-ideal plasmas in an external electric field**

**Mihajlov A.A., Djuric Z., Adamyan V.M., Sakan N.M.**

**(2001) Journal of Physics D: Applied Physics, 34 (21) , pp. 3139-3144.**

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Document Electrical conductivity of dense non-ideal plasmas in external HF electric field Authors of Document Tkachenko, I.M., Adamyan, V.M., Mihajlov, A.A., (...), Ulić, D., Srećković, V.A. Year the Document was Publish 2006 Source of the Document Journal of Physics A: Mathematical and General

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**Trace element study in Tisa River and Danube alluvial sediment in Serbia**

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94 (1), pp. 46-74+IV

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Broj:02-1801/09

Datum: 16.10.2009. godine.

Na osnovu člana 88 Zakona o visokom obrazovanju („Službeni glasnik Republike Srpske“, br. 85/06 i 30/07) i člana 94 Statuta Nezavisnog univerziteta Banja Luka – Prečišćen tekst, na prijedlog Nastavno-naučnog vijeća Fakulteta za društvene nauke, na sjednici održanoj 16.01.2009.godine, Senat Univerziteta donosi:

**ODLUKU**  
**o izboru u zvanje docenta**

1. Nenad Sakan, doktor fizičkih nauka, bira se u zvanje docenta na nastavnom predmetu *Fizika i životna sredina* na period od pet godina.
2. Ova odluka stupa na snagu danom donošenja.

**Obrazloženje**

Na osnovu stalno otvorenog konkursa za izbor u zvanje nastavnika i saradnika na Nezavisnom univerzitetu Banja Luka, Senat Univerziteta je dana 22.09.2009. godine Odlukom broj 02-1633/09 imenovao Komisiju za razmatranje konkursnog materijala i pisanje izvještaja u sljedećem sastavu: akademik SANU, dr Nikola Konjević, predsjednik, prof. dr Desanka Šulić, član, i prof. dr Srđan Bukvić, član, za izbor u zvanje docenta na nastavnom predmetu *Fizika i životna sredina*.

Komisija je razmotrila konkursni materijal i 13.10.2009. godine sačinila Izvještaj u kojem je konstatovano da dr Nenad Sakan ispunjava sve uslove, te se predlaže za izbor u zvanje docenta u naučnoj oblasti prirodnih nauka, uža naučna oblast Fizika.

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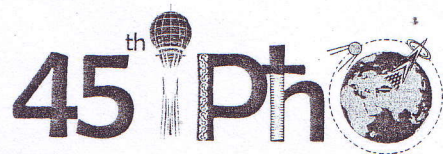
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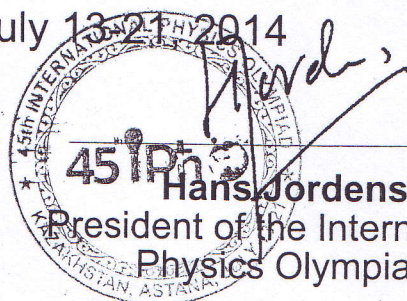
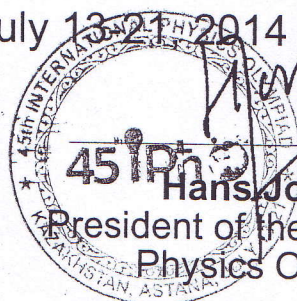
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ŽIVOTNU SREDINU NA PODRUČJU GRADA BANJA LUKA

- Magistarski rad -

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Kandidat:

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BANJA LUKA, Decembar 2012.godine

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У Београду, 17.10.2016.

## ПОТВРДА

Др Ненад Сакан је у оквиру пројекта који је био регистрован код Министарства за науку бр. ОИ 141033 (2006-2010) и чији руководиоца је био др Анатолиј Михајлов, научни саветник (заменик др Љубинко Игњатовић, научни саветник) руководио пројектним задатком који се односио на моделовање оптичких карактеристика густе неидеалне воденикове плазме одсеченим Кулоновим потенцијалом.

---

Др Љубинко Игњатовић, научни саветник

Заменик руководиоца пројекта ОИ 141033

(Евидентиране уплате до 3.6.2016.)



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42. Владимир Удовичић	●	●	●	●	●
43. Милутин Благојевић	●	●	●	●	●
44. Александар Крмпот	●	●	●	●	●
45. Милован Шуваков	●	●	●	●	●
46. Сања Тошић	●	●	●	●	●
47. Драган Маркушев	●	●	●	●	●
48. Зоран Мијић	●	●	●	●	●
49. Милан Радоњић	●	●	●	●	●
50. Милош Радоњић	●	●	●	●	●
51. Срђан Марјановић	●	●	●	●	●
52. Александар Бојаров	●	●	●	●	●
53. Јелена Сивош	●	●	●	●	●
54. Коста Спасић	●	●	●	●	●
55. Владимир Дамљановић	●	●	●	●	●
56. Бранко Николић	●	●	●	●	●
57. Јакша Вучићевић	●	●	●	●	●
58. Саша Дујко	●	●	●	●	●
59. Милош Ранковић	●	●	●	●	●
60. Драгана Марић	●	●	●	●	●

	2016	2015	2014	2013	2012
<b>ИНН 'Винча'</b>					
61. Страхиња Лукић	●	●	●	●	●
62. Стеван Јокић	●	●	●	●	●
63. Милутин Степић	●	●	●	●	●
64. Душко Борка	●	●	●	●	●
65. Валентин Ивановски	●	●	●	●	●
66. Весна Борка Јовановић	●	●	●	●	●
67. Слободанка Галовић	●	●	●	●	●
68. Иванка Божовић Јелисавчић	●	●	●	●	●
69. Мила Пандуровић	●	●	●	●	●
70. Иван Смиљанић	●	●	●	●	●
71. Јудита Мамузић	●	●	●	●	●
72. Гордана Милутиновић Думбеловић	●	●	●	●	●
73. Милорад Шилјековић	●	●	●	●	●
74. Катарина Вуковић	●	●	●	●	●



75. Љупчо Хацијевски	●	●	●	●	●
76. Далибор Чевизовић	●	●	●	●	●
77. Миољуб Нешић	●	●	●	●	●
78. Марица Поповић	●	●	●	●	●
79. Горан Качаревић	●	●	●	●	●
80. Јована Петровић	●	●	●	●	●

#### ПМФ Нови Сад

	2016	2015	2014	2013	2012
81. Маја Стојановић	●	●	●	●	●
82. Имре Гут	●	●	●	●	●
83. Раденко Кисић	●	●	●	●	●
84. Бранка Радуловић	●	●	●	●	●
85. Тијана Продановић	●	●	●	●	●
86. Оливера Клисурић	●	●	●	●	●
87. Стеван Армаковић	●	●	●	●	●
88. Стевица Ђуровић	●	●	●	●	●
89. Ивана Богдановић	●	●	●	●	●
90. Богдан Богдановић	●	●	●	●	●
91. Мирослав Цветинов	●	●	●	●	●
92. Петар Мали	●	●	●	●	●
93. Мира Терзић	●	●	●	●	●

#### ПМФ Крагујевац

	2016	2015	2014	2013	2012
94. Момир Арсенијевић	●	●	●	●	●
95. Јасна Стевановић	●	●	●	●	●
96. Ана Симовић	●	●	●	●	●
97. Љубица Кузмановић	●	●	●	●	●
98. Драгослав Никезић	●	●	●	●	●
99. Милан Ковачевић	●	●	●	●	●
100. Драгица Кнежевић	●	●	●	●	●
101. Владимир Марковић	●	●	●	●	●
102. Виолета Петровић	●	●	●	●	●
103. Мирко Радуловић	●	●	●	●	●
104. Бранислав Чабрић	●	●	●	●	●
105. Светислав Савовић	●	●	●	●	●

#### ПМФ Ниш

	2016	2015	2014	2013	2012
106. Мирослав Николић	●	●	●	●	●
107. Горан Ђорђевић	●	●	●	●	●
108. Љубиша Нешић	●	●	●	●	●
109. Драгољуб Димитријевић	●	●	●	●	●
110. Милан Милошевић	●	●	●	●	●
111. Иван Манчев	●	●	●	●	●
112. Владан Павловић	●	●	●	●	●



113. Драган Радивојевић	●	●	●	●	●
114. Ненад Милојевић	●	●	●	●	●
115. Миодраг Радовић	●	●	●	●	●
116. Видосав Марковић	●	●	●	●	●
117. Дејан Димитријевић	●	●	●	●	●

#### ПМФ Косовска Митровица

	2016	2015	2014	2013	2012
118. Биљана Вучковић	●	●	●	●	●
119. Душица Спасић	●	●	●	●	●
120. Љиљана Гулан	●	●	●	●	●
121. Јелена Живковић	●	●	●	●	●
122. Гордана Милић	●	●	●	●	●
123. Бранко Дрљача	●	●	●	●	●

#### Електронски факултет

	2016	2015	2014	2013	2012
124. Горан Ристић	●	●	●	●	●
125. Никола Нешић	●	●	●	●	●

#### Остали

	2016	2015	2014	2013	2012
126. Душанка Обадовић, Педагошки факултет у Сомбору, Нови Сад	●	●	●	●	●
127. Јован Алексић, Астрономска опсерваторија, Београд	●	●	●	●	●
128. Љиљана Јокић, АКМ Едукација, Београд	●	●	●	●	●
129. Милентије Луковић, Факултет техничких наука, Чачак	●	●	●	●	●
130. Вера Бојовић, ЗУОВ, Београд	●	●	●	●	●
131. Томаш Немеш, Факултет техничких наука, Нови Сад	●	●	●	●	●
132. Југослав Карамарковић, Грађевинско-архитектонски факултет, Ниш	●	●	●	●	●
133. Јелена Ковачевић Дојчиновић, Астрономска опсерваторија, Београд	●	●	●	●	●
134. Гордана Мајсторовић, Војна академија, Београд	●	●	●	●	●
135. Јелена Урошевић, ЗУОВ, Београд	●	●	●	●	●
136. Марија Бошњак, Педагошки факултет у Сомбору	●	●	●	●	●
137. Марија Крнета, МПНТР	●	●	●	●	●
138. Милена Давидовић, Грађевински факултет, Београд	●	●	●	●	●
139. Никола Цветановић, Саобраћајни факултет, Београд	●	●	●	●	●
140. Јелена Ајтић, Ветеринарски факултет, Београд	●	●	●	●	●
141. Дарко Сарван, Ветеринарски факултет, Београд	●	●	●	●	●
142. Надежда Новаковић, Државни универзитет у Новом Пазару, Ниш	●	●	●	●	●
143. Златан Шошкић, Факултет за машинство и грађевинарство, Краљево	●	●	●	●	●
144. Мирослав Филиповић, Висока пословно-техничка школа, Ужице	●	●	●	●	●
145. Владимир Вељић, Машински факултет, Београд	●	●	●	●	●
146. Никола Ивановић, Пољопривредни факултет, Београд	●	●	●	●	●

#### Град Београд

2016	2015	2014	2013	2012
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147. Љиљана Иванчевић, ОШ 'Ђорђе Крстић', Београд	● ● ● ● ●
148. Слађана Николић, ОШ 'Милан Ђ. Милићевић', Београд	● ● ● ● ●
149. Биљана Стојичић, Земунска гимназија, Београд	● ● ● ● ●
150. Миланка Кнежевић, ТШ 'Нови Београд', Београд	● ● ● ● ●
151. Маријана Крњајић, ТШ 'Нови Београд', Београд	● ● ● ● ●
152. Зоран Јовичић, ОШ 'Вељко Дугошевић', Београд	● ● ● ● ●
153. Драгица Ивковић, Математичка гимназија, Београд	● ● ● ● ●
154. Миленија Јоксимовић, ХПТШ, Београд	● ● ● ● ●
155. Душица Ивановић, ОШ 'Милоје Васић', Калуђерица	● ● ● ● ●
156. Радосава Лазовић, Седма београдска гимназија	● ● ● ● ●
157. Марика Чочовска-Миловановић, Зуботехничка школа, Београд	● ● ● ● ●
158. Гордана Бојат, ОШ 'Јелица Миловановић' - Сопот, Београд	● ● ● ● ●
159. Славиша Станковић, ОШ 'Милош Црњански', Београд	● ● ● ● ●
160. Иван Станић, Математичка гимназија, Београд	● ● ● ● ●
161. Драган Мандушић, ОШ 'Јован Јовановић Змај', Обреновац	● ● ● ● ●
162. Милош Прелић, Пољопривредна школа ПК 'Београд'	● ● ● ● ●
163. Наташа Чалуковић, Математичка гимназија, Београд	● ● ● ● ●
164. Ида Перић, Прва београдска гимназија	● ● ● ● ●
165. Сања Булат, ОШ 'Бранислав Нушић', Београд	● ● ● ● ●
166. Јовица Милисављевић, Математичка гимназија, Београд	● ● ● ● ●
167. Вишња Јовановић, Математичка гимназија, Београд	● ● ● ● ●
168. Катарина Матић, Математичка гимназија, Београд	● ● ● ● ●
169. Саша Шуњеварић, ОШ 'Стеван Синђелић', Београд	● ● ● ● ●
170. Ирена Панов Стаменов, ОШ 'Доситеј Обрадовић', Умка	● ● ● ● ●
171. Селма Поповић, ОШ 'Ћирило и Методије', Београд	● ● ● ● ●
172. Анђа Поповић, ОШ 'Јован Дучић', Београд	● ● ● ● ●
173. Игор Димитријевић, ОШ 'Исидора Секулић', Београд	● ● ● ● ●
174. Тамара Дробац, Медицинска школа 'Београд', Београд	● ● ● ● ●
175. Ивана Томић, ОШ 'Стари град', Београд	● ● ● ● ●
176. Ранка Рајковић, ОШ 'Радоје Домановић', Београд	● ● ● ● ●
177. Петровка Торбица, Техничка школа 'Нови Београд', Београд	● ● ● ● ●
178. Весна Тодоровић-Ристић, ОШ 'Јелена Ћетковић', Београд	● ● ● ● ●
179. Милена Царић, Медицинска школа 'Београд', Београд	● ● ● ● ●
180. Жељко Вукадиновић, Средња туристичка школа, Нови Београд	● ● ● ● ●
181. Љиљана Марковић, Тринаеста београдска гимназија, Нови Београд	● ● ● ● ●
182. Александра Милошевић, Београд	● ● ● ● ●
183. Ксенија Кезић Кањевац, ОШ 'Свети Сава', Младеновац	● ● ● ● ●
184. Ана Гулић, Војна гимназија, Београд	● ● ● ● ●
185. Братислав Јовановић, ОШ 'Борислав Пекић', Београд	● ● ● ● ●
186. Љубица Вучић, ОШ 'Веселин Маслеша', Београд	● ● ● ● ●
187. Ђорђе Ћипаризовић, ОШ 'Лаза Костић', Београд	● ● ● ● ●
188. Светлана Петровић Кураица, Четврта београдска гимназија, Београд	● ● ● ● ●
189. Слађана Шкода, ОШ 'Деспот Стефан Лазаревић', Београд	● ● ● ● ●
190. Вера Вранић, ОШ 'Ђорђе Крстић', Београд	● ● ● ● ●
191. Маријана Јовић Лучић, ОШ 'Ђорђе Крстић', Београд	● ● ● ● ●
192. Весна Манић, ОШ 'Никола Тесла', Београд	● ● ● ● ●
193. Никола Павловић, ОШ 'Десанка Максимовић', Београд	● ● ● ● ●
194. Жарко Његовановић, Гимназија, Младеновац	● ● ● ● ●



