



28th Summer School and International Symposium on the Physics of Ionized Gases

Aug. 29 - Sep. 2, 2016, Belgrade, Serbia

CONTRIBUTED PAPERS

&

ABSTRACTS OF INVITED LECTURES,
TOPICAL INVITED LECTURES, PROGRESS REPORTS
AND WORKSHOP LECTURES

Editors:

Dragana Marić, Aleksandar Milosavljević,
Bratislav Obradović and Goran Poparić



University of Belgrade,
Faculty of Physics



Serbian Academy
of Sciences and Arts

**28th Summer School and International
Symposium on the Physics of Ionized
Gases**

S P I G 2016

CONTRIBUTED PAPERS

&

ABSTRACTS OF INVITED LECTURES,
TOPICAL INVITED LECTURES, PROGRESS REPORTS
AND WORKSHOP LECTURES

Editors

Dragana Marić, Aleksandar Milosavljević,
Bratislav Obradović and Goran Poparić

University of Belgrade,
Faculty of Physics

Serbian Academy
of Sciences and Arts

Belgrade, 2016

CONTRIBUTED PAPERS & ABSTRACTS OF INVITED
LECTURES, TOPICAL INVITED LECTURES, PROGRESS
REPORTS AND WORKSHOP LECTURES

of the 28th Summer School and International Symposium on
the Physics of Ionized Gases

August 29 – September 2, 2016, Belgrade, Serbia

Editors:

Dragana Marić, Aleksandar Milosavljević,
Bratislav Obradović and Goran Poparić

Publisher:

University of Belgrade, Faculty of Physics,
Belgrade
Studentski trg 12, P. O. Box 44
11000 Belgrade, Serbia

Computer processing:

Tatjana Milovanov

Printed by

Skripta Internacional, Mike Alasa 54, Beograd

Number of copies

200

ISBN 978-86-84539-14-6

©2016 by University of Belgrade, Faculty of Physics

All rights reserved. No part of this book may be reproduced, stored or
transmitted in any manner without the written permission of the Publisher.

PREFACE

This publication of Faculty of Physics, University of Belgrade contains the Contributed papers and abstracts of Invited Lectures, Topical Invited Lectures, Progress Reports and associated Workshops' Lectures that will be presented at the 28th Summer School and International Symposium of the Physics of Ionized Gases – SPIG 2016. The symposium will be held at the Serbian Academy of Sciences and Arts in Belgrade, Serbia, from August 29th to September 2nd, 2016. The symposium is organized by the Faculty of Physics, University of Belgrade and Serbian Academy of Sciences and Arts, with the support of the Ministry of Education, Science and Technological Development, Republic of Serbia.

The SPIG conference covers a wide range of topics, bringing together leading scientists worldwide to present and discuss state of art research and the most recent applications, thus stimulating a modern approach of interdisciplinary science. The Invited lectures and Contributed papers are related to the following research fields: Atomic Collision Processes (Electron and Photon Interactions with Atomic Particles, Heavy Particle Collisions, Swarms and Transport Phenomena), Particle and Laser Beam Interactions with Solids (Atomic Collisions in Solids, Sputtering and Deposition, Laser and Plasma Interaction with Surfaces), Low Temperature Plasmas (Plasma Spectroscopy and other Diagnostic Methods, Gas Discharges, Plasma Applications and Devices) and General Plasmas (Fusion Plasmas, Astrophysical Plasmas and Collective Phenomena). The 28th SPIG includes two workshops that are closely related to the conference topics: the workshop on X-ray Interaction with Biomolecules in Gas Phase (XiBiGP) and the 4th International Workshop on Non-Equilibrium Processes (NonEqProc).

The Editors would like to thank the members of the Scientific and Advisory Committees of SPIG 2016 for their efforts in proposing the invited lectures and review of the contributed papers, as well as the chairmen of the associated workshops for their efforts and help in organizing the workshops and selection of invited talks. We particularly acknowledge the support of all members of the Local Organizing Committee for their help in the organization of the Conference. We are grateful to sponsors of the conference: RoentDek Handels GmbH and the European Physical Journal D.

Finally, we would like to thank all the invited speakers and participants for taking part in 28th SPIG and to wish them a pleasant stay in Belgrade, inspired and valuable moments and a very successful conference.

Editors: Dragana Marić, Aleksandar Milosavljević,
Bratislav Obradović and Goran Poparić

Belgrade, 2016.

ACKNOWLEDGEMENT

**28th SUMMER SCHOOL AND INTERNATIONAL
SYMPOSIUM ON THE PHYSICS OF IONIZED GASES**

is organized by

**University of Belgrade,
Faculty of Physics, Belgrade, Serbia**

and

**Serbian Academy of
Sciences and Arts**

with the support of the

**Ministry of Education, Science and Technological Development,
Republic of Serbia**

with the technical support of the

PANACOMP - Zemlja Čuda d.o.o.

and sponsored by:

**RoentDek Handels GmbH
The European Physical Journal D**

SPIG 2016

SCIENTIFIC COMMITTEE

D. Marić, Serbia (Co-Chair), Serbia
A. R. Milosavljević (Co-Chair), Serbia
D. Borka, Serbia
S. Buckman, Australia
J. Burgdörfer, Austria
J. Cvetić, Serbia
M. Danezis, Greece
Z. Donko, Hungary
V. Guerra, Portugal
D. Ilić, Serbia
M. Ivković, Serbia
D. Jovanović, Serbia
K. Lieb, Germany
I. Mančev, Serbia
N. J. Mason, UK
K. Mima, Japan
Z. Mišković, Canada
L. Nahon, France
B. Obradović, Serbia
G. Poparić, Serbia
P. Roncin, France
I. Savić, Serbia
Y. Serruys, France
N. Simonović, Serbia
M. Škorić, Japan
M. Trtica, Serbia

ADVISORY COMMITTEE

D. Belić
N. Bibić
M. S. Dimitrijević
S. Đurović
N. Konjević
M. Kuraica
J. Labat
G. Malović
B. P. Marinković
Z. Mijatović
M. Milosavljević
Z. L.J. Petrović
L. Popović
J. Purić
B. Stanić

ORGANIZING COMMITTEE

Faculty of Physics Belgrade
Serbian Academy of Sciences and Arts

G. Poparić (Co-chair)
B. Obradović (Co-chair)

M. Ristić (Co-Secretary)
M. Vojnović (Co-Secretary)

N. Konjević
M. Vičić
N. Cvetanović
G. Sretenović
V. Kovačević
I. Krstić

SPIG 2016 CONFERENCE TOPICS

Section 1.

ATOMIC COLLISION PROCESSES

- 1.1. Electron and Photon Interactions with Atomic Particles
- 1.2. Heavy Particle Collisions
- 1.3. Swarms and Transport Phenomena

Section 2.

PARTICLE AND LASER BEAM INTERACTION WITH SOLIDS

- 2.1. Atomic Collisions in Solids
- 2.2. Sputtering and Deposition
- 2.3. Laser and Plasma Interaction with Surfaces

Section 3.

LOW TEMPERATURE PLASMAS

- 3.1. Plasma Spectroscopy and Other Diagnostics Methods
- 3.2. Gas Discharges
- 3.3. Plasma Applications and Devices

Section 4.

GENERAL PLASMAS

- 4.1. Fusion Plasmas
- 4.2. Astrophysical Plasmas
- 4.3. Collective Phenomena

CONTENTS

Section 1. ATOMIC COLLISION PROCESSES

Invited Lectures

- I. B. Abdurakhmanov, A. W. Bray, I. Bray, I. I. Fabrikant, D. V. Fursa,
A. S. Kadyrov, C. M. Rawlins, J. S. Savage and M. C. Zammit
*Convergent Close-Coupling Theory for Collisions in Atomic and
Molecular Physics*..... 3
- Lorenzo Avaldi
Spectroscopy and Dynamics of Molecules of Biological Interest..... 4
- Till Jahnke
Small Helium Clusters: Few Atoms, Many Phenomena..... 5

Topical Invited Lectures

- D. Céolin
*High Energy Photoemission as a Probe of the Electronic Structure of KCl
Aqueous Solution*..... 6
- R. Delaunay, M. Gatchell, A. Domaracka, A. Mika, M. H. Stockett,
L. Adoui, H. Zettergren, H. Cederquist, B. A. Huber and P. Rousseau
*Molecular Growth Inside of (Polycyclic Aromatic) Hydrocarbon Clusters
Induced by Ion Collisions*..... 7
- J. P. Sullivan
Positron Scattering Measurements from Biologically Relevant Molecules... 8

Progress Reports

- Miloš Lj. Ranković, Alexandre Giuliani and Aleksandar R. Milosavljević
*Electron Impact Action Spectroscopy of Mass/Charge Selected
Macromolecular Ions*..... 9
- Anita Ribar, Georg Alexander Holzer, Štefan Matejčík and Stephan Denifl
Electron Interactions with Doped Neon Clusters..... 10
- Michal Ryszka, Elahe Alizadeh and Sylwia Ptasinska
*Low Energy Electron-Induced Fragmentation of Nicotine and
N-Methylpyrrolidine*..... 11