195. Даница Величковић, ТШ 'Нови Београд', Београд	● ● ● ● ●
196. Милица Мирковић, ОШ 'Браћа Барух', Београд	● ● ● ● ●
197. Ирена Брајевић, Осма београдска гимназија	● ● ● ● ●
198. Татјана Павела, Железничка техничка школа, Београд	● ● ● ● ●
199. Љиљана Пајовић Јовановић, ОШ 'Васа Пелагић', Београд	● ● ● ● ●
200. Татјана Милованов, ОШ 'Браћа Јерковић', Београд	● ● ● ● ●
201. Снежана Карталија, ОШ 'Живојин Перић' - Стублине, Обреновац	● ● ● ● ●
202. Јелисавета Хрњаковић, ОШ 'Франце Прешерн', Београд	● ● ● ● ●
203. Снежана Кутлашић, ОШ 'Борислав Пекић', Београд	● ● ● ● ●
204. Јасна Цветковић, ОШ 'Доситеј Обрадовић', Београд	● ● ● ● ●
205. Милета Васовић, ОШ 'Кнегиња Милица', Београд	● ● ● ● ●
206. Веселка Пушоња, ОШ 'Раде Драинац', Београд	● ● ● ● ●
207. Мирослав Шнеблић, Гимназија 'Свети Сава', Београд	● ● ● ● ●
208. Данијела Савић, ООШ 'Владислав Рибникар', Београд	● ● ● ● ●
209. Наташа Костић, ОШ 'Владимир Назор' - Железник, Београд	● ● ● ● ●
210. Саша Богдановић, Гимназија 'Свети Сава', Београд	● ● ● ● ●
211. Селена Манојловић, ОШ 'Драган Ковачевић', Београд	● ● ● ● ●
212. Ненад Тодоровић, Четврта београдска гимназија	● ● ● ● ●
213. Бранко Ивковић, ОШ 'Јован Јовановић Змај', Обреновац	● ● ● ● ●
214. Ненад Саковић, ОШ 'Ђура Јакшић', Београд	● ● ● ● ●
215. Дивна Вујашевић, ОШ 'Владимир Назор' - Железник, Београд	● ● ● ● ●
216. Златица Лукић, ЕТШ 'Раде Кончар', Београд	● ● ● ● ●
217. Снежана Ивановић, ОШ 'Стеван Дукић', Београд	● ● ● ● ●
218. Стефан Поповић, ОШ 'Свети Сава', Младеновац	● ● ● ● ●
219. Славица Вукосављевић, ОШ 'Јефимија', Обреновац	● ● ● ● ●
220. Владан Игић, Земунска гимназија, Београд	● ● ● ● ●
221. Ана Манготић, ОШ 'Кнегиња Милица', Београд	● ● ● ● ●
222. Коста Панић, Прва београдска гимназија	● ● ● ● ●
223. Данијела Станојевић, Гимназија, Младеновац	● ● ● ● ●
224. Татјана Миљаковић, Пета београдска гимназија	● ● ● ● ●
225. Татјана Јоцић Стефановић, Осма београдска гимназија	● ● ● ● ●
226. Славица Златановић, Осма београдска гимназија	● ● ● ● ●
227. Ненад Алексић, Осма београдска гимназија	● ● ● ● ●
228. Ивана Мајсторовић, Осма београдска гимназија	● ● ● ● ●
229. Славиша Весић, Прва београдска гимназија	● ● ● ● ●
230. Светлана Дамјановић, Прва београдска гимназија	● ● ● ● ●
231. Виолета Лујић, Прва београдска гимназија	● ● ● ● ●
232. Слободан Спремо, Девета београдска гимназија	● ● ● ● ●
233. Слободанка Реџић, Девета београдска гимназија	● ● ● ● ●
234. Дејан Јевтовић, Девета београдска гимназија	● ● ● ● ●
235. Саша Цупаћ, Девета београдска гимназија	● ● ● ● ●
236. Жељко Цветић, Девета београдска гимназија	● ● ● ● ●
237. Гордана Илић, Седма београдска гимназија, Београд	● ● ● ● ●
238. Бисерка Симић, ОШ 'Душко Радовић' - Сремчица, Београд	● ● ● ● ●
239. Јелена Живановић, Земунска гимназија, Београд	● ● ● ● ●
240. Драгица Крвавац, ОШ 'Краљ Петар Први', Београд	● ● ● ● ●
241. Јован Лазић, ОШ 'Филип Кљајић Фића', Београд	● ● ● ● ●
242. Александра Станојевић, Техничка школа-Железник, Београд	● ● ● ● ●



243. Наташа Табаковић, ОШ 'Иван Горан Ковачић', Београд	●	●	●	●	●
244. Весна Марковић, ОШ 'Стеван Сремац' - Борча, Београд	●	●	●	●	●
245. Татјана Војиновић, ОШ 'Никола Тесла'-Винча, Београд	●	●	●	●	●
246. Милица Симић, ОШ 'Никола Тесла'-Винча, Београд	●	●	●	●	●
247. Бојана Зеленовић, Осма београдска гимназија	●	●	●	●	●
248. Радован Ковачевић, Осма београдска гимназија	●	●	●	●	●
249. Вера Ђаковић, Београд	●	●	●	●	●
250. Александра Стефановић, ОШ 'Надежда Петровић', Београд	●	●	●	●	●
251. Зоран Ракић, ОШ 'Коста Ђукић', Београд	●	●	●	●	●
252. Катарина Стевановић, Спортска гимназија, Београд	●	●	●	●	●
253. Гордана Алексић, Спортска гимназија, Београд	●	●	●	●	●
254. Ивана Кнежевић, Спортска гимназија, Београд	●	●	●	●	●
255. Мирјана Гаџић, Спортска гимназија, Београд	●	●	●	●	●
256. Ранко Марковић, ОШ 'Милена Павловић Барили', Београд	●	●	●	●	●
257. Предраг Родић, ОШ 'Зага Маливук', Београд	●	●	●	●	●
258. Јасмина Стевановић, ОШ 'Дуле Караклајић', Београд	●	●	●	●	●
259. Ката Вулетић, ОШ 'Вожд Карађорђе'-Јаково, Београд	●	●	●	●	●
260. Радојка Чупић, ОШ 'Јован Стерија Поповић', Београд	●	●	●	●	●
261. Саша Пеневски, ОШ 'Браћа Јерковић', Београд	●	●	●	●	●
262. Здравко Марјановић, Прва обреновачка основна школа, Обреновац	●	●	●	●	●
263. Душанка Росић, ОШ 'Јанко Веселиновић', Београд	●	●	●	●	●
264. Жељка Клус, ОШ 'Светозар Марковић', Београд	●	●	●	●	●
265. Нада Јојић, ОШ 'Филип Филиповић', Београд	●	●	●	●	●
266. Драгана Пиваш, ОШ 'Скадарлија', Београд	●	●	●	●	●
267. Ненад Головић, Гимназија 'Црњански', Београд	●	●	●	●	●
268. Милијана Петрићевић, Спортска гимназија, Београд	●	●	●	●	●
269. Драгослава Јекић, Медицинска школа Звездара, Београд	●	●	●	●	●
270. Снежана Бећирић, Медицинска школа Звездара, Београд	●	●	●	●	●
271. Драгослав Џојић, ОШ 'Васа Чарапић'-Бели Поток, Београд	●	●	●	●	●
272. Маријана Крсмановић, ОШ 'Вожд Карађорђе' - Јаково, Београд	●	●	●	●	●
273. Љиљана Стојановић, Београд	●	●	●	●	●
274. Весна Радовановић Пеневски, ОШ 'Уједињене Нације', Београд	●	●	●	●	●
275. Снежана Немеш, ОШ 'Вук Караџић', Београд	●	●	●	●	●
276. Александра Мијовић, Зуботехничка школа, Београд	●	●	●	●	●

### Јужно-бачки округ

	2016	2015	2014	2013	2012
277. Адријана Сарић, ОШ 'Мирослав Антић' - Футог, Нови Сад	●	●	●	●	●
278. Гордана Хајдуковић Јандрић, ОШ 'Мирослав Антић' - Футог, Нови Сад	●	●	●	●	●
279. Лука Танасијин, ОШ 'Петар Кочић' - Темерин, Нови Сад	●	●	●	●	●
280. Светозар Трескавица, ОШ 'Милош Црњански', Нови Сад	●	●	●	●	●
281. Маринко Петковић, ШОСО 'Милан Петровић', Нови Сад	●	●	●	●	●
282. Марина Дороцки, Гимназија 'Исидора Секулић', Нови Сад	●	●	●	●	●
283. Тамара Пазаркић, ОШ 'Јован Јовановић Змај', Сремска Каменица	●	●	●	●	●
284. Милутин Рауш, ОШ 'Ђура Даничић', Нови Сад	●	●	●	●	●
285. Тијана Јоџић, Медицинска школа, Нови Сад	●	●	●	●	●
286. Снежана Булајић, Гимназија 'Јован Јовановић Змај', Нови Сад	●	●	●	●	●
287. Драгана Давидовац, ОШ 'Јован Грчић Миленко' - Беочин, Нови Сад	●	●	●	●	●



288. Гордана Беклавац, Гимназија 'Светозар Марковић', Нови Сад	●	●	●	●	●
289. Јелена Петровић, ОШ 'Мирослав Мика Антић', Нови Сад	●	●	●	●	●
290. Ана Влаховић, Гимназија, Врбас	●	●	●	●	●
291. Златко Штрбац, Гимназија 'Јован Јовановић Змај', Нови Сад	●	●	●	●	●
292. Васа Вучуревић, ОШ 'Бранко Радичевић' - Савино Село, Врбас	●	●	●	●	●
293. Драгана Сумзер, Гимназија 'Јован Јовановић Змај', Нови Сад	●	●	●	●	●
294. Драган Вујовић, Средња стручна школа '4. јули', Врбас	●	●	●	●	●
295. Бојан Миљевић, Нови Сад	●	●	●	●	●
296. Нада Дебелић, ОШ 'Бранко Радичевић', Нови Сад	●	●	●	●	●
297. Срето Унковић, ОШ 'Вук Караџић', Бачка Паланка	●	●	●	●	●

### Нишавски округ

	2016	2015	2014	2013	2012
298. Владан Младеновић, Гимназија, Алексинац	●	●	●	●	●
299. Југослав Ђорђевић, ОШ 'Бубањски хероји', Ниш	●	●	●	●	●
300. Славољуб Митић, Гимназија 'Светозар Марковић', Ниш	●	●	●	●	●
301. Весна Гроздановић, ОШ 'Учитељ Таса', Ниш	●	●	●	●	●
302. Гордана Станојевић, ОШ 'Учитељ Таса', Ниш	●	●	●	●	●
303. Братислав Симић, Гимназија, Алексинац	●	●	●	●	●
304. Татјана Мишић, ОШ 'Чегар', Ниш	●	●	●	●	●
305. Марина Најдановић-Лукић, ОШ 'Десанка Максимовић' - Чокот, Ниш	●	●	●	●	●
306. Светлана Ђикић, ОШ 'Ђура Јакшић' - Јелашница, Ниш	●	●	●	●	●
307. Дарко Симић, ОШ 'Чегар', Ниш	●	●	●	●	●
308. Александра Вуковић, ОШ 'Љупче Николић', Алексинац	●	●	●	●	●
309. Даниела Станојевић, Гимназија 'Светозар Марковић', Ниш	●	●	●	●	●
310. Славољуб Радуловић, Гимназија, Алексинац	●	●	●	●	●
311. Јелена Ђорђевић, Гимназија 'Светозар Марковић', Ниш	●	●	●	●	●
312. Драгана Јеленковић, Гимназија 'Светозар Марковић', Ниш	●	●	●	●	●
313. Јелена Станковић, Ниш	●	●	●	●	●
314. Биљана Јовановић, Гимназија 'Стеван Сремац', Ниш	●	●	●	●	●
315. Јасмина Каралић, Ниш	●	●	●	●	●
316. Јасмина Радовановић, Медицинска школа 'Др Миленко Хаџић', Ниш	●	●	●	●	●
317. Сузана Станимировић, Медицинска школа 'Др Миленко Хаџић', Ниш	●	●	●	●	●
318. Лазар Раденковић, Гимназија 'Бора Станковић', Ниш	●	●	●	●	●
319. Снежана Здравковић, ОШ 'Краљ Петар I', Ниш	●	●	●	●	●
320. Милена Митровић, ОШ 'Душан Тасковић Срећко', Нишка Бања	●	●	●	●	●
321. Магдалена Петровић, ОШ 'Бранислав Нушић' - Доња Трнава, Ниш	●	●	●	●	●
322. Слађана Бараћ, ОШ 'Иван Горан Ковачић', Нишка Бања	●	●	●	●	●
323. Владана Голубовић, Ниш	●	●	●	●	●
324. Лалица Рашић, Медицинска школа, Ниш	●	●	●	●	●

### Шумадијски округ

	2016	2015	2014	2013	2012
325. Ана Жлибар, Прва крагујевачка гимназија	●	●	●	●	●
326. Катарина Ђорђевић, Прва крагујевачка гимназија	●	●	●	●	●
327. Ана Марковић, Прва крагујевачка гимназија	●	●	●	●	●
328. Драган Карајовић, Прва крагујевачка гимназија	●	●	●	●	●



329. Соња Савовић, ОШ 'Свети Сава', Крагујевац	●	●	●	●	●
330. Јасмина Јовичић, ОШ 'Наталија Нана Недељковић' - Грошница, Крагујевац	●	●	●	●	●
331. Биљана Живковић, ОШ 'Вук Стефановић Караџић', Крагујевац	●	●	●	●	●
332. Сава Илић, ОШ 'Милош Обреновић', Аранђеловац	●	●	●	●	●
333. Данијела Митровић, ОШ 'Милан Илић-Чича', Аранђеловац	●	●	●	●	●
334. Ненад Пауновић, ОШ 'Вук Стефановић Караџић' - Чачак, Крагујевац	●	●	●	●	●
335. Весна Спасојевић, Прва крагујевачка гимназија	●	●	●	●	●
336. Наташа Милинковић, ОШ 'Милутин и Драгиња Тодоровић', Крагујевац	●	●	●	●	●
337. Љиљана Симић Равлић, ОШ '21. октобар', Крагујевац	●	●	●	●	●
338. Иван Павићевић, ОШ 'Сретен Младеновић' - Десиминовац, Крагујевац	●	●	●	●	●
339. Драган Огњановић, Прва техничка школа, Крагујевац	●	●	●	●	●
340. Александра Зечевић, Гимназија - Чачак, Крагујевац	●	●	●	●	●
341. Јелена Вељовић Мијаиловић, ОШ 'Свети Сава' - Топоница, Кнић	●	●	●	●	●
342. Валентина Рацић, ОШ 'Трећи крагујевачки батаљон', Крагујевац	●	●	●	●	●
343. Снежана Милићевић, ОШ 'Станислав Сремчевић', Крагујевац	●	●	●	●	●
344. Биљана Вујановић, ОШ 'Милан Илић-Чича', Аранђеловац	●	●	●	●	●
345. Соња Ковачевић, ОШ 'Милоје Симовић'-Драгобраћа, Крагујевац	●	●	●	●	●
346. Сузана Арнаут, Прва крагујевачка гимназија	●	●	●	●	●
347. Далибор Делибашић, Гимназија, Аранђеловац	●	●	●	●	●
348. Бојана Ђорђевић, Средња школа 'Никола Тесла', Баточина	●	●	●	●	●
349. Марина Ковановић, ОШ 'Свети Сава' Баточина, Крагујевац	●	●	●	●	●
350. Катарина Ђелошевић, Машинско-саобраћајна школа - Чачак, Крагујевац	●	●	●	●	●
351. Ана Јанковић, ОШ 'Свети Сава', Аранђеловац	●	●	●	●	●
352. Јелена Брковић, Медицинска школа, Крагујевац	●	●	●	●	●
353. Соња Игрутиновић, Медицинска школа, Крагујевац	●	●	●	●	●
354. Стана Јевтић, Медицинска школа, Крагујевац	●	●	●	●	●
355. Мирјана Чаировић, Медицинска школа, Крагујевац	●	●	●	●	●
356. Светлана Мијаиловић, ОШ 'Станислав Сремчевић', Крагујевац	●	●	●	●	●

### Косово и Метохија

	2016	2015	2014	2013	2012
357. Марина Бишевац, Медицинска школа, К. Митровица	●	●	●	●	●
358. Слободан Михајловић, Гимназија, К. Митровица	●	●	●	●	●
359. Мајда Поповић, ОШ 'Краљ Милутин', Грачаница	●	●	●	●	●
360. Александра Гвоздић, ТШ 'М. Петровић Алас', К. Митровица	●	●	●	●	●
361. Велика Арсенијевић, ОШ 'Благоје Радић'- Зупче, Зубин Поток	●	●	●	●	●
362. Славица Терзић, СШ 'Григорије Божовић', Зубин Поток	●	●	●	●	●
363. Јовица Мишковић, ЕТШ 'Миладин Поповић'-Сушица, Приштина	●	●	●	●	●
364. Бранимир Вукадиновић, Медицинска школа, К. Митровица	●	●	●	●	●
365. Данијела Спасић, Медицинска школа, К. Митровица	●	●	●	●	●
366. Миљана Раденковић, СТШ 'Михајло Петровић - Алас', К. Митровица	●	●	●	●	●
367. Ема Мурић, Гимназија, К. Митровица	●	●	●	●	●
368. Јасмина Гаџе, ОШ 'Вук Караџић'-Прилужје, Вучитрн	●	●	●	●	●
369. Вера Прокић, Пољопривредна школа, Приштина-Лешак	●	●	●	●	●
370. Славица Антонијевић, ОШ 'Лепосавић', Лепосавић	●	●	●	●	●
371. Радица Бишевац Томашевић, ОШ 'Јован Цвијић', Зубин Поток	●	●	●	●	●
372. Маријана Зеленовић, Гимназија, К. Митровица	●	●	●	●	●
373. Јасмина Стевић	●	●	●	●	●