Contributed Papers

1.1. Viktor Ayadi, Péter Földi, Péter Dombi and Károly Tökési <i>Initial Phase Space Dependent Tunnel Ionization of the Hydrogen Atom.....</i>	12
1.2. A. Bunjac, D. B. Popović and N. S. Simonović <i>Photoionization of Sodium by a Few Femtosecond Laser Pulse - Time-Dependent Analysis.....</i>	16
1.3. A. Bunjac, D. B. Popović and N. S. Simonović <i>Strong-Field Ionization of Sodium in the Quasistatic Regime.....</i>	20
1.4. R. Celiberto, V. Laporta, R. K. Janev and J. M. Wadehra <i>Resonant Vibrational Excitation of Ro-Vibrationally Excited H₂ and D₂ by Electron Impact.....</i>	24
1.5. Nikola Filipović, Vladan Pavlović and Ljiljana Stevanović <i>Effect of Magnetic Field on Structural Properties of Confined Hydrogen Atom.....</i>	28
1.6. S. Fritzsche, D. Seipt, A. A. Peshkov and A. Surzhykov <i>Interaction of Atoms and Ions with Twisted Light.....</i>	32
1.7. N. P. Kucska, T. Mukoyama and K. Tökési <i>Ionization of Rubidium by Electron Impact.....</i>	36
1.8. Jelena Maljković, Paulina Maciejewska and Janina Kopyra <i>Dissociative Electron Attachment to Benzene Chromium Tricarbonyl.....</i>	39
1.9. M. Z. Milošević and N. S. Simonović <i>Calculations of Ionization Rates for Alkali-Metal Atoms in Electric Field...</i>	43
1.10. M. Z. Milošević and N. S. Simonović <i>Calculations of Electron Detachment Rates for Hydrogen Negative Ion in Electric Field.....</i>	47
1.11. Zehra Nur Ozer and Umran Atmaca <i>Double Differential Cross Sections of Acetylene at 350 eV by Electron Impact.....</i>	51
1.12. Zehra Nur Ozer and Mevlut Dogan <i>Electron Impact Ionization of Carbon Containing Molecules.....</i>	55
1.13. Y. Y. Qi, J. G. Wang and R. K. Janev <i>Oscillator Strengths of Hydrogen-Like Ions in Quantum Plasmas.....</i>	59
1.14. M. M. Vojnović, M. M. Ristić, M. P. Popović and G. B. Poparić <i>Total and Partial Cross Sections for Electron Impact Ionization of N₂.....</i>	63

1.15. D. Jakimovski and R. K. Janev <i>Polarization of Lyman α Radiation from $H^+ + H$ Collisions in Debye Plasmas</i>	67
1.16. D. Jakimovski and R. K. Janev <i>Electron Capture in $H^+ - H$ Collisions with Cosine-Debye-Hückel Screened Interaction</i>	71
1.17. L. Liu, C. H. Liu, J. G. Wang and R. K. Janev <i>Spin-Resolved Electron Capture in $Be^{3+} + Li$ Collisions</i>	75
1.18. Ivan Mančev and Nenad Milojević <i>Projectile Angular Distribution in Single Electron Capture from Helium by Protons</i>	79
1.19. Nenad Milojević and Ivan Mančev <i>Thomas Peak in Fast $H^+ - He$ Collisions</i>	83
1.20. Y. Wu, L. Liu, X. H. Lin, J. G. Wang and R. K. Janev <i>Cross Section for Spin-Resolved Electron Capture in $He^+ - H$ Collisions</i>	87
1.21. M. M. Aoneas, M. M. Ristić, M. M. Vojnović and G. B. Poparić <i>Rate Coefficients for Electron Impact Ionization of CO_2 in RF Electric Field</i>	92
1.22. M. M. Aoneas, M. M. Ristić, M. M. Vojnović and G. B. Poparić <i>Excitation of the $A^3\Sigma_u^+$ State of the Nitrogen Molecule in RF Electric Field</i>	96
1.23. Marija Grofulović, Luís L. Alves and Vasco Guerra <i>Swarm Analysis and Dissociation Cross Sections for CO_2</i>	100
1.24. J. Mirić, D. Bošnjaković, I. Simonović, Z. Lj. Petrović and S. Dujko <i>Monte Carlo Simulations of Electron Transport in CF_3I and SF_6 Gases</i>	104
1.25. J. Mirić, I. Simonović, D. Bošnjaković, Z. Lj. Petrović and S. Dujko <i>Electron Transport in Mercury Vapor: Dimer Induced NDC and Analysis of Transport Phenomena in Electric and Magnetic Fields</i>	108
1.26. Ž. Nikitović, M. Gilić, Z. Raspopović, M. Petrović and V. Stojanović <i>Cross Section and Transport Parameters for K^+ in Dimethoxy Ethane</i>	112
1.27. Ž. Nikitović, Z. Raspopović and V. Stojanović <i>Transport Properties of He^+ in CF_4</i>	116
1.28. I. Simonović, Z. Lj. Petrović, R. D. White and S. Dujko <i>Transport Coefficients for Electron Swarms in Liquid Argon and Liquid Xenon</i>	120