374. Душан Савић, ОШ 'Петар Петровић Његош' - Горње Кусце, Гњилане

375. Душанка Костовић, Лепосавић

## Мачвански округ

376. Мирко Нагл, Гимназија, Шабац

377. Мирослав Ристановић, Гимназија, Лозница

378. Драган Станковић, Гимназија 'Вук Караџић', Лозница

379. Гордана Вукосављевић, Техничка школа, Лозница

380. Јасмина Ђокић Јовановић, Гимназија, Шабац

381. Милојко Стефановић, Средња школа, Крупањ

382. Маријана Тешић, Медицинска школа, Шабац

383. Срећко Илић, Медицинска школа, Шабац

384. Радојка Ристановић, ОШ 'Вера Благојевић'-Бања Ковиљача, Лозница

385. Татјана Цвејовић, ПМФ Нови Сад

386. Жељка Марковић, СШ 'Вук Караџић', Љубовија

387. Драган Дојић, Средња школа, Крупањ

388. Татјана Марковић Топаловић, Медицинска школа, Шабач

389. Весна Степановић, Техничка школа, Шабац

390. Никола Гледић, Техничка школа, Шабац

391. Светлана Николић, ОШ 'Јанко Веселиновић', Шабач

392. Јасмина Милутиновић, ОШ 'Боривоје Ж. Милојевић', Крупањ

393. Владимир Симовић, ОШ 'Јован Цвијић' - Змињак, Шабац

394. Маја Катанић, ОШ 'Вук Караџић', Шабач

395. Милица Бељић, ОШ 'Војвода Степа', Липолист, Шабач

396. Јово Михајловић, ОШ 'Николај Велимировић', Шабац

397. Марина Вилотић, Средња школа 'Свети Сава', Лозница

398. Миломир Сарић, Гимназија 'Вук Караџић', Лозница

399. Раденка Јанковић, ОШ 'Краљ Александар Карађорђевић', Прњавор

400. Снежана Вуковић, Гимназија, Шабац

401. Бранко Богосављевић, ОШ 'Свети Сава' - Липнички Шор, Лозница

402. Томислав Михаиловић, ОШ 'Стојан Новаковић', Шабац

403. Биљана Гајић, ОШ 'Јеврем Обреновић', Шабац

404. Драган Ђокић

405. Веселин Цветиновић, ОШ 'Боривоје Ж. Милојевић', Крупањ

406. Живорад Илић, Средња школа 'Свети Сава', Лозница

407. Драгана Лукић, ОШ 'Јанко Веселиновић' - Црна Бара, Богатић

408. Билџана Срдановић, ОШ 'Мика Митровић', Богатић

409. Дејан Павловић, ОШ 'Јован Цвијић' - Змињак, Шабац

410. Весна Рибић, ОШ 'Николај Велимировић', Шабач

411. Снежана Ранковић, ОШ 'Жикица Јовановић Шпанац' - Бела Црква, Крупањ

412. Симо Цревар, Шабац

413. Биљана Баштовановић, ОШ 'Ната Јеличић', Шабач

414. Миливој Павловић, ОШ 'Мајур', Шабач

415. Савко Чајић, ОШ 'Јанко Веселиновић', Шабач

416. Бранка Ковић, ОШ 'Стојан Новаковић', Шабац

417. Наталија Марковић, ОШ 'Доситеј Обрадовић' - Вољујац, Шабач

418. Весна Коларић, ОШ 'Лаза К. Лазаревић', Шабац





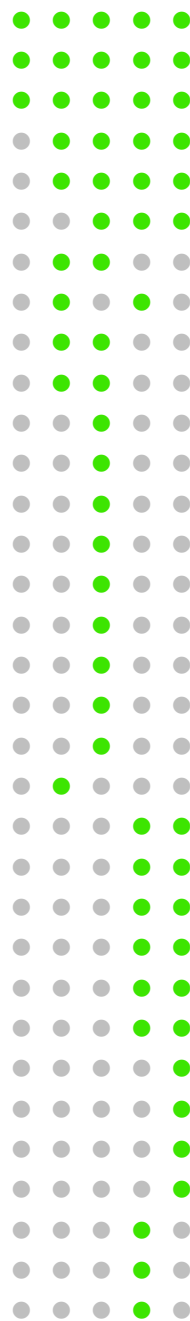
419. Биљана Томић, ОШ 'Лаза К. Лазаревић', Шабац  
 420. Славка Крстић, ОШ 'Јеврем Обреновић', Шабац  
 421. Мирољуб Станојевић, Средња економска школа, Лозница  
 422. Божица Владић, ОШ 'Браћа Рибар'-Доња Борина, Мали Зворник



### Рашки округ

423. Предраг Савић, Гимназија, Краљево  
 424. Наташа Китановић, ОШ 'Светозар Марковић', Краљево  
 425. Драгана Милуновић, ЕСТШ 'Никола Тесла', Краљево  
 426. Владан Пејовић, Гимназија, Краљево  
 427. Мирјана Јанковић, Гимназија, Краљево  
 428. Ратомир Вучковић, Гимназија, Краљево  
 429. Рифат Бихорац, Гимназија, Нови Пазар  
 430. Љубиша Вељковић, ОШ 'Чибуковачки партизани', Краљево  
 431. Мирјана Ицић, Гимназија, Врњачка Бања  
 432. Назим Суљић, ОШ 'Јошаница'-Лукаре, Нови Пазар  
 433. Хакија Бешировић, Гимназија, Нови Пазар  
 434. Суад Хоџић, Гимназија, Нови Пазар  
 435. Марија Недељковић-Живковић, Гимназија, Врњачка Бања  
 436. Назир Суљић, Нови Пазар  
 437. Нафија Суљић, Економско-трговинска школа, Нови Пазар  
 438. Ирена Мутавџић, ОШ 'Рашка', Рашка  
 439. Слободанка Чуглучанин  
 440. Бесим Љајић, ОШ 'Десанка Максимовић', Нови Пазар  
 441. Јасмина Бисерчић, ОШ 'Попински борци', Врњачка Бања  
 442. Ениса Демировић, ОШ 'Меша Селимовић' - Рибариће, Тутин  
 443. Дејан Ракић, Гимназија, Краљево  
 444. Душан Букумира, ОШ 'Ђура Јакшић' - Конарево, Краљево  
 445. Марина Траиловић, Медицинска школа, Краљево  
 446. Марија Томић Говић, ОШ 'IV краљевачки батаљон', Краљево  
 447. Миле Продановић, ОШ 'Вук Караџић', Рибница  
 448. Драгана Ђорђевић, ПХШ 'Др Ђорђе Радић', Краљево  
 449. Милош Дедеић, ОШ 'IV краљевачки батаљон', Краљево  
 450. Дејан Ракоњац, ОШ 'Свети Сава' - Рибница, Краљево  
 451. Александар Обрадовић, ОШ 'Димитрије Туцовић', Краљево  
 452. Јасмина Милојевић, ОШ 'Живан Маричић', Жича  
 453. Звонимир Зајић, ОШ 'Петар Николић' - Самаила, Краљево  
 454. Јованка Тодосијевић, ОШ 'Јово Курсула', Краљево  
 455. Ружица Каравесовић, Медицинска школа, Краљево

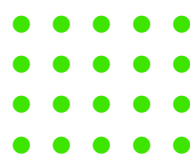
2016 2015 2014 2013 2012



### Поморавски округ

456. Ивана Круљ, ОШ 'Ђура Јакшић', Ћуприја  
 457. Предраг Пеђа Милошевић, Гимназија Параћин  
 458. Горан Миленковић, ОШ 'Рада Миљковић', Јагодина  
 459. Весна Тодоровић, ОШ 'Рада Миљковић', Јагодина

2016 2015 2014 2013 2012



460. Дарко Миљанић, Гимназија, Ћуприја	●	●	●	●	●
461. Славица Илић, Гимназија, Ћуприја	●	●	●	●	●
462. Дејан Милуновић, Пољопривредно-ветеринарска школа, Свилајнац	●	●	●	●	●
463. Драгана Ђурић, ОШ 'Бранко Крсмановић' - Доња Мутница, Параћин	●	●	●	●	●
464. Драгана Васковић, ОШ 'Радоје Домановић', Параћин	●	●	●	●	●
465. Предраг Милеуснић, ОШ 'Вук Караџић', Ћуприја	●	●	●	●	●
466. Надица Савић Ђујић, ОШ 'Бошко Ђуричић', Јагодина	●	●	●	●	●
467. Снежана Танић, ОШ 'Стеван Јаковљевић', Параћин	●	●	●	●	●
468. Марина Васић, ОШ 'Бранко Крсмановић'-Д. Мутница, Параћин	●	●	●	●	●
469. Иван Стевановић, ОШ 'Момчило Поповић-Озрен', Параћин	●	●	●	●	●
470. Славица Тодоровић, Гимназија 'Светозар Марковић', Јагодина	●	●	●	●	●
471. Мирјана Матић Радосављевић, Прва техничка школа, Јагодина	●	●	●	●	●
472. Сузана Милојевић, ОШ 'Деспот Стефан Високи', Деспотовац	●	●	●	●	●
473. Драго Вељовић, ОШ 'Милан Мијалковић', Јагодина	●	●	●	●	●
474. Владан Јовановић, ОШ '17. октобар', Јагодина	●	●	●	●	●
475. Мирјана Павловић, ОШ 'Вук Караџић'-Глоговац, Јагодина	●	●	●	●	●
476. Јасмина Милосављевић, ОШ '17. октобар', Јагодина	●	●	●	●	●
477. Татјана Пајић, Средња школа, Свилајнац	●	●	●	●	●
478. Соња Ђорђевић, Гимназија 'Светозар Марковић', Јагодина	●	●	●	●	●
479. Љиљана Николић, Гимназија 'Светозар Марковић', Јагодина	●	●	●	●	●
480. Љиљана Крстић, ЕТГШ 'Никола Тесла', Јагодина	●	●	●	●	●
481. Марија Миљковић, ОШ 'Бранко Радичевић' - Поповац, Параћин	●	●	●	●	●

### Јужно-банатски округ

	2016	2015	2014	2013	2012
482. Јелена Марковић, Електротехничка школа 'Н. Тесла', Панчево	●	●	●	●	●
483. Драгољуб Џуџић, Регионални центар за таленте 'М. Пупин', Панчево	●	●	●	●	●
484. Јасмина Ћосић, Гимназија 'Урош Предић', Панчево	●	●	●	●	●
485. Сандра Војичић, ОШ 'Младост', Вршац	●	●	●	●	●
486. Миленко Дабић, Гимназија 'Урош Предић', Панчево	●	●	●	●	●
487. Анђела Спасић, Гимназија, Вршац	●	●	●	●	●
488. Наташа Трифуновић, Хемијско-медицинска школа, Вршац	●	●	●	●	●
489. Љиљана Јанковић, ОШ 'Бранко Радичевић', Панчево	●	●	●	●	●
490. Милан Сурла, Телескин ДОО, Панчево	●	●	●	●	●
491. Ненад Грозданић, ОШ 'Сава Жебелан' - Црепаја, Ковачица	●	●	●	●	●
492. Чедомила Кривокапић, Пољопривредна школа, Вршац	●	●	●	●	●
493. Драгица Тасић, ОШ 'Вук Караџић', Старчево	●	●	●	●	●
494. Борислав Познатов, Гимназија 'Урош Предић', Панчево	●	●	●	●	●
495. Марина Орлов, ОШ 'Свети Сава', Панчево	●	●	●	●	●
496. Јелена Цветковић, Гимназија, Вршац	●	●	●	●	●
497. Сања Воденичар Марковић, ТШ '23 мај', Панчево	●	●	●	●	●
498. Александар Виг, ОШ 'Вук Стефановић Караџић', Старчево	●	●	●	●	●
499. Владимир Марковић, ТШ '23 мај', Панчево	●	●	●	●	●
500. Маријан Фаркаш, ОШ 'Жарко Зрењанин', Бела Црква	●	●	●	●	●
501. Јелица Ротар Симоновић, Медицинска школа, Панчево	●	●	●	●	●
502. Зорица Станкић, ОШ 'Исидора Секулић', Панчево	●	●	●	●	●
503. Радашин Петронијевић, Панчево	●	●	●	●	●





	2016	2015	2014	2013	2012
<b>Зајечарски округ</b>					
504. Младен Шљивовић, Гимназија, Зајечар	●	●	●	●	●
505. Страхиња Главонић, Зајечар	●	●	●	●	●
506. Стана Мишић Ковачевић, ШУ Зајечар	●	●	●	●	●
507. Мирјана Станојевић, Гимназија, Зајечар	●	●	●	●	●
508. Виолета Велимировић, ОШ 'Љубица Радосављевић Нада', Зајечар	●	●	●	●	●
509. Анђелка Антић, СШ 'Никола Тесла', Бољевац	●	●	●	●	●
510. Злата Урошевић, ОШ 'Љуба Нешић', Зајечар	●	●	●	●	●
511. Милијан Срејић, Гимназија, Књажевац	●	●	●	●	●
512. Слађана Јовановић, ОШ 'Јеремија Илић-Јегор'-Рготина, Зајечар	●	●	●	●	●
513. Љиљана Тодоровић, Медицинска школа, Зајечар	●	●	●	●	●
514. Драгица Никодијевић, ОШ 'Дубрава', Књажевац	●	●	●	●	●
515. Тамара Андоновић, ОШ 'Димитрије Тодоровић-Каплар', Књажевац	●	●	●	●	●
516. Живорад Илић, ОШ 'Митрополит Михаило', Сокобања	●	●	●	●	●
517. Војкан Здравковић, ОШ 'Митрополит Михаило', Сокобања	●	●	●	●	●
518. Јелена Петровић, ОШ 'Вук Караџић', Књажевац	●	●	●	●	●
519. Александар Јевтић, ОШ '9. српска бригада', Бољевац	●	●	●	●	●
520. Наташа Јовановић, ОШ 'Хајдук Вељко', Зајечар	●	●	●	●	●

	2016	2015	2014	2013	2012
<b>Сремски округ</b>					
521. Бранислава Блајваз, ОШ 'Јован Јовановић Змај', Сремска Митровица	●	●	●	●	●
522. Јанко Јовановић, Гимназија, Сремска Митровица	●	●	●	●	●
523. Добрила Костић, ОШ 'Растко Немањић - Свети Сава', Нова Пазова	●	●	●	●	●
524. Драгана Арсенијевић, ОШ '23. октобар'-Голубинци, С. Пазова	●	●	●	●	●
525. Зоран Мандић, ОШ 'Свети Сава', Сремска Митровица	●	●	●	●	●
526. Ана Аларгић, СТШ 'Никола Тесла', Сремска Митровица	●	●	●	●	●
527. Љиљана Стокановић, ОШ 'Трива Витасовић-Лебарник'-Лаћарак, С. Митровица	●	●	●	●	●
528. Снежана Керкез, ОШ 'Душан Јерковић', Рума	●	●	●	●	●
529. Рада Трајковић, СТШ 'Никола Тесла', Сремска Митровица	●	●	●	●	●
530. Мирко Младеновић, ОШ 'Слободан Бајић-Паја', Сремска Митровица	●	●	●	●	●
531. Љиљана Пантелић, Медицинска школа 'Драгиња Никшић', Сремска Митровица	●	●	●	●	●
532. Властимир Жељајић, Гимназија, Рума	●	●	●	●	●
533. Сања Ивић, ОШ 'Јован Поповић', Сремска Митровица	●	●	●	●	●
534. Марија Куруцић, Гимназија, Сремска Митровица	●	●	●	●	●
535. Јован Свилар, ОШ 'Бранко Радичевић'-Кузмин, Сремска Митровица	●	●	●	●	●
536. Слађана Стојсављевић, ОШ 'Јован Поповић', Инђија	●	●	●	●	●
537. Златко Шалић, Гимназија, Сремска Митровица	●	●	●	●	●

	2016	2015	2014	2013	2012
<b>Расински округ</b>					
538. Наташа Ралић, Прва техничка школа, Крушевац	●	●	●	●	●
539. Сања Матијашевић, ШУ Крушевац	●	●	●	●	●
540. Милош Митровић, ОШ 'Доситеј Обрадовић', Ћићевац	●	●	●	●	●
541. Драгана Милићевић, Гимназија, Крушевац	●	●	●	●	●
542. Нада Савић, Гимназија, Крушевац	●	●	●	●	●



543. Миланка Илић, Гимназија, Крушевац	●	●	●	●	●
544. Гордана Настић, ОШ 'Нада Поповић', Крушевац	●	●	●	●	●
545. Лидија Радовановић, Висока хем.тех. школа, Крушевац	●	●	●	●	●
546. Снежана Белоица, ОШ 'Љубивоје Бајић'-Медвеђа, Трстеник	●	●	●	●	●
547. Манда Кнежевић, ОШ 'Николај Велимировић', Александровац	●	●	●	●	●
548. Горан Милићевић, ОШ 'Јован Поповић', Крушевац	●	●	●	●	●
549. Љиљана Станковић, ОШ 'Јован Јовановић Змај', Крушевац	●	●	●	●	●
550. Горица Ивановић, ОШ 'Доситеј Обрадовић', Крушевац	●	●	●	●	●
551. Драган Капларевић, ОШ 'Бранко Радичевић' - Разбојна, Крушевац	●	●	●	●	●
552. Весна Радић, ОШ 'Раде Додић' - Милутовац, Трстеник	●	●	●	●	●

### Средње-банатски округ

	2016	2015	2014	2013	2012
553. Дарко Радованчевић, Гимназија, Зрењанин	●	●	●	●	●
554. Никола Танкосић, Гимназија, Зрењанин	●	●	●	●	●
555. Биљана Танкосић, Зрењанин	●	●	●	●	●
556. Светислав Коман, Гимназија, Зрењанин	●	●	●	●	●
557. Тибор Макан, Гимназија, Зрењанин	●	●	●	●	●
558. Никушор Петров, Гимназија, Зрењанин	●	●	●	●	●
559. Југослав Богдановић, ХПТШ 'Урош Предич', Зрењанин	●	●	●	●	●
560. Вера Дамјанов, Гимназија, Зрењанин	●	●	●	●	●
561. Миша Брацић, ОШ 'Соња Маринковић', Зрењанин	●	●	●	●	●
562. Велизар Монић, ОШ 'Серво Михаљ', Зрењанин	●	●	●	●	●
563. Ивана Мезеи, Медицинска школа, Зрењанин	●	●	●	●	●
564. Силвана Живковић, ОШ 'Ђура Јакшић', Зрењанин	●	●	●	●	●