1.29. I. Simonović, Z. Lj. Petrović, R. D. White and S. Dujko <i>Transition of an Electron Avalanche into a Streamer in Liquid Argon and Liquid Xenon</i>	124
1.30. V. Stojanović, J. Jovanović, D. Marić and Z. Lj. Petrović <i>Cross Sections for Scattering and Mobility of OH And H₃O⁺ Ions in H₂O</i>	128

Section 2. PARTICLE AND LASER BEAM INTERACTION WITH SOLIDS

Invited Lecture

Philippe Roncin <i>Diffraction of Fast Atoms on Surfaces, Decoherence Due to Phonons, Electrons and Topological Defects</i>	135
--	-----

Topical Invited Lectures

Li Baiwen, Zheng Chunyang, Cao Lihua and Ning Cheng <i>Recent Progress on Numerical Simulation for High-Energy Density Plasma (HEDP) at IAPCM</i>	136
Vito Despoja, Ivan Radović and Zoran L. Mišković <i>Interactions of Charged Particles with Double-Layer Graphene</i>	137
Christoph Lemell <i>Attosecond Streaking of Photoelectrons Emitted from Solids</i>	138
Károly Tókési, C. Lemell and J. Burgdörfer <i>Classical Trajectory Monte Carlo Method – „Watching Quantum Physics in Real Time”</i>	139

Progress Reports

Miloš Burger <i>The Role of Spectroscopic Diagnostics in Studying Laser-Plasma Interaction</i>	141
M. V. Erofeev, V. S. Ripenko, M. A. Shulepov and V. F. Tarasenko <i>Plasma Treatment of Metal Surface by Nanosecond Diffuse Discharge at Atmospheric Pressure</i>	142
Xu Han, James Kapaldo, Ireneusz Janik and Sylwia Ptasinska <i>Estimation of Radiation Dose Equivalent in Aqueous Solutions Subjected to Atmospheric Pressure Plasma Jets</i>	143

J. Kočišek, K. Grygoryeva, A. Pysanenko, J. Lengyel, J. Fedor and M. Fárník <i>Electron-Induced Reactions in Clusters</i>	144
Miloš Nenadović, Danilo Kisić, Svetlana Štrbac and Zlatko Rakočević <i>Morphological and Structural Properties of Silver and Gold Nanoparticles Obtained by Ion Implantation in High Density Polyethylene</i>	145
Zoran Ristić <i>In-Situ Analysis of the Pulsed Laser Deposition (PLD) Fabricated LaAlO₃/SrTiO₃ Heterostructures</i>	146
Roland Sachser and Michael Huth <i>Febid for Application in Material Science and Solid State Physics</i>	147
Sára Tóth, László Himics and Margit Koós <i>Generation of Highly Luminescent Color Centers in Nanocrystalline Diamond by CVD Method</i>	148
Ying-Ying Zhang, Yuan-Hong Song and You-Nian Wang <i>Interactions of Moving Charged Particles with Multi-Walled Carbon Nanotubes (MWNTs)</i>	149
Contributed Papers	
2.1. D. Borka, C. Lemell, V. Borka Jovanović and K. Tőkési <i>Simulation of Electron Transmission through Platinum Capillaries</i>	150
2.2. T. Djordjević, L. Karbunar, V. Despoja, I. Radović and Z. L. Mišković <i>Plasmon-Phonon Hybridization in Layered Structures Including Graphene</i>	154
2.3. E. Giglio, K. Tőkési and R. D. DuBois <i>A Quantitative Study of Ion Guiding Between Two Glass Plates</i>	158
2.4. M. D. Majkić, R. J. Dojčilović and N. N. Nedeljković <i>Final Charge and Energy Z-Distributions of Slow Ar^{Z+}, Kr^{Z+} and Xe^{Z+} Ions in Front of a Solid Surface</i>	162
2.5. M. D. Majkić, N. N. Nedeljković, D. K. Božanić and R. J. Dojčilović <i>Rydberg State Population of Slow Ar^{XV}, Kr^{XV} and Xe^{XV} Ions Impinging a Solid Surface at Arbitrary Collision Geometry</i>	166
2.6. G. U. L. Nagy, I. Rajta and K. Tőkési <i>2D Simulation of 1 MeV Proton Microbeam Transmission through an Insulating Macrocapillary</i>	170