### Западно-бачки округ

	2016	2015	2014	2013	2012
565. Душан Мишковић, Гимназија, Сомбор	●	●	●	●	●
566. Милисав Остојић, СТШ 'Михајло Пупин', Кула	●	●	●	●	●
567. Милан Мартињук, ОШ 'Петефи бригада', Кула	●	●	●	●	●
568. Љиљана Мијатовић, Гимназија 'Вељко Петровић', Сомбор	●	●	●	●	●
569. Снежана Николић, ОШ 'Никола Тесла' - Кљајићево, Сомбор	●	●	●	●	●
570. Соња Јурковић Луткић, ОШ 'Братство-јединство', Сомбор	●	●	●	●	●
571. Марија Радуловић, ОШ 'Мирослав Антић' - Чонопља, Сомбор	●	●	●	●	●
572. Ервин Бриндза, ОШ 'Братство јединство', Сомбор	●	●	●	●	●
573. Ладислав Палфи, ОШ 'Братство јединство'-Светозар Милетић, Сомбор	●	●	●	●	●
574. Драгољуб Ђурић, ОШ 'Иван Горан Ковачић'-Станишић, Сомбор	●	●	●	●	●
575. Југослава Балаћ, ОШ 'Иван Горан Ковачић'-Сонта, Апатин	●	●	●	●	●
576. Весна Чортан, ОШ 'Жарко Зрењанин', Апатин	●	●	●	●	●
577. Боро Булат, ОШ 'Жарко Зрењанин', Апатин	●	●	●	●	●
578. Слободан Божић, ОШ 'Никола Тесла'-Липар, Кула	●	●	●	●	●
579. Милош Кривокућа, ОШ '20. октобар'-Сивац, Кула	●	●	●	●	●
580. Анђелка Терзић, ОШ 'Иво Лола Рибар', Сомбор	●	●	●	●	●
581. Стеван Хилко, ОШ 'Вук Караџић' - Црвенка, Кула	●	●	●	●	●
582. Драган Вукелић, ОШ 'Доситеј Обрадовић', Сомбор	●	●	●	●	●
583. Петрана Јаковић, ШООО, Сомбор	●	●	●	●	●



584. Љубица Ђурица, ОШ 'Аврам Мразовић', Сомбор	●	●	●	●	●
585. Милан Брдар, Гимназија, Сомбор	●	●	●	●	●

### Златиборски округ

	2016	2015	2014	2013	2012
586. Гордана Варница, Гимназија 'Свети Сава', Пожега	●	●	●	●	●
587. Ангелина Јеротијевић Марковић, ОШ 'Стари град', Ужице	●	●	●	●	●
588. Снежана Јевђовић, Ужичка гимназија, Ужице	●	●	●	●	●
589. Јелена Радовановић, ОШ 'Слободан Секулић', Ужице	●	●	●	●	●
590. Никола Јовановић, Гимназија 'Јосиф Панчић', Бајина Башта	●	●	●	●	●
591. Живојин Павловић, Ужичка гимназија, Ужице	●	●	●	●	●
592. Бранка Смиљанић, Гимназија 'Свети Сава', Пожега	●	●	●	●	●
593. Џмиљка Васовић, Ужичка гимназија, Ужице	●	●	●	●	●
594. Даница Тошић, Пољопривредна школа 'Љубо Мићић', Пожега	●	●	●	●	●
595. Соња Гроздановић, Гимназија 'Свети Сава', Пожега	●	●	●	●	●
596. Весна Димитријевић, Прва основна школа Краља Петра II, Ужице	●	●	●	●	●
597. Верица Брковић, ОШ 'Слободан Секулић', Ужице	●	●	●	●	●
598. Милија Топаловић, Средња школа 'Свети Ахилије', Ариље	●	●	●	●	●
599. Иван Жунић, ОШ 'Алекса Дејовић' - Севојно, Ужице	●	●	●	●	●

### Браничевски округ

	2016	2015	2014	2013	2012
600. Маја Јовановић Глигоријевић, Гимназија, Пожаревац	●	●	●	●	●
601. Зорица Алексић, Гимназија, Пожаревац	●	●	●	●	●
602. Милан Алексић, Гимназија, Пожаревац	●	●	●	●	●
603. Иван Стојановић, Гимназија, Пожаревац	●	●	●	●	●
604. Јелена Добричић, ОШ 'Вук Караџић', Пожаревац	●	●	●	●	●
605. Светислав Љубисављевић, Медицинска школа, Пожаревац	●	●	●	●	●
606. Драган Аврамовић, Медицинска школа, Пожаревац	●	●	●	●	●
607. Драгана Танчић, ОШ 'Вук Караџић', Пожаревац	●	●	●	●	●
608. Снежана Стојановић, ОШ 'Краљ Александар I', Пожаревац	●	●	●	●	●
609. Драган Мандић, ОШ 'Иво Лола Рибар', Велико Градиште	●	●	●	●	●
610. Тодор Драгољевић, Средња школа, Велико Градиште	●	●	●	●	●

### Пчињски округ

	2016	2015	2014	2013	2012
611. Весна Митић, СШ 'Свети Сава', Бујановац	●	●	●	●	●
612. Срба Стошић, ОШ 'Вук Стефановић Караџић' - Левосоје, Бујановац	●	●	●	●	●
613. Назми Нухији, ОШ 'Десанка Максимовић', Бујановац	●	●	●	●	●
614. Слађан Ристић, ОШ 'Вук Караџић', Прешево	●	●	●	●	●
615. Ферат Рустеми, ОШ 'Десанка Максимовић', Бујановац	●	●	●	●	●
616. Сузана Ивановић, ОШ 'Вук Караџић', Врање	●	●	●	●	●
617. Хирмете Велиу, Гимназија 'Скендербег', Прешево	●	●	●	●	●
618. Татјана Стошић, Центар за таленте, Врање	●	●	●	●	●
619. Иванка Станковић, Гимназија 'Бора Станковић', Врање	●	●	●	●	●
620. Владица Спасић, ОШ 'Вук Караџић', Сурдулица	●	●	●	●	●
621. Саша Јовановић, Гимназија 'Бора Станковић', Врање	●	●	●	●	●



622. Ивица Митић, ОШ '1. мај' - Вртогош, Врање	●	●	●	●	●
623. Добри Станковић, Медицинска школа, Врање	●	●	●	●	●

### Северно-бачки округ

	2016	2015	2014	2013	2012
624. Јелена Писаров, ОШ 'Матко Вуковић', Суботица	●	●	●	●	●
625. Даниел Баровић, ОШ 'Јован Микић', Суботица	●	●	●	●	●
626. Биљана Танасић, Гимназија 'Светозар Марковић', Суботица	●	●	●	●	●
627. Милорад Ковачевић, ОШ 'Иштван Сечењи', Суботица	●	●	●	●	●
628. Стојанка Бјелетић, Медицинска школа, Суботица	●	●	●	●	●
629. Мирко Киселички, Гимназија 'Светозар Марковић', Суботица	●	●	●	●	●
630. Љиљана Крнајски, Гимназија 'Светозар Марковић', Суботица	●	●	●	●	●
631. Аранка Амштадт, ОШ 'Јован Јовановић Змај', Суботица	●	●	●	●	●
632. Александар Ристић, ОШ 'Ђуро Салај', Суботица	●	●	●	●	●
633. Тања Мијатов, Гимназија 'Светозар Марковић', Суботица	●	●	●	●	●

### Јабланички округ

	2016	2015	2014	2013	2012
634. Драган Димић, ШООО 'Доситеј Обрадовић', Лесковац	●	●	●	●	●
635. Предраг Стојановић, ОШ 'Петар Тасић', Лесковац	●	●	●	●	●
636. Саша Стојановић, Гимназија, Лесковац	●	●	●	●	●
637. Веселинка Петковић, ОШ 'Станимир Вељковић-Зеле'-Бојник, Лесковац	●	●	●	●	●
638. Синиша Стојиљковић, Гимназија, Лесковац	●	●	●	●	●
639. Зоран Костић, ОШ 'Јосиф Костић', Лесковац	●	●	●	●	●
640. Александар Николић, ОШ 'Светозар Марковић', Лесковац	●	●	●	●	●
641. Драгана Злопорубовић, Гимназија, Лесковац	●	●	●	●	●
642. Љиљана Анђелковић, Гимназија, Лесковац	●	●	●	●	●
643. Марија Стојановић Красић, Медицинска школа, Лесковац	●	●	●	●	●
644. Зоран Тодоровић, ХТШ 'Божидар Ђорђевић Кукар', Лесковац	●	●	●	●	●

### Северно-банатски округ

	2016	2015	2014	2013	2012
645. Лаура Ароксалаши, Сенћанска гимназија, Сента	●	●	●	●	●
646. Едеш Каталин, Сенћанска гимназија, Сента	●	●	●	●	●
647. Александар Атлагић, Сенћанска гимназија, Сента	●	●	●	●	●
648. Петар Вуца, ОШ "Др Тихомир Остојић" - Остојићево, Кикинда	●	●	●	●	●
649. Драган Васић, ОШ 'Васа Стајић' - Мокрин, Кикинда	●	●	●	●	●
650. Милан Данић, ОШ 'Свети Сава', Кикинда	●	●	●	●	●
651. Јудит Хун, ОШ 'Ђура Јакшић', Кикинда	●	●	●	●	●
652. Јелена Вулић, ОШ 'Јован Поповић', Кикинда	●	●	●	●	●
653. Милан Толмач, ОШ 'Петар Кочић' - Наково, Кикинда	●	●	●	●	●
654. Лајош Сакмањ, Гимназија 'Бољаи', Сента	●	●	●	●	●
655. Биљана Груловић, ОШ 'Вук Караџић', Кикинда	●	●	●	●	●

### Подунавски округ

2016 2015 2014 2013 2012



656. Милутин Вучковић, Гимназија, Смедерево	●	●	●	●	●
657. Јелена Тасић, ОШ 'Бранислав Нушић', Смедерево	●	●	●	●	●
658. Дамјан Станковић, Гимназија, Смедерево	●	●	●	●	●
659. Горан Тодоров Филиповић, Гимназија, Смедерево	●	●	●	●	●
660. Весна Симоновић, Гимназија, Смедерево	●	●	●	●	●
661. Тања Милосављевић, Гимназија, Смедерево	●	●	●	●	●
662. Нада Цвејић, ОШ 'Херој Срба' - Осипаоница, Смедерево	●	●	●	●	●
663. Зорица Цвејић, ОШ 'Доситеј Обрадовић', Смедерево	●	●	●	●	●
664. Мирјана Петровић, ОШ 'Академик Радомир Лукић'-Милошевац, В. Плана	●	●	●	●	●

### Пиротски округ

	2016	2015	2014	2013	2012
665. Нина Јовановић, Гимназија, Пирот	●	●	●	●	●
666. Мирјана Еленков, Гимназија, Пирот	●	●	●	●	●
667. Драган Манчић, ОШ 'Свети Сава', Пирот	●	●	●	●	●
668. Горан Игњатовић, ОШ 'Душан Радовић', Пирот	●	●	●	●	●
669. Наташа Ристић, Пирот	●	●	●	●	●
670. Борица Ћирић, ОШ 'Љупче Шпанац', Бела Паланка	●	●	●	●	●
671. Ана Петров, Гимназија, Пирот	●	●	●	●	●
672. Драгиша Николић, Гимназија, Пирот	●	●	●	●	●

### Борски округ

	2016	2015	2014	2013	2012
673. Иван Стојановић, СШ 'Свети Сава', Кладово	●	●	●	●	●
674. Александар Митровић, Машинско-електротехничка школа, Бор	●	●	●	●	●
675. Марина Радић, ОШ 'Љубица Јовановић Радосављевић' - Подвршка, Кладово	●	●	●	●	●
676. Горан Марковић, Гимназија 'Бора Станковић', Бор	●	●	●	●	●
677. Минка Милићевић, ОШ 'Душан Радовић', Бор	●	●	●	●	●
678. Љилјана Стојановић, Гимназија, Неготин	●	●	●	●	●
679. Наташа Ђорђевић Паовић, ОШ 'Вук Караџић', Неготин	●	●	●	●	●
680. Биљана Мучибабић, Гимназија, Мајданпек	●	●	●	●	●

### Колубарски округ

	2016	2015	2014	2013	2012
681. Милка Нинковић, ОШ 'Андреа Савчић', Ваљево	●	●	●	●	●
682. Предраг Стојаковић, Гимназија, Ваљево	●	●	●	●	●
683. Дамјан Лазић, ОШ 'Илија Бирчанин' - Ставе, Ваљево	●	●	●	●	●
684. Невена Смолчић, ОШ 'Милован Глишић', Ваљево	●	●	●	●	●
685. Драгица Ђукнић, Ваљево	●	●	●	●	●

### Моравички округ

	2016	2015	2014	2013	2012
686. Ирена Стевановић, Гимназија, Чачак	●	●	●	●	●
687. Зоран Недељковић, ОШ 'Свети Сава', Горњи Милановац	●	●	●	●	●
688. Милка Поледица, ОШ 'Милинко Кушић', Ивањица	●	●	●	●	●
689. Слободан Пантић, ОШ 'Краљ Александар I', Горњи Милановац	●	●	●	●	●



690. Милка Николић, ОШ 'Др Драгиша Мишовић', Чачак	●	●	●	●	●
691. Горан Ивковић, ОШ 'Свети Сава', Чачак	●	●	●	●	●
692. Олга Дукић, ОШ 'Вук Караџић', Чачак	●	●	●	●	●
693. Момчило Ћирић, ОШ 'Танаско Рајић', Чачак	●	●	●	●	●
694. Драган Јовићевић, ОШ 'Бранислав Петровић'-Слатина, Чачак	●	●	●	●	●
695. Снежана Ђурђевић, ОШ 'Филип Филиповић', Чачак	●	●	●	●	●

### Топлички округ

696. Драгана Обрадовић Стаменковић, ОШ 'Вук Караџић' - Житни поток, Прокупље	2016	2015	2014	2013	2012
	●	●	●	●	●

### Нераспоређени

697. Бранкица Рибачкова	2016	2015	2014	2013	2012
698. Данијела Петровић	●	●	●	●	●
699. Ивана Лакићевић	●	●	●	●	●
700. Надица Мутин	●	●	●	●	●

### Студенти

701. Милица Ђекић, Физички факултет, Београд	2016	2015	2014	2013	2012
702. Лана Неоричић, Физички Факултет, Београд	●	●	●	●	●
703. Зорана Недељковић, Физички Факултет, Београд	●	●	●	●	●
704. Милица Милојевић, Физички факултет, Београд	●	●	●	●	●
705. Данило Делибашић, ПМФ Ниш	●	●	●	●	●
706. Никола Филиповић, ПМФ Ниш	●	●	●	●	●
707. Весна Стојанац, Физички факултет, Београд	●	●	●	●	●
708. Марија Марковић, Физички факултет, Београд	●	●	●	●	●
709. Јелена Кршић, Физички факултет, Београд	●	●	●	●	●
710. Чедо Шкорић, Физички Факултет, Београд	●	●	●	●	●
711. Александра Димић, Физички факултет, Београд	●	●	●	●	●
712. Александар Матић, Физички факултет, Београд	●	●	●	●	●
713. Јована Милијановић, Физички факултет, Београд	●	●	●	●	●
714. Ана Ђулаковић, Физички факултет, Београд	●	●	●	●	●
715. Јелена Стошић, Физички факултет, Београд	●	●	●	●	●
716. Милена Димитријевић, Физички Факултет, Београд	●	●	●	●	●
717. Зоран Томић, ПМФ Ниш	●	●	●	●	●
718. Јелена Милановић, Физички Факултет, Београд	●	●	●	●	●
719. Марија Дубачкић, Физички Факултет, Београд	●	●	●	●	●
720. Тијана Радовановић, Физички Факултет, Београд	●	●	●	●	●
721. Вук Јовићевић, Физички Факултет, Београд	●	●	●	●	●
722. Вукашин Милошевић, Физички Факултет, Београд	●	●	●	●	●
723. Стефан Анђелковић, Физички Факултет, Београд	●	●	●	●	●
724. Весна Чворић, Физички Факултет, Београд	●	●	●	●	●
725. Ивана Поповић, Физички Факултет, Београд	●	●	●	●	●
726. Војислав Паунић, Физички Факултет, Београд	●	●	●	●	●
727. Никола Ивановић, Физички Факултет, Београд	●	●	●	●	●



728. Данило Николић, Физички Факултет, Београд	●	●	●	●	●
729. Славица Рафаиловић, Физички Факултет, Београд	●	●	●	●	●
730. Јана Петровић, Физички Факултет, Београд	●	●	●	●	●
731. Јелена Репић, Физички Факултет, Београд	●	●	●	●	●
732. Јелена Костић, Физички Факултет, Београд	●	●	●	●	●
733. Ивана Дугалић, Физички Факултет, Београд	●	●	●	●	●
734. Мирјана Ракићевић, Физички Факултет, Београд	●	●	●	●	●
735. Александра Радовановић, Физички Факултет, Београд	●	●	●	●	●
736. Лука Клиначаревић, Физички Факултет, Београд	●	●	●	●	●
737. Гордана Алексић, Физички Факултет, Београд	●	●	●	●	●
738. Виолета Милојевић, Физички Факултет, Београд	●	●	●	●	●
739. Душан Етински, Физички Факултет, Београд	●	●	●	●	●
740. Емилија Симоновић, Физички Факултет, Београд	●	●	●	●	●
741. Марко Стојановић, ПМФ Ниш	●	●	●	●	●
742. Вања Вуковић, Физички факултет, Београд	●	●	●	●	●
743. Вукица Поповић, Физички факултет, Београд	●	●	●	●	●
744. Јелена Матковић, Физички Факултет, Београд	●	●	●	●	●
745. Филип Килибарда, Физички Факултет, Београд	●	●	●	●	●
746. Игор Прлина, Физички Факултет, Београд	●	●	●	●	●
747. Вељко Јанковић, Физички факултет, Београд	●	●	●	●	●
748. Никола Коњик, Физички факултет, Београд	●	●	●	●	●
749. Ана Худомал, Физички факултет, Београд	●	●	●	●	●
750. Драгана Вуловић, Физички факултет, Београд	●	●	●	●	●
751. Иван Цицварић, Физички Факултет, Београд	●	●	●	●	●
752. Горица Здравковић, Физички Факултет, Београд	●	●	●	●	●
753. Светислав Мијатовић, Физички Факултет, Београд	●	●	●	●	●

### Млади физичари

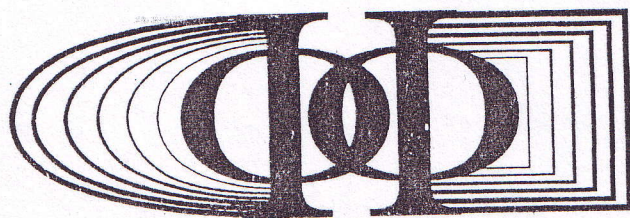
754. Драгица Симовић, Шабац	2016	2015	2014	2013	2012
755. Лазар Младеновић, Лесковац	●	●	●	●	●
756. Стефан Станковић, Лесковац	●	●	●	●	●
757. Ана Митковић, Лесковац	●	●	●	●	●
758. Ђорђе Митровић, Лесковац	●	●	●	●	●
759. Јелена Јовановић, Лесковац	●	●	●	●	●
760. Анђела Доневић, Лесковац	●	●	●	●	●
761. Јелена Тодоровић, Лесковац	●	●	●	●	●
762. Петар Бојовић, Лесковац	●	●	●	●	●

Списак свих индивидуалних чланова Друштва биће истакнут на званичном сајту ДФС, сем оних који изричито траже да се њихово име не објављује.

Све колеге које су уплатиле чланарину, а њихово име се не налази на списку или желе да додају неке податке (школа, e-mail), могу да се мејлом обратe колеги Иринелу Тапалаги (irinel@ff.bg.ac.rs).







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ФИЗИЧКИ ФАКУЛТЕТ

**ФОНД „Проф. др ЉУБОМИР ЋИРКОВИЋ”**

Одлуком Одбора фонда „Проф. др Љубомир Ћирковић”  
за најбољи дипломски рад одбрањен на  
Физичком факултету у 1997/1998 години  
награђује се

*Ненад Сакан*

На основу тога издаје се ова

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**О ДОДЕЉИВАЊУ НАГРАДЕ**

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### PROGRAM

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ODELJENJE ZA MEHANIKU

PROGRAM ZA MAJ 2006.

Pozivamo Vas da učestvujete u radu sednica Odeljenja i to:

**SREDA, 03. maj 2006. u 18 sati:**

*Nenad Sakan (Institut za fiziku, Beograd)*

**OTSECENI KULONOV POTENCIJAL I APROKSIMACIJE OPTICKIH PROCESA U GUSTOJ PLAZMI**

Primenom otsecenog Kulonovog potencijala razmatrani su procesi neprekidne emisije i apsorpcije u gustoj jako jonizovanoj plazmi srednje i velike neidealnosti. Dobijeni teorijski rezultati su upoređeni sa posojecim eksperimentalnim rezultatima.

**SREDA, 10. maj 2006. u 12 sati:**

*Alessandro M. Forte (Universit du Qubec Montral)*

**A Numerical Investigation of Time-Dependent Thermal Convection in Earth's Interior**

The physical and mathematical formulation of a model of thermal convection in a viscous fluid will be presented. This model will be used to explore the dynamics in Earth's 3000 kilometre-thick rocky shell called the mantle. The discussion will first focus on the mathematical and numerical development of a model of time-dependent, compressible thermal convection in 3-D spherical geometry which is based on a pseudo-spectral solution of the coupled equations of energy and momentum conservation assuming a linear viscous rheology. The equations of mass and momentum conservation are solved only once using generalized spherical harmonic basis functions to obtain spectral Green functions. These Green functions describe the viscous impulse response of the mantle and they are used to mathematically predict the flow induced by an arbitrary distribution of density perturbations. With this approach, the thermal convection problem is effectively reduced to the solution of the conservation of energy equation. The present-day distribution of temperature anomalies in Earth's mantle may be derived from global seismic tomographic images of three-dimensional (3-D) structure inside our planet. These estimates of mantle thermal structure provide a starting point for numerical reconstructions of the spatial and temporal evolution of the 3-D structure and flow in the mantle. The Rayleigh number which characterizes the convective vigour in the mantle is estimated to be very high and therefore the effect of thermal diffusion will be much weaker than thermal advection in most of the mantle. This assumption will be used as a basis for reconstructing past thermal states in the mantle.

**SREDA, 17. maj 2006. u 18 sati:**

*Katica (Stevanovic) Hedrih, Julijana D. Simonovic (Masinski fakultet, Nis)*

**SLOBODNE TRANSVERZALNE OSCILACIJE ELASTICNO SPREGNUTIH KRUNIH PLO?A**

Prikazuju se rezultati analiticke i numericke analize transversalnih oscilacija elasticno spregnutih kruznih ploca. Koriscenjem mogucnosti programa Maple i MathCad'a docaravaju se rezimi viefrekventnih oscilacija elasticno spregnutih krunih ploca za razlicite uslove oslanjanja i razlicite pocetne uslove. Pokazano je da se u jednom obliku oscilovanja javlja dvofrekventni reim oscilovanja indukovani pocetnim poremećajima prirodnog nedeformisanog stanja sistema. Kljucne reci: Elasticno spregnute kruzne ploce, Bessel-ove funkcije, beskonacni redovi, dvofrekventni reimi.

**SREDA, 24. maj 2006. u 18 sati:**

*B. Gajic, V. Dragovic (Matematički institut SANU, Beograd)*

**SISTEMI HES-APELJROTOVOG TIPA**

Konstruisani su visedimenzioni analogoni klasičnog Hes-Apeljrotovog slučaja kretanja krutog tela. Za tako dobijene sisteme dato je i Laksovo predstavljanje sa spektralnim parametrom. Detaljna algebarsko-geometrijska integracija sprovedena je u dimenziji četiri. Istaknuta je sličnost sa integracijom Lagranžove dvojne cigre.

**SREDA, 31. maj 2006. u 18 sati:**

*Srboljub S. Simic (Fakultet tehničkih nauka, Novi Sad)*

**O hiperboličnim modelima mesavina gasova**

Početv od modela homogenih mesavina koje je izložio Truzdel u okvirima racionalne termodinamike razvila su se dva pristupa ovoj problematici. U prvom se analizira jedno temperaturno polje (jednotemperaturni modeli), dok se u drugom svakoj komponenti pridružuje njena sopstvena temperatura (visetemperaturni modeli). Navedene pretpostavke dovode do formiranja različitih matematičkih modela između kojih njihov odnos nije uspostavljena jasna veza.

U ovom radu će biti prikazan hiperbolični visetemperaturni model homogene gasne meavine. Pokazaće se da se odgovarajući jednotemperaturni hiperbolični model može tretirati kao podsistem polaznog sistema. Ovakva struktura modela omogućuje dobijanje vanih rezultata kvalitativne prirode: ocenu gornje granice za karakteristične brzine prostiranja talasa u jednotemperaturnom modelu, globalnu analizu ponašanja glatkih rešenja i asimptotsko ponašanje rešenja visetemperaturnog modela.

Rad je plod saradnje sa prof. Tomazom Rudjerijem (Tommaso Ruggeri) sa Univerziteta u Bolonji, Italija.

Sednice se održavaju u zgradi SANU, Knez Mihailova 35, u sali 2 na prvom spratu.

Sekretar Odeljenja  
dr Božidar Jovanović

Upravnik Odeljenja  
Akademik Vladan Djordjević, s.r.

---

## THE METHODS FOR DETERMINATION OF HF CHARACTERISTICS OF NONIDEAL PLASMA

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Polytechnic University of Valencia, Camino de Vera s/n,  
Valencia 46022, Spain*

**Abstract.** In this work the previously developed method of calculation of HF electro-conductivity of non-ideal plasma is applied to the area of higher electron densities, up to  $10^{24} \text{ cm}^{-3}$  and in the temperature range  $30\,000 \text{ K} \leq T \leq 200\,000 \text{ K}$ . The computations are carried out in the frequency range  $[0, 1 \cdot \omega_p]$ ,  $\omega_p$  being the plasma frequency. A good agreement with the previously published data is obtained.

### 1. INTRODUCTION

This work is a continuation of the works [2, 1, 3, 4]. In [1] we presented data for slightly non-ideal plasma HF conductivity, while in [2] we have covered the area of moderately non-ideal plasma, while in [3] and [4] we have reached extreme dense concentrations in a range of  $1 \cdot 10^{21} \text{ cm}^{-3} \leq N_e \leq 1 \cdot 10^{23} \text{ cm}^{-3}$  and for  $30\,000 \text{ K} \leq T \leq 200\,000 \text{ K}$ . Here we present and compare the data for extremely dense non-ideal fully ionized hydrogen plasmas with thermodynamic conditions data presented in [5]. There are two values that was reproducible from their data  $\Gamma = 0.5$   $r_s = 4$ , and  $\Gamma = 0.5$   $r_s = 1$  which yields  $N_e = 2.517 \cdot 10^{22} \text{ cm}^{-3}$ ,  $T = 15\,7882 \text{ K}$  and  $N_e = 1.611 \cdot 10^{24} \text{ cm}^{-3}$   $T = 63\,153 \text{ K}$  respectively. Here  $\Gamma = \beta e^2/a$ , where  $\beta$  is inverse temperature in energy units and  $a = r_s$  is the mean interionic distance (electronic Wigner-Seitz radius).

In this work a completely ionized hydrogen plasma is considered in a homogenous and monochromatic HF external electric field

$$\vec{E}(t) = \vec{E}_0 \exp\{-i\omega t\}$$

The dynamic electric conductivity  $\sigma(\omega)$  is given by a complex function of the field frequency:

$$\sigma(\omega) = \sigma_{\text{Re}}(\omega) + i \cdot \sigma_{\text{Im}}(\omega), \quad (1)$$

and, according to [1, 2],  $\sigma(\omega)$  is taken in the integrated Drude-like form:

$$\sigma(\omega) = \frac{4e^2}{3m} \int_0^\infty \frac{\tau(E)}{1 - i\omega\tau(E)} \cdot \left[ -\frac{dw(E)}{dE} \right] \rho(E) E dE \quad (2)$$

where  $\rho(E)$  is the density of electronic states in the energy space and  $w(E)$  is a Fermi-Dirac distribution function  $\tau(E)$  is the static electronic relaxation time. The basic feature of our theory [8, 9, 10, 11] is the evaluation of the relaxation time within the following approach: each electron (carrier) moves in a self-consistent field generated by all other free charges in the system. The finite values of the transport coefficients result from electron's scattering on the self-consistent field fluctuations. It is based on the paper [12], which related the Lorenz-model expression for the fully-ionized plasma electrical conductivity to the strict quantum-statistical calculation involving the Green's function formalism with the self-consistent field potential. It was shown that thus obtained static conductivity is in semi-quantitative agreement with available experimental data and also possesses correct limiting forms of Ziman and Spitzer, corresponding to high and low densities, respectively [11].

A detailed comparison with alternative methods of theoretical investigation of the dynamic conductivity, see, e.g., [13] and [14] is presented in this paper.

#### New methods:

$$\sigma(\omega) = \frac{\omega \frac{i\omega_p^2}{4\pi} - \Omega^2 \sigma_0}{\omega^2 - \Omega^2 + i\omega\Omega^2 \frac{4\pi\sigma_0}{\omega_p^2}}, \quad (3)$$

$$\Omega^2 = \frac{\omega_p^2}{3n_e V} \sum_j^N \left\langle 2 \sum_v f(\varepsilon_v) |\psi_v(R_j)|^2 \right\rangle_0, \quad (4)$$

where,

$\varepsilon_v$  - energy levels

$\psi_v$  - corresponding eigenfunction in one-electron states  $v$

$f(\varepsilon)$  - Fermi distribution function.

### 1. First method

$$\Omega^2 = \frac{\omega_p^2}{3} \left( 1 + \frac{2m^2 e^2}{\pi^2 \hbar^4 n_e} \int_0^\infty \frac{1}{\exp \beta(\varepsilon - \mu) + 1} \arctan \left( \frac{2}{\kappa} \sqrt{\frac{2m\varepsilon}{\hbar^2}} \right) d\varepsilon \right), \quad (5)$$

$$\frac{1}{2\pi^2} \left( \frac{2m}{\hbar^2} \right)^{\frac{3}{2}} \int_0^\infty \frac{1}{\exp \beta(\varepsilon - \mu) + 1} \sqrt{\varepsilon} d\varepsilon = n_e, \quad (6)$$

### 2. Second method

$$\Omega^2 = \frac{\omega_p^2}{3} \left\{ 1 + \frac{\beta e^2}{\lambda_T (1 + \lambda_T / \lambda_D)} \right\}, \quad (7)$$

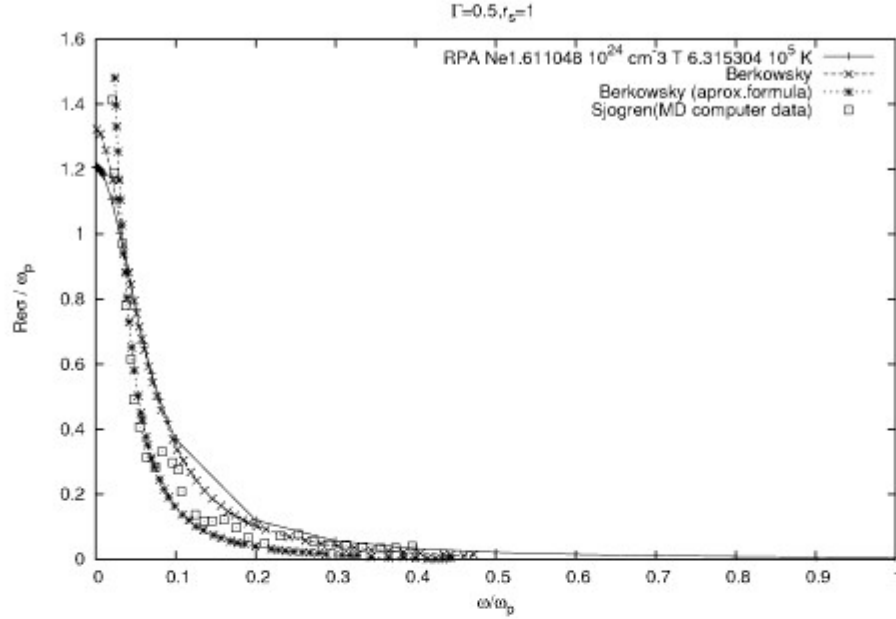
where,

$\lambda_T = \hbar / 2 \sqrt{\beta / m}$  - electronic thermal wavelength

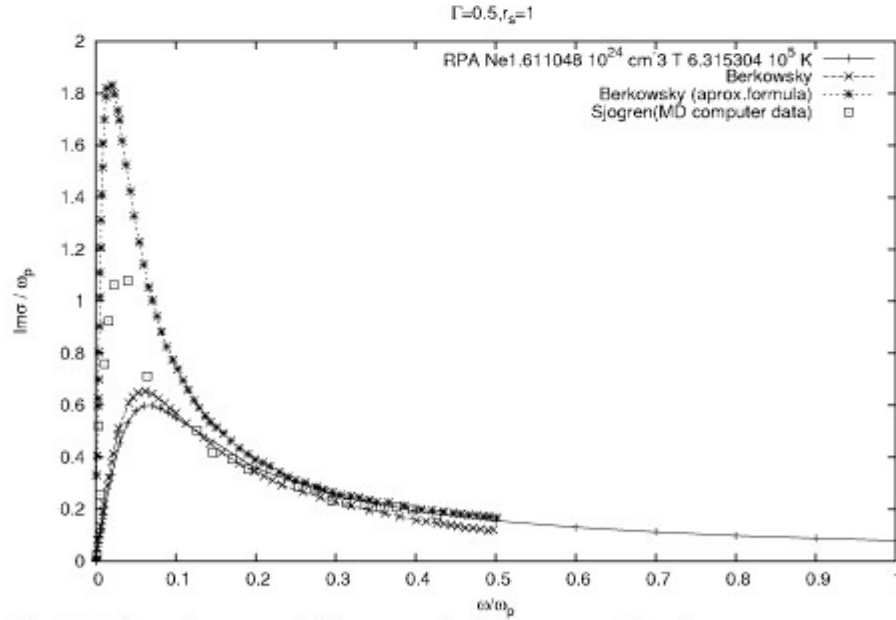
$\lambda_D^{-2} = 4\pi e^2 \beta \sum_{j=0}^s Z_j^2 n_j$  - the Debye radius

## 2. RESULTS

**Comparison with the other data:** On the basis numerical calculations presented earlier in [3, 4], both  $\sigma_{Re}$  and  $\sigma_{Im}$  are computed, but for the previously mentioned thermodynamic conditions. The results are displayed in the figures 1-4. The figures represent the data from several separate sources [5, 6, 7] as compared to our data. A good agreement with existing data [5, 6, 7] in a wide range of dimensionless frequency  $\omega/\omega_p$ .