2.7. N. N. Nedeljković, M. D. Majkić, M. A. Mirković and R. J. Dojčilović <i>Cascade Neutralization of Slow Highly Charged Ions Impinging a Solid Surface at Arbitrary Collision Geometry</i>	174
2.8. V. Burakov, M. Nedelko, N. Tarasenko, A. Nevar and N. Tarasenko <i>Synthesis of Silicon Nanoparticles by Atmospheric Pressure Electrical Discharges in Liquid</i>	178
2.9. Radmila Panajotović and Jasna Vujin <i>Modifications of Lipid/2D-Material Heterostructures by SEM</i>	182
2.10. Kamran Akbari and Zoran L. Mišković <i>Terahertz Radiation from Multilayer Graphene Induced by a Fast Electron</i>	186
2.11. M. V. Erofeev, E. Kh. Baksht, V. S. Ripenko, M. A. Shulepov and V. F. Tarasenko <i>Spatial Structure of Runaway Electron Preionized Diffuse Discharge and Its Impact on a Plane Anode</i>	190
2.12. Dragan Pantić, Miloš Burger, Zoran Nikolić, Vladimir Milosavljević, Goran Poparić and Stevan Djenžić <i>Influence of Laser Irradiance, Ambient Gas Pressure and Internal Shockwaves on the Homogeneity of Laser Produced Plasma</i>	194

Section 3. LOW TEMPERATURE PLASMAS

Invited Lectures

Pascal Boubert <i>Optical Diagnostics in High Enthalpy Plasmas</i>	203
Peter J. Bruggeman <i>Plasma-Liquid Interaction</i>	204
Pietro Favia <i>Plasma Processes for Life Sciences</i>	205
Masaru Hori <i>Plasma Science Towards Next-Generation Healthcare Innovations</i>	206
J. Meichsner, S. Nemschokmichal, R. Tschiersch and T. Wegner <i>Influence of Negative Ions on the Dynamics of Electric Gas Discharges</i>	207
R. Stamm, I. Hannachi, M. Meireni, C. Logeais, H. Capes, L. Godbert-Mouret, M. Koubiti, J. Rosato and Y. Marandet <i>Lines Shapes in Turbulent Plasmas</i>	208

Topical Invited Lectures

Ronny Brandenburg, Milko Schiorlin, Rouven Klink and Abdollah Sarani <i>Barrier Discharges in CO₂ Containing Gases at Atmospheric Pressure....</i>	209
N. De Oliveira, D. Joyeux, K. Ito, B. Gans, J. C. Loison, K. Hickson and L. Nahon <i>High Resolution Absorption Spectroscopy of Transient Species in the VUV Range.....</i>	211
Marija Gorjanc <i>Application of Plasma for Development of Innovative Functional Textiles</i>	213
M. Macias-Montero, T. Velusamy and D. Mariotti <i>Synthesis of Quantum Dots by Atmospheric Pressure Plasmas and Their Integration in Photovoltaic Devices.....</i>	214
C. D. Pintassilgo and V. Guerra <i>Gas Heating Mechanisms in N₂-O₂ Plasmas.....</i>	215
J. Schulze, M. Daksha, B. Berger, A. Derzsi, I. Korolov and Z. Donko <i>Realistic Surface Coefficients for Secondary Electron Emission and Electron Reflection in PIC/MCC Simulations of Capacitive RF Plasmas....</i>	216