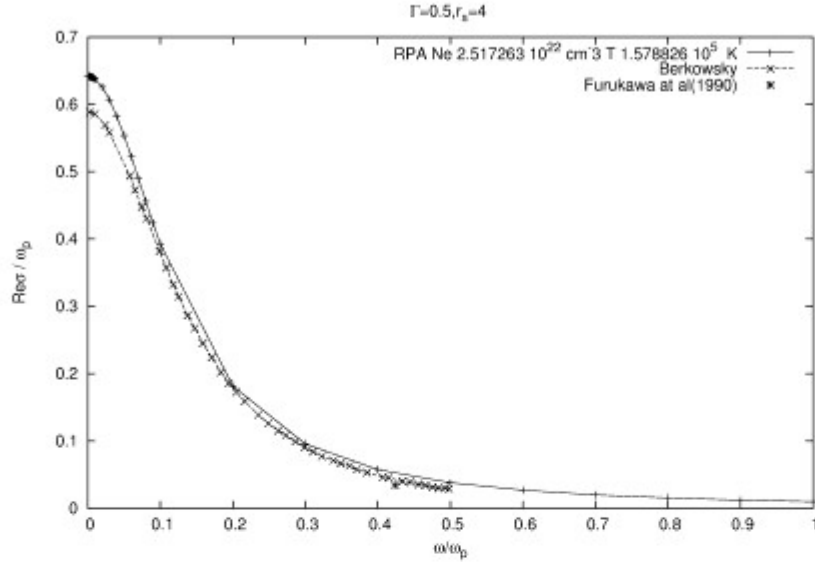


**Fig. 1** The real part of HF electrical conductivity of fully ionized Hydrogen plasma for  $\Gamma = 0.5$   $r_s = 1$ , compared with other authors [5], [6] and [7].

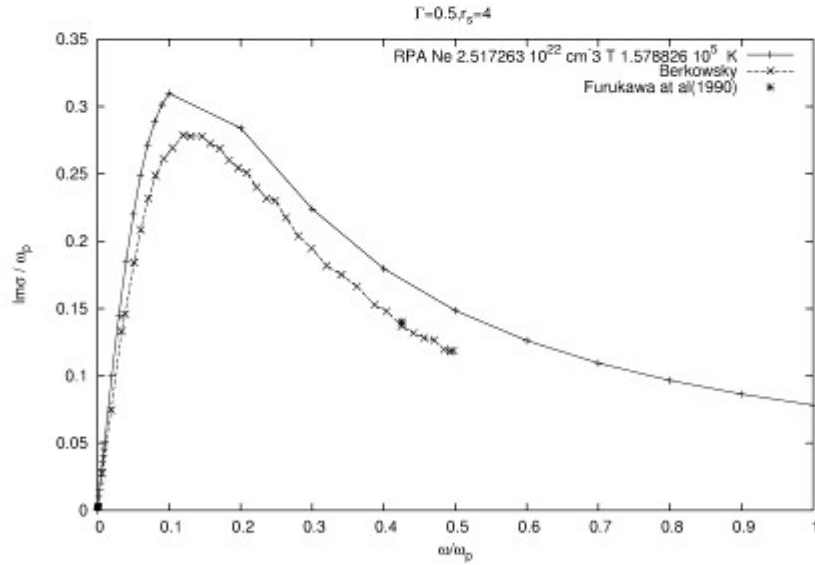


**Fig. 2** The imaginary part of electro conductivity, same as Fig. 1.



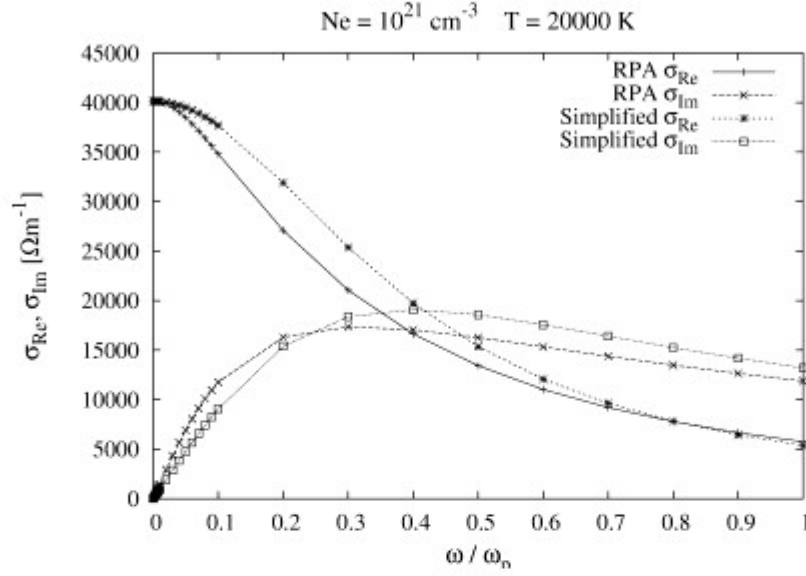


**Fig. 3** The real part of HF electrical conductivity of fully ionized H plasma for  $\Gamma = 0.5$   $r_s = 4$ , compared with other authors [5] and [7].

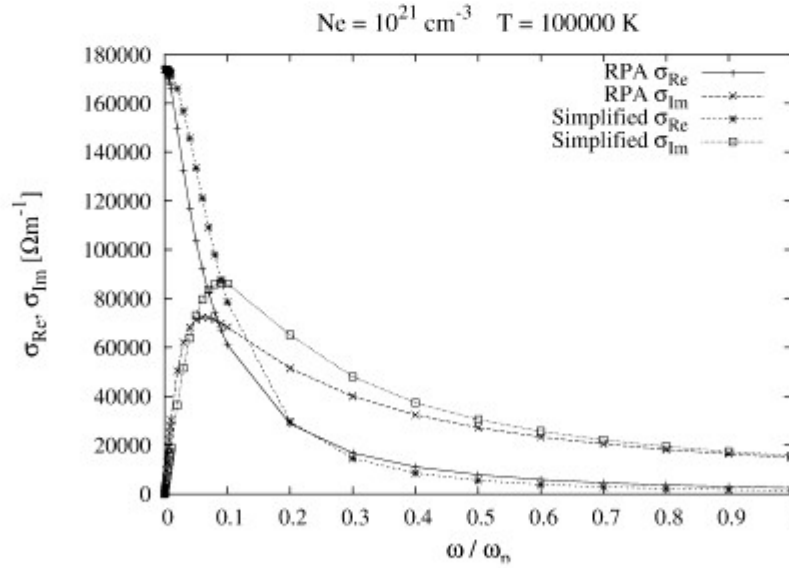


**Fig. 4.** The real part of HF electrical conductivity of fully ionized H plasma for  $\Gamma = 0.5$   $r_s = 4$ , compared with other authors [5] and [7].

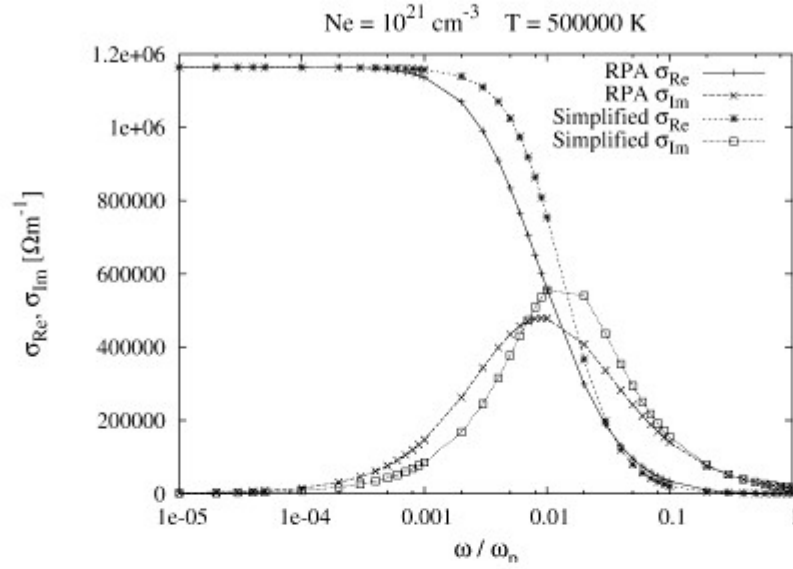
**Comparison of the methods:** Results of numerical calculations using equations (5), (6), (7) presented earlier in this paper are displayed in the figures 5 – 13.



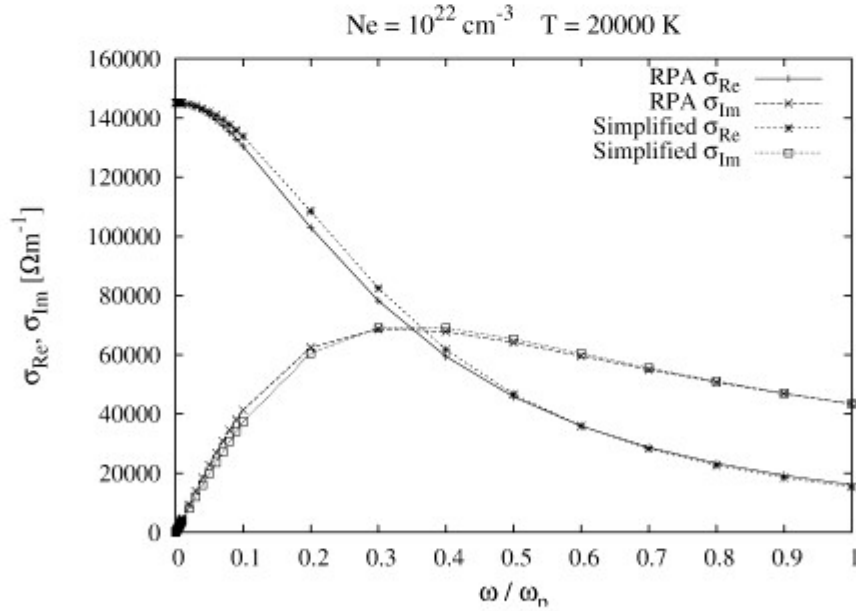
**Fig. 5.** The comparison of the simplified calculation method and the basic modified RPA method for the fully ionized hydrogen like plasma with the electron density  $10^{21} \text{ cm}^{-3}$ , and temperature 20000K.



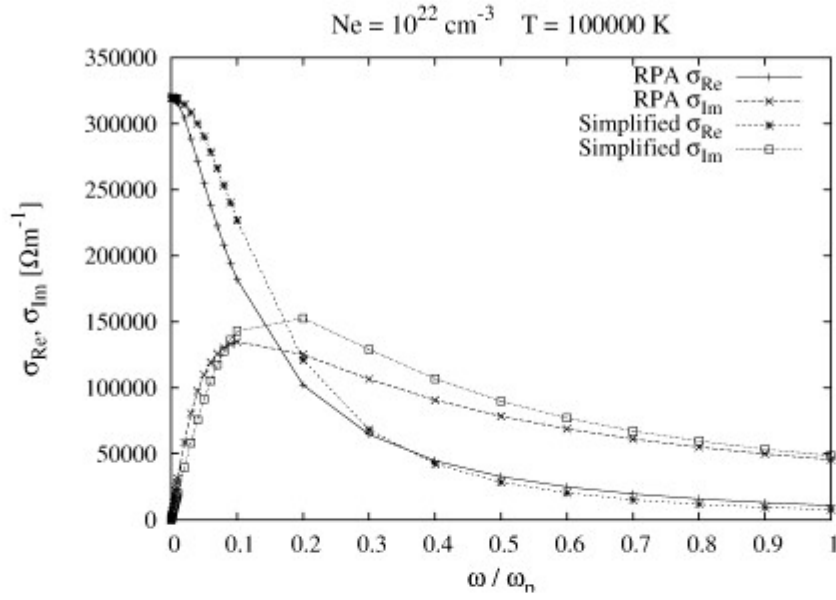
**Fig. 6.** Same as Fig. 5 but for  $N_e = 10^{21} \text{ cm}^{-3}$  and  $T = 100000 \text{ K}$ .



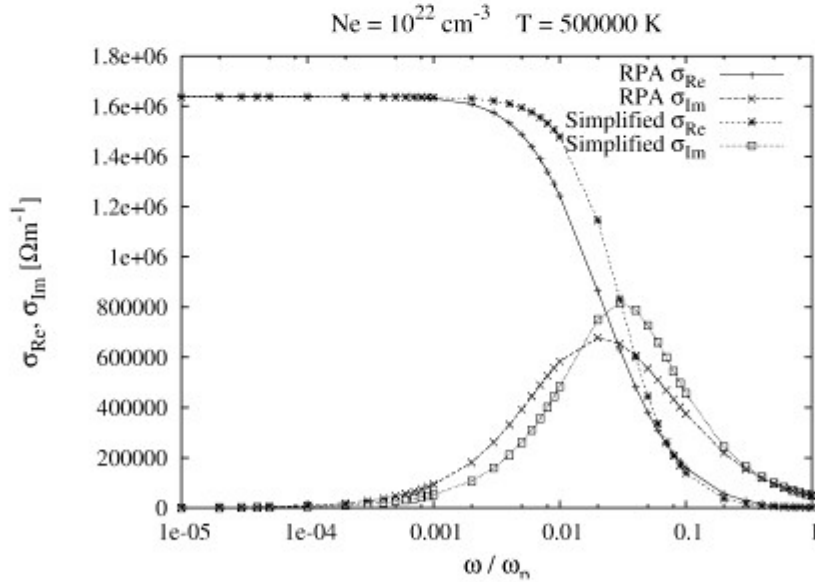
**Fig. 7.** Same as Fig. 5 but for  $Ne = 10^{21} \text{ cm}^{-3}$  and  $T = 500000 \text{ K}$ .



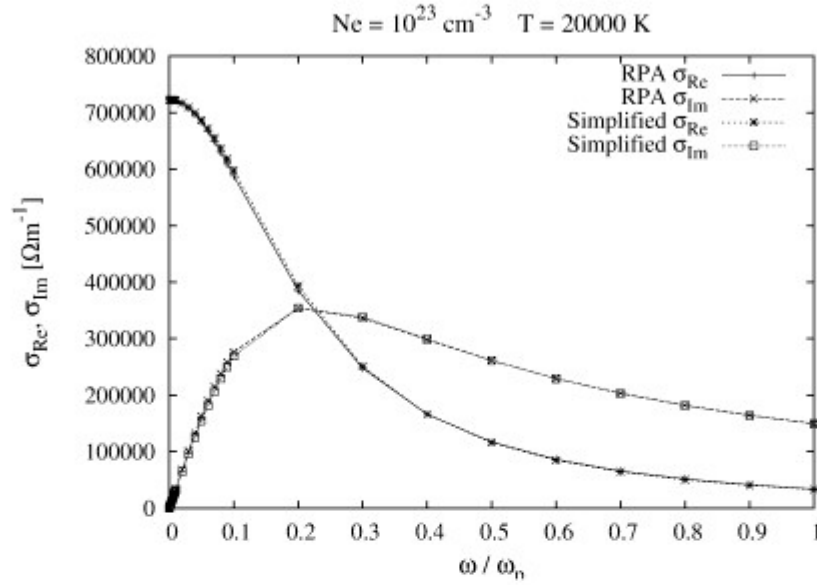
**Fig. 8.** Same as Fig. 5 but for  $Ne = 10^{22} \text{ cm}^{-3}$  and  $T = 20000 \text{ K}$ .



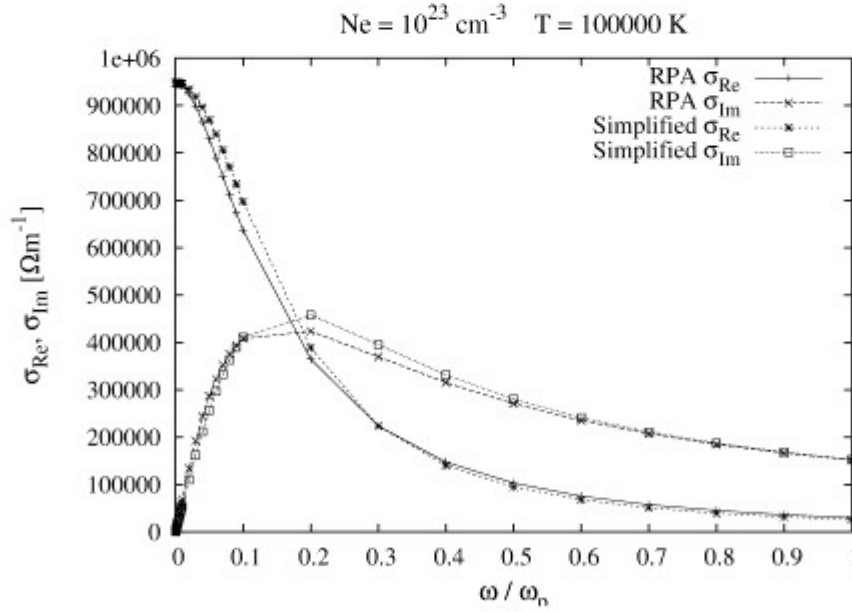
**Fig. 9.** Same as Fig. 5 but for  $\text{Ne} = 10^{22} \text{ cm}^{-3}$  and  $T = 100000 \text{ K}$ .