Progress Reports

Teodora Gajo <i>Experimental Study of the Influence of Debye Shielding on the Stark Shift of Neutral Helium Lines in Dense Plasmas.....</i>	217
M. R. Gavrilović <i>Study of Single Pulse Laser Induced Breakdown on the Target in Water....</i>	218
S. Iséni, X. Damany, G. Sretenović, V. Kovačević, I. Krstić, S. Dozias, J.-M. Povesle, M. Kuraica and E. Robert <i>Electric Field and Discharge Properties of Single and Multiple Arrangement of Pulsed Atmospheric Plasma Streams.....</i>	219
Z. Navrátil, R. Josepson, N. Cvetanović, B. Obradović and P. Dvořák <i>Electric Field Measurement in Atmospheric Pressure Radiofrequency Discharge in Helium.....</i>	220
J. Rosato <i>Radiation Transport with Partial Coherence in Optically Thick Plasmas....</i>	221
E. T. Slikboer, Y. N. Nguyen, O. Guaitella, G. Sretenović, A. Obrušník and A. Sobota <i>Electric Fields in kHz-Driven Plasma Jets.....</i>	222

Goran B. Sretenović <i>Measurements of the Electric Field Development in Helium Plasma Jets....</i>	223
--	-----

Contributed Papers

3.1. M. T. Belmonte, L. Gavanski, R. J. Peláez, J. A. Aparicio, S. Djurović and S. Mar <i>Transition Probabilities of Some UV Kr II Spectral Lines.....</i>	224
3.2. N. Cvetanović, O. Galmiz and A. Brablec <i>Spectroscopic Investigation of the Underwater Diaphragm Discharge.....</i>	228
3.3. T. Gajo, M. Ivković, I. Savić, Z. Mijatović, S. Djurović and N. Konjević <i>The Influence of Debye Screening on the Shift of the He I 706.52 nm Spectral Line.....</i>	232
3.4. L. Gavanski, M. T. Belmonte, I. Savić and S. Djurović <i>Stark Halfwidths of Several O II Spectral Lines.....</i>	236
3.5. S. S. Ivković, B. M. Obradović, N. Cvetanović and M. M. Kuraica <i>Study of Gas Flow Influence on Homogenous Barrier Discharge in Helium</i>	240
3.6. V. V. Kovačević, G. B. Sretenović, A. Sobota, O. Guaitella, I. B. Krstić, B. M. Obradović and M. M. Kuraica <i>Influence of the Liquid Target on the Electric Field Strength in Helium Plasma Jet.....</i>	244
3.7. Dejan Maletić, Nevena Puač, Gordana Malović and Zoran Lj. Petrović <i>Influence of Air Added in the Helium Flow on the Plasma Bullet Formation.....</i>	248
3.8. Z. Mijatović, S. Djurović, I. Savić, L. Gavanski, T. Gajo and R. Kobilarov <i>Shift of Hydrogen H_{β} Spectral Line Measured in Wall Stabilized Arc.....</i>	252
3.9. Z. Navrátil, T. Morávek, J. Čech and J. Ráhel' <i>OES Diagnostics of Pre-Breakdown Light Emission in Coplanar APGD in Helium.....</i>	256
3.10. Sanja S. Pavlović, Vladimir M. Milosavljević, Patrick J. Cullen and Goran B. Poparić <i>Optical Diagnostic and Modeling of RF Plasma Discharges in The N_2 - Ar Gas Mixtures.....</i>	260
3.11. I. Savić, L. Gavanski, M. T. Belmonte and S. Djurović <i>Stark Halfwidths of Some Spectral Lines of Ionized Silicon.....</i>	264

3.12. M. Skočić, M. Burger and S. Bukvić <i>Self-Absorption in Laser Induced Plasma</i>	268
3.13. Ilija Stefanović, Vladimir Stojanović, Jasmina Jovanović, Cedric Pattyn, Shahzad Hussain, Eva Kovačević and Johannes Berndt <i>Mass Spectra Analysis of RF Nitrogen Plasma for Functionalization of Carbon Nanostructures</i>	272
3.14. M. Vinic, B. Stankov, M. Ivkovic and N. Konjevic <i>Characterization of an Atmospheric Pressure Pulsed Microjet</i>	276
3.15. Julien Annaloro and Arnaud Bultel <i>State-To-State and Collisional-Radiative Modeling of the CO₂-N₂-Ar Plasma Chemistry for the Exomars Mission</i>	280
3.16. S. Dujko, D. Bošnjaković and A. Luque <i>Electron Transport in the Planetary Atmospheres Due to Lightning Generated Electromagnetic Pulses</i>	284
3.17. N. V. Ivanović, Dj. Spasojević, N. M. Šišović and N. Konjević <i>A Routine for Demixing of Polarization Components in Profiles of Hydrogen Balmer Spectral Lines</i>	288
3.18. A. P. Jovanović, M