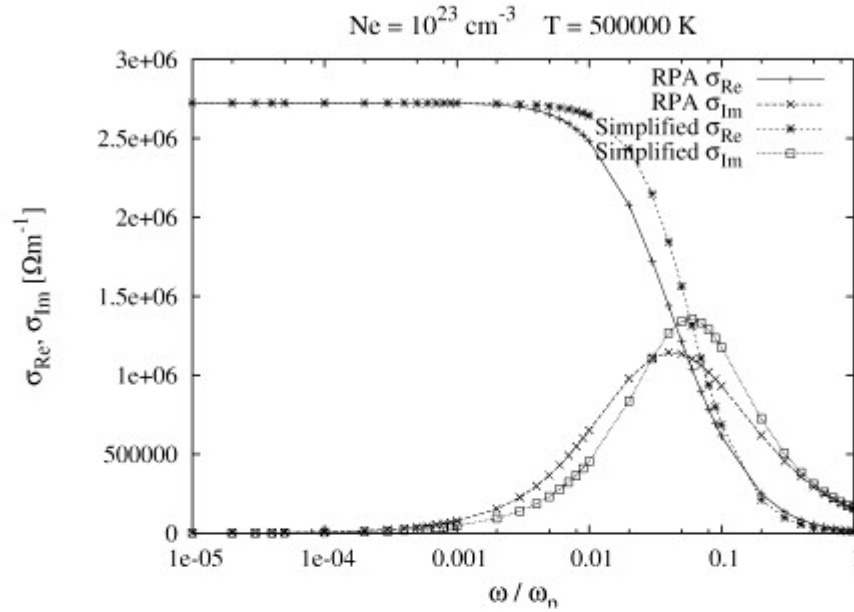
**Fig. 10.** Same as Fig. 5 but for  $\text{Ne} = 10^{22} \text{ cm}^{-3}$  and  $T = 500000 \text{ K}$ .



**Fig. 11.** Same as Fig. 5 but for  $\text{Ne} = 10^{23} \text{ cm}^{-3}$  and  $T = 20000 \text{ K}$



**Fig. 12.** Same as Fig. 5 but for  $\text{Ne} = 10^{23} \text{ cm}^{-3}$  and  $T = 100000 \text{ K}$ .



**Fig. 13.** Same as Fig. 5 but for  $\text{Ne} = 10^{23} \text{ cm}^{-3}$  and  $T = 500000 \text{ K}$ .

With the help of the presented results the other, easily measurable, dynamical characteristics of dense plasma could be obtained [2, 3, 4].

### 3. CONCLUSIONS

Method of calculations has been proven, and simplified using formulas (5), (6), (7). Method works well in a much broader area than expected. Work is in progress on inclusion of neutrals, and preliminary calculations with multifold ionized states. Heading towards the area of more dense plasma where a good experimental data exists.

### ACKNOWLEDGMENTS

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## THE CALCULATION OF THE PHOTO ABSORPTION PROCESSES IN DENSE HYDROGEN PLASMA WITH THE HELP OF CUT-OFF COULOMB POTENTIAL MODEL

NENAD SAKAN

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**Abstract.** Extensive work was done in the application of a cut-off Coulomb model on the description of the optical processes of the photo ionization and inverse bremsstrahlung. Presented work deals with a usage of a cut-off Coulomb model pseudo potential for the calculation of the optical absorption process in dense hydrogen plasma as a entirely quantum mechanical process. Although the mentioned processes are strongly influenced by the collective process in dense plasma, the used pseudo potential enables to model the described interaction with the plasma system as a binary process. There are several advantages of such approach; the existence of the exact analytical solutions for the wave functions in the described potential enables to eliminate one of the several sources of numerical error. Also, more complex processes of the interaction inside plasma could be considered, and they have been added in presented work. The work on description of such processes has been started. The collective phenomena of the plasma are here described as an additional shifting and broadening of a bond states levels. Furthermore, with the adding of mentioned broadening and additional shifting of the bond states as free external parameters the good agreement between the analyzed experimental data and our model solutions occurs. The method of determination of the cut-off radius was developed and applied in our considerations. The presented model is a good approach for the description of dense hydrogen plasma of moderate and high non-ideality. It presents an easily extendable model, in which is easy to introduce additional processes and effects.



## The Calculation of the Photo Absorption Processes in Dense Hydrogen Plasma with the Help of Cut-Off Coulomb Potential Model

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# The Calculation of the Photo Absorption Processes in Dense Hydrogen Plasma with the Help of Cut-Off Coulomb Potential Model

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**Abstract.** Extensive work was done in the application of a cut-off Coulomb model on the description of the optical processes of the photo ionization and inverse bremsstrahlung. Presented work deals with a usage of a cut-off Coulomb model pseudo potential for the calculation of the optical absorption process in dense hydrogen plasma as a entirely quantum mechanical process. Although the mentioned processes are strongly influenced by the collective process in dense plasma, the used pseudo potential enables to model the described interaction with the plasma system as a binary process. There are several advantages of such approach; the existence of the exact analytical solutions for the wave functions in the described potential enables to eliminate one of the several sources of numerical error. Also, more complex processes of the interaction inside plasma could be considered, and they have been added in presented work. The work on description of such processes has been started. The collective phenomena of the plasma are here described as an additional shifting and broadening of a bond states levels. Furthermore, with the adding of mentioned broadening and additional shifting of the bond states as free external parameters the good agreement between the analyzed experimental data and our model solutions occurs. The method of determination of the cut-off radius was developed and applied in our considerations. The presented model is a good approach for the description of dense hydrogen plasma of moderate and high non-ideality. It presents an easily extendable model, in which is easy to introduce additional processes and effects.

## 1. Introduction

In this paper is studied a new model method of the describing of the continuous absorption of electromagnetic (EM) radiation in dense strongly ionized hydrogen plasma, caused by the atomic photo-ionization processes

$$E_{h\nu} + H^*(nl) \rightarrow H^+ + e_{\vec{q}}, \quad (1)$$

and electron-ion inverse "bremsstrahlung" processes

$$E_{h\nu} + e_{\vec{q}} + H^+ \rightarrow e_{\vec{q}'} + H^+, \quad (2)$$

where  $E_{h\nu}$  is the energy of the photon with the wavelength  $\lambda$ ,  $n$  and  $l$  - principal and orbital quantum numbers of hydrogen excited states,  $\vec{q}$  and  $\vec{q}'$  - the momentum of the free electron before and after scattering on the considered ion  $H^+$ .

While in weakly and moderately non-ideal plasma, this absorption is caused by the neutral atoms and electron-ion collision complex which interaction with the neighborhood can be neglected, as for example in Solar photosphere [5, 6], or described within the framework of a perturbation theory [18, 12, 13, 15, 16] in the dense strongly non-ideal plasma the situation is in principle different.

By now a lot of effort was aimed to the development of the quantum-statistical methods for the description of the thermodynamical and transport properties of dense strongly non-ideal plasma [9, 11, 8, 7, 10, 14] while the absorption processes was treated only for plasma with electron densities  $N_e < 10^{18} \text{cm}^{-3}$ , where the approximation of electron-atom and electron-ion binary collisions is still applicable. The area of really dense plasma with  $N_e > 10^{19} \text{cm}^{-3}$  was not systematically studied from the aspect of the bound-bound, bound-free and free-free absorption processes, excluding some efforts of semi-empirical describing of such processes [25, 26]. Because of that the development of a model method which describes the mentioned absorption process in dense strongly non-ideal plasma on a simple and physically acceptable way is the one of the actual tasks. Within this work as a landmark is taken the hydrogen plasma with the electron density  $N_e = 1.5 \cdot 10^{19} \text{cm}^{-3}$  and the temperature  $T = 23000 \text{K}$ , which was experimentally studied in [26]. The direct result of this work is a new model method for the determination of absorption coefficients  $\kappa_{bf}(\lambda)$  and  $\kappa_{ff}(\lambda)$ , characterizing the bound-free and free-free absorption processes (1) and (2) in the strongly non-ideal hydrogen plasma, which is based on a cut-off Coulomb pseudo-potentials, similar to the one used for the determination of the non-ideal plasma conductivity. The presented method is tested in the optical range of photon wavelengths  $350 \text{nm} \leq \lambda_{h\nu} \leq 550 \text{nm}$ .

## 2. Theory

### 2.1. The cut-off Coulomb potentials

The obvious way of simplification of principally many body processes of photo absorption transitions inside plasma was transformation to the corresponding transitions of the electron in an adequately chosen pseudo-potential, which replaces the considered ion and the rest of the system. In [22], in order to obtain the method of the describing of such process which would be practically applicable, generally non-local pseudo-potential in usual way was sought in the form of the corresponding local one-particle potential. As such potential was chosen one of model screening Coulomb potential, namely cut-off potential (4).

On the occasion of the choosing of the model potential it was taken into account the argumentation from the [22], which shows that often used model Debye-Hückel (DH) potential is not adequate for strongly non-ideal plasma. Let us draw attention that we here do not have in mind some undesirable properties of the DH potential [28, 27], but the way of the obtaining of that potential itself. Namely, in accordance with [19] the DH potential is the average electrostatic potential which is generated by the observed ion and all charged particles from its neighborhood, which are often treated as the screening cloud. Consequently, the electron, that is involved in scattering on the considered ion, also is the part of that cloud. In spite of this fact the DH potential, as it is known, is used often in weakly non-ideal plasma when the number  $n_D \gg 1$ , where  $n_D$  is the number of the electrons inside the sphere with the Debye radius  $r_D$ .

However, in the case of strongly non-ideal plasmas, when  $n_D \cong 1$ , as it is in the considered plasma, practically, the complete cloud is consisted of the free electron that is involved in scattering, and the DH potential could not be used any more. Contrary to that, in the case  $n_D \cong 1$  the application of the cut-off Coulomb potential, as it was noted in [22], is physically completely justified, since it automatically provides: just Coulomb behavior of the potential in the close vicinity of the considered ion; the lowering of the atom ionization potential caused by the influence of the neighborhood, which is equal to the average potential energy of a free electron in plasma; non Coulomb asymptotic of the wave function of a free electron.

All mentioned have caused that one of the considered here model cut-off Coulomb potentials has the form, which is shown, in the Fig. (1a), where  $e$  is the absolute value of electron charge,  $r$  - the distance from the origin of the chosen reference frame,  $r_c$  - corresponding screening radius, and the value  $U_p = -e^2/r_c$  has to be interpreted as the above mentioned the average potential energy of a free electron in plasma. Other model cut-off Coulomb potential is considered here because the fact that in the case of the first model the average potential energy of the electron in the region  $0 < r < r_c$ , for the difference of the region  $r_c < r < \infty$ , is not equal to the energy  $U_p$ , which is illustrated by Fig. (1 a). However, in the plasma the moving of the electron from the region occupied by the one ion to the region occupied by the nearest neighbor ion is realized in the potential with the maximal value (between the position of the mentioned ions), which is greater than average values of potential. Because of that the average potential energies of the electron in the region occupied by the one ion and in the rest of the plasma have to be equal to the average energy of the free electron in the whole system denoted here by  $U_p$ . One can see that this condition can be satisfied in the case of other cut-off Coulomb potential, which is shown in Fig. (1b), when the parameter  $k = 1/2$ . Namely, it can be shown that

$$\int_0^{(k+1)r_c} U(r) 4\pi r^2 dr = U_p V = -\frac{e^2}{r_c} \cdot \frac{4\pi}{3} [(k+1)r_c]^3, \quad (3)$$

is only valid for  $k = 1/2$ , where  $V$  is the volume of sphere with radius  $r_c$ , which is determined on the basis of the result from [28].

In further consideration we will take the value  $-e^2/r_c$  as the zero of the energy. After that, the potentials shown in the Figs. (1a) and (1b) are transformed to the forms  $U_0(r; r_c)$  and  $U_k(r; r_c)$ , respectively, where

$$U_0(r; r_c) = \begin{cases} -\frac{e^2}{r} + \frac{e^2}{r_c} & : 0 < r \leq r_c, \\ 0 & : r_c < r, \end{cases} \quad (4)$$

$$U_k(r; r_c) = \begin{cases} -\frac{e^2}{r} + \frac{e^2}{r_c} & : 0 < r \leq (k+1)r_c, \\ 0 & : (k+1)r_c < r \end{cases}, \quad (5)$$

where  $U_0(r; r_c)$  is the same potential as in [22]. Because of the above mentioned, in the case of the potential  $U_k(r; r_c)$  we will consider that  $k = 1/2$ .

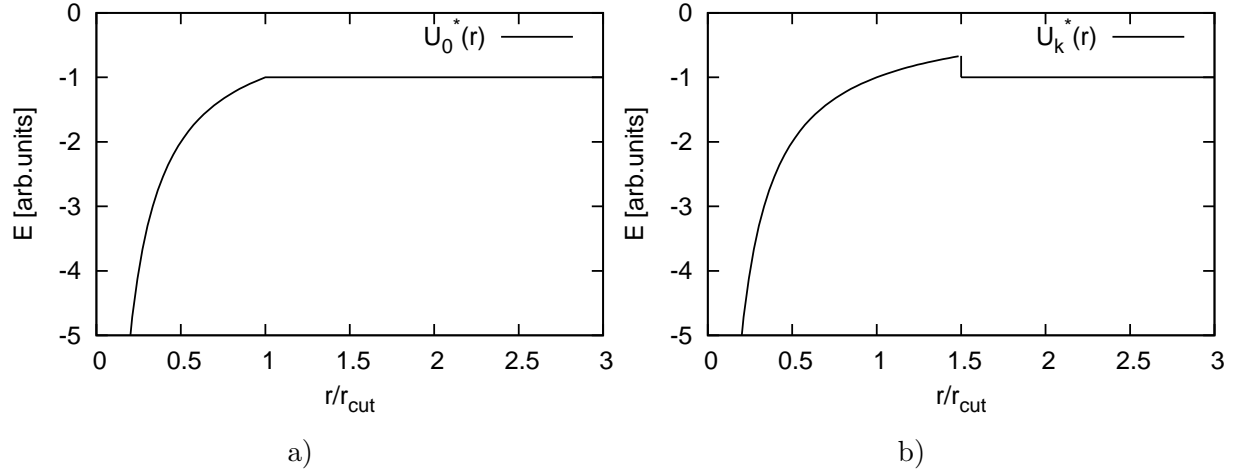
Let us denote that the form of the potential (5) is not caused by the presence of some new mechanism that increases the barrier in the region  $r > r_c$  for the electron in the complex  $(H^+ + e)_{nl}$  or  $(H^+ + e)_{\bar{q}}$ , but exclusively by the requirement for the satisfying of the condition (3).

## 2.2. The photo-ionization and inverse "bremsstrahlung" cross-sections

Since under the condition from [26] the considered wavelength  $\lambda \gg r_s$ , where  $r_s = (3/4\pi N_e)^{1/3}$  is the corresponding Wigner-Seitz radius, the dipole approximation in the case of considered processes is valid. According to that, the cross section for these bound-free and free-free absorption processes are given by the expressions from [24], namely

$$\sigma(nl; E') = \frac{4\pi^2 e^2 k}{3(2l+1)} \sum_{l'=l\pm 1} l_{max} \left( \int P_{nl} r P_{E'l'} dr \right)^2, \quad (6)$$

$$\sigma(E; E') = \frac{8\pi^4 \hbar e^2 k}{3 q^2} \sum_{l'=l\pm 1} l_{max} \left( \int P_{El} r P_{E'l'} dr \right)^2, \quad (7)$$



**Figure 1.** The behavior of the used potentials: **a)** - from (4), **b)** - from (5).

where  $k = \epsilon_\lambda/\hbar c$  is the momentum of the absorbed photon with the given  $\lambda$ ,  $E = \hbar^2 q^2/2m$  and  $E' = \hbar^2 q'^2/2m$  - the energies of the free electron,  $l_{max}$  - maximal value of  $l$  and  $l'$ ,  $m$  - the electron mass, and  $c$  - the light velocity. Here the radial wave function of the electron in the model potentials (4) and (5) with  $k = 0.5$  is denoted with  $P_{nl}/r$ , for the bound states with given  $n$  and  $l$ , and with  $P_{El}/r$  and  $P_{E'l'}/r$  for the free states with the given  $E$  and  $l$  or  $E'$  and  $l'$ . The functions  $P_{nl}$  and  $P_{El}$  are obtained in strict analytical form by the means of the expressions for the Whittaker, Coulomb, spherical Bessel, and modified Bessel functions.

In further calculations for the determination of the photo-ionization cross section  $\sigma(nl; E')$  is used Eq. 6, while in the case of inverse "bremsstrahlung" cross section  $\sigma(E; E')$  is used the expression which is obtained by means of the known relations [24], which connect the matrix elements of the  $j$ -th components ( $j = 1, 2, 3$ ) of the radius-vector  $\vec{r}$ , electron momentum  $\vec{p}$ , and gradient of the potential  $\vec{\nabla}U(\vec{r})$ , namely

$$\langle in | \vec{\nabla}_j U(\vec{r}) | fin \rangle = \frac{i}{\hbar} (E_{in} - E_{fin}) \langle in | \vec{p}_j | fin \rangle, \quad (8)$$

$$\langle in | \vec{p}_j | fin \rangle = \frac{i m}{\hbar} (E_{in} - E_{fin}) \langle in | \vec{r}_j | fin \rangle, \quad (9)$$

where  $U(\vec{r})$  in the considered case is equal to  $U_0(r)$  or  $U(r; k)$ . Namely, from Eqs. (7), (8) and (9) it follows the expression

$$\sigma(E; E') = \frac{4\pi^4}{3} \frac{\hbar^6 e^2}{m^3 c E E_{h\nu}^3} \sum_{l'=l\pm 1}^{l_{max}} l_{max} \left( \int_0^{(k+1)r_c} P_{El} \nabla_r U(r) P_{E'l'} dr \right)^2, \quad (10)$$

where  $E_{h\nu} = E' - E$ , and with  $U(r) = U(r; k = 0) \equiv U_0(r)$  or  $U(r; k = 1/2)$ , which enables to use the shape of the potentials (4) and (5) and to avoid all difficulties connected with the calculation of the dipole matrix element in Eq. (7) in the whole region of space  $0 < r \leq \infty$ . Just Eq. (10) is used here for the calculation of the inverse "bremsstrahlung" cross-section  $\sigma(E; E')$ .

### 2.3. The partial and total absorption coefficients

The expressions (6) and (10) for the photo-ionization and inverse "bremsstrahlung" cross-sections enable the direct determination of the partial absorption coefficients, characterizing the bound-free and free-free absorption processes (1) and (2), given by the relations

$$\kappa_{bf}^{(0)}(\lambda; N_e, T) = \sum_{n=1}^{n_{max}} \sum_{l=0}^{n-1} N_{nl} \cdot \sigma(nl; E'), \quad (11)$$

$$\kappa_{ff}^{(0)}(\lambda; N_e, T) = N_i N_e \cdot \int_0^\infty \sigma(E; E') v f(v) dv, \quad (12)$$

where  $N_{nl}$  is the density of the atoms  $H^*$ , e.g. electron-ion pairs in the bound states with the given quantum numbers  $n$  and  $l$ ,  $T$  - the plasma temperature, and  $n_{max}$  - the principal quantum number of the last realizing bond state for the given  $N_e$  and  $T$ . However, while the expression (12) for the free-free absorption coefficient  $\kappa_{ff}^{(0)}(\lambda; N_e, T)$  should generate the purely acceptable results, the situation in connection with Eq. (11) is different. Namely, the results obtained by means of Eq. (11) should be similar to the ones for the diluted plasma (see for example [5]), since, contrary to the existing experimental results [26], the unique serious difference would ensue from the lowering of the photo-ionization limits for the realizing bound states for the value close to  $e^2/r_c$ .

The plasma-ion interaction at the considered densities is mainly of Stark type, and also it was made a transition from many particle model towards the two particle model. Because of that there should be included and additionally considered a shift and the broadening of a bond state levels, as a result of a many particle interactions. The mentioned shifts and broadenings are treated as the semi-empirical quantities, which appear as the external parameter of the theory. Here, the shift of  $(nl)$ -level is denoted by  $\Delta_{nl}^{sh}$ , and broadening by  $\Delta_{nl}^{br}$ . As it is usual we assume that the electron in atom  $H_{nl}^*$  in the plasma could be in the state with the energies which are dominantly grouped around the energy  $\varepsilon_{nl}^{max} = \varepsilon(nl) + \Delta_{nl}^{sh}$ , inside the interval  $(\varepsilon_{nl}^{max} - \Delta_{nl}^{br}/2, \varepsilon_{nl}^{max} + \Delta_{nl}^{br}/2)$ . Let  $P_{nl}(\varepsilon)$  is the probability density which characterizes the distribution of the energies of the mentioned state within the interval  $(\varepsilon_{nl}^{max} - \Delta_{nl}^{br}/2, \varepsilon_{nl}^{max} + \Delta_{nl}^{br}/2)$ , which satisfies the conditions

$$max\{P_{nl}(\varepsilon)\} = P(\varepsilon = \varepsilon_{nl}^{max}), \quad \int_{\varepsilon_{nl}^{max} - \Delta_{nl}^{br}/2}^{\varepsilon_{nl}^{max} + \Delta_{nl}^{br}/2} P_{nl}(\varepsilon) d\varepsilon = 1. \quad (13)$$

In accordance with above consideration, here we will characterize the bound-free and free-free processes by the photo-ionization and inverse "bremsstrahlung" partial absorption coefficients

$$\kappa_{bf}(\lambda; N_e, T) = \int_{\varepsilon_{nl}^{max} - \Delta_{nl}^{br}/2}^{\varepsilon_{nl}^{max} + \Delta_{nl}^{br}/2} P_{nl}(\varepsilon) \cdot \tilde{\kappa}_{bf}^{(0)}(\lambda; N_e, T; \varepsilon) d\varepsilon, \quad (14)$$

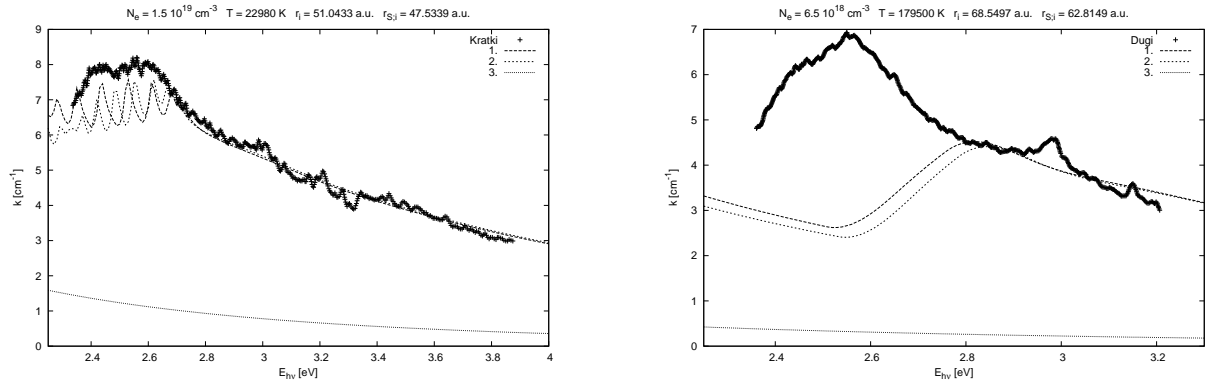
where  $\tilde{\kappa}_{bf}^{(0)}(\lambda; N_e, T; \varepsilon)$  is obtained from (6) and (11) by replacing free electron energy  $E'$  with  $\tilde{E}' = E' + (\varepsilon - \varepsilon_{nl})$ ,

$$\kappa_{ff}(\lambda; N_e, T) = \kappa_{ff}^{(0)}(\lambda; N_e, T), \quad (15)$$

where  $\kappa_{ff}^{(0)}(\lambda; N_e, T)$  is given by Eq. (12), as well as the corresponding total absorption coefficient

$$\kappa_{tot}(\lambda; N_e, T) = (\kappa_{ff}(\lambda; N_e, T) + \kappa_{bf}(\lambda; N_e, T)) \cdot \left[ 1 - \exp\left(-\frac{\epsilon_\lambda}{kT}\right) \right], \quad (16)$$

where it is taken into account the influence of the stimulated emission.



**Figure 2.** The calculated data for the potential (4), left figure The short pulse, comparison with the results in the case of the potential  $U_0$  with  $r_c = 44.964$  a.u. Curve **1.** - model with changeable shift and broadening,  $\Delta E = 0.6$  eV and  $\delta E = 1$  eV for  $n = 2$ . Curve **2.** - model with constant shift and broadening, case  $\Delta E = 0,5$  eV i  $\delta E = 0,75$  eV. **3.** -  $\kappa_{ff}$ . The right figure, long pulse, comparison with the results in case of the potential  $U_0$  with  $r_c = 55.0523$  a.u.. Curve **1.** - model with changeable shift and broadening  $\Delta E = 0.275$  eV and  $\delta E = 0.25$  eV for  $n = 2$ . Curve **2.** - model with constant shift and broadening, case  $\Delta E = 0.25$  eV i  $\delta E = 0.25$  eV, **3.** -  $\kappa_{ff}$ .

### 3. Results and discussion

In this paper the calculations of the total absorption coefficient  $\kappa_{tot}(\lambda; N_e, T)$  with the cut-off Coulomb potential (4) were made for the strongly non-ideal hydrogen plasma  $N_e = 1.5 \cdot 10^{19} \text{ cm}^{-3}$  and  $T = 23000 \text{ K}$ , as well as  $N_e = 6.5 \cdot 10^{18} \text{ cm}^{-3}$  and  $T = 18000 \text{ K}$  taken from [26].

After process of selection of adequate shift and broadening parameters and comparison with the experimental data, good agreement was found. The good agreement with the experimental data in area where only continuous absorption is present, e.g. at the energies  $E_{h\nu} \geq 2.8$  eV, and the form of the total continuous absorption coefficient gives a space for bond-bond transition absorption.

Without further research on bond-bond transition within the frame of this model, there is not much to be said and analyzed for the model of broadening and shifting of bond state levels. Allthow, at this moment, it is just a parameter without further involvement into the processes behind it, it should be emphasized again that good agreement with experimental data exists.

### 4. Conclusion

Besides the fact that the presented model is still in process of development, a good agreement with the experimental data was shown.

There is a need to develop a model of bond-bond absorptions, which would enable the investigation of form of broadening and shifting of bond state levels. It would enable the studies of the broadening and shifting effects more in detail and develop a more concise model.

Also there is still a need for developing of both faster numerical procedures and code parallelism to improve speed and accuracy.

### Acknowledgments

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## Program of the SPIG 2010

**Locations:** Tourist center (*Hall A*) and Hotel "Lepenski Vir" (*Halls B & C*)  
- [Map](#).

Sunday, 29 August 2010		
	Arrival of the Participants	
20.00-21.30	Registration Welcome Cocktail	
Monday, 30 August 2010		
Time	Hall A	
08.00-09.30	Registration	
09.30-09.45	Opening Chair L. Popović	
09.45-10.30	Jaroslav Labat (Serbia) <i>SPIG from beginning to today</i>	
10.30-11.00	Coffee Break	
	Chair G. Malović	
11.00-11.45	Ulrich Kogelschatz (Switzerland) [3] <i>Collective Phenomena in Volume and Surface Barrier Discharges</i>	
11.45-12.30	Satoshi Hamaguchi (Japan) [2] <i>Plasma surface interactions in material processing</i>	
12.30-15.00	Lunch Break	
	Hall B	Hall C
15.00-15.30	Chair B. Marinković	Chair: M. Dimitrijević
	Jiri Horacek (Czech Republic) [1] <i>Calculation of resonances by means of analytical continuation and Pade approximation</i>	Sylvie Sahal-Brechot <i>Case studies on recent Stark broadening measurements and Stark-b database</i>
15.30-16.00	Ronald McCarroll (France) [1] <i>Isotopic effects in atomic and molecular reactions</i>	Seiji Ishiguro (Japan) <i>Multi-scale simulation for</i>
16.00-16.30	Nenad Bundaleski (Portugal)[2] <i>Adsorption dynamics of water on the surface of TiO<sub>2</sub>(110)</i>	Andrey N. Klyucharev <i>Influence of inelastic atom-Rydberg processes on kinetic and optical properties in the temperature laboratory and astrophysics</i>
16.30-17.00	Coffee Break	
17.00-17.20	Chair: Z. Rakočević	Chair. M. Kurbanov
	Paul Tiwald (Austria) [2] <i>Theory of below-threshold kinetic electron emission</i>	Kari Niemi (Finland) <i>Optical diagnostics on cold atomic and molecular plasmas</i>

17.20-17.40	<b>Branko Tomčik</b> (Serbia)[2] <i>Deposition and characterization of ultra thin diamond like carbon films</i>	<b>Saša Gocić</b> (Serbia) [2] <i>Electrical breakdown in nitrogen and physical processes and</i>
17.40-18.00	<b>Ivan Radović</b> (Serbia) [2] <i>Interactions of ions with grapheme</i>	<b>Suzana Stamenković</b> (Serbia) [2] <i>New models and distribution of breakdown time delay</i>
18.00-19.30	<b>Posters #: 1.01-1.04 &amp; 2.01-2.05 &amp; 3.01-3.13 &amp; 4.01-4.04</b>	
<b>Tuesday, 31 August 2010</b>		
<b>Time</b>	<b>Hall A</b> <b>Chair. N. Nedeljković</b>	
09.00-09.45	<b>Yuri Akishev</b> (Russia) [3] <i>Generation of Atmospheric Pressure Non-Thermal Plasma By Diffusive and Constriction in Rest And Flowing Gases (Air And Nitrogen)</i>	
09.45-10.30	<b>Julien Fuchs</b> (France) [2] <i>Ultra-high intensity laser-solid interactions and applications</i>	
10.30-11.00	<b>Coffee Break</b>	
11.00-11.45	<b>Chair: I. Mančev</b>	
	<b>Oddur Ingolfsson</b> (Iceland) [2] <i>Comprehensive study on the metastable negative ion fragmentation of individual DNA components and larger oligonucleotides</i>	
11.45-12.15	<b>Dirk Peter van der Werf</b> (UK) [1] <i>Antimatter transport processes</i>	
12.15-15.00	<b>Lunch Break</b>	
	<b>Hall B</b>	
15.00-15.30	<b>Chair: Z. Mijatović</b>	
	<b>Elena Filimonova</b> (Russia) [3] <i>Effect of gas mixture composition on tar removal process in a pulsed corona discharge reactor</i>	
15.30-16.00	<b>Miran Mozetić</b> (Slovenia) [3] <i>Application of highly non-equilibrium plasma for modification of biomedical samples</i>	
16.00-16.30	<b>Leanid Simonchik</b> (Belarus) [3] <i>Parametric Decay Instability Control By Non-Monochromatic Pumps</i>	
16.30-17.00	<b>Coffee Break</b>	
17.00-17:20	<b>Chair: D. Jovanović</b>	
	<b>Evangelia Lyratzi</b> (Greece) [4] <i>Using the GR model to study the AGN spectra</i>	
17.20-17.40	<b>Edi Bon</b> (Serbia) [4] <i>The disk emission in the Broad Line Region of Active</i>	

	Galactic Nuclei	
17.40-18:00	M.A. Mirković (Serbia) [2] Formation and decay of the Rydberg states of multiply charged ions interacting with solid surfaces	
18.00-19.30	Posters #: 1.05-1.08 & 2.06-2.10 & 3.14-3.26 & 4.05-4.08	
Wednesday, 01 September 2010		
Time	Hall A Chair: N. Bibić	
09.00-09.45	Wolfram Kollatschny (Germany) [4] Line Profile Variations in selected Seyfert Galaxies	
09.45-10.30	Yuri Lebedev (Russia) [3] Microwave Discharges: Generation and Diagnostics	
10.30-11.00	Coffee Break	
12.00-18.00	Excursion ➦ Boat cruise through the gorge of Danube	
Thursday, 02 September 2010		
Time	Hall A Chair: J. Purić	
09.00-09.45	Akio Komori (Japan) [4] High Density and High Temperature Plasmas in Large Helical Devices	
09.45-10.30	Jan-Michael Rost (Germany) [1] Ultrafast and ultracold: Finite plasmas under extreme conditions	
10.30-11.00	Coffee Break	
11.00-11.:30	Chair: S. Djurović	
	Ramon Pelaez (Spain) [3] Regularities and Irregularities of Stark Widths for the single ionized noble gases	
11.30-12.00	Øshild Fredriksen (Norway) [3] On magnetic field geometry and its effects on double layers and flows in low-temperature plasmas	
12.00-15.00	Lunch Break	
	Hall B	Hall C
15.00-15.20	Chair: E. Danezis	Chair: N. Simić
	Dragana Ilić (Serbia) [4] Physical properties of the Broad Line Region in Active Galactic Nuclei	Casten Makocheke Trends in positron scattering
15.20-15.40	Vesna Borka Jovanović (Serbia) [4] Spectral indexes of radio loops	Ana Banković (S Recent advances in studies of electric and magnetic fields in

15:40-16:00	<b>Nenad Sakan</b> (Serbia) [4] <i>The Calculation Of The Photo Absorption Processes In Dense Hydrogen Plasma With The Help Of Cut-Off Coulomb Potential Model</i>	<b>Milovan Đuvakov</b> (Serbia) [4] <i>Nonlinear transport in gases, plasmas and solids</i>
16.00-16.20	<b>Dejan Dimitrijević</b> (Serbia) [4] <i>Parametric dependence of two-plasmon decay in homogeneous plasma</i>	<b>Aleksandar Milosavljević</b> (Serbia) [4] <i>Gas-phase photoionization cross sections</i>
16.20-16.50	<b>Coffee Break</b>	
16.50-17.10	<b>Chair. Lj. Hadzijevski</b>	<b>Chair. Z. Mićović</b>
	<b>Milan S. Dimitrijević</b> (Serbia) [4] <i>European Virtual Atomic and Molecular Data Center  VAMDC</i>	<b>Olivier Guaitella</b> (France) [4] <i>Influence of adsorbent material on the propagation and conversion of laser radiation on by-products</i>
17.10-17.30	<b>Zoran Simić</b> (Serbia) [4] <i>Stark broadening of heavy metal spectral lines in atmospheres of chemically peculiar stars</i>	<b>Bratislav Obradović</b> (Serbia) [4] <i>Evolution of electric field in barnard stars</i>
17:30-17:50	<b>Ivan Dojčinović</b> (Serbia) [4] <i>Plasma flow interaction with ITER divertor related surfaces</i>	<b>Ana Mančić</b> (Serbia) [4] <i>Generation and probing of warm dense matter created by laser-acceleration</i>
18.00-19.30	<b>Posters #: 1.09-1.12 &amp; 2.11-2.16 &amp; 3.27-3.40 &amp; 4.09-4.11</b>	
20.30	<b>Conference dinner</b>	
<b>Friday, 03 September 2010</b>		
<b>Time</b>	<b>Hall A</b> <b>Chair. N. Konjević</b>	
10.00-10.45	<b>Pascal Chabert</b> (France) [3] <i>Modelling of chlorine inductive discharges</i>	
10:45-11:15	<b>Lu-Jing Hou</b> (Germany) [3] <i>Numerical experiments in strongly coupled dusty plasmas</i>	
11.15-11.45	<b>Coffee Break</b>	
11.45-12.00	<b>Closing</b>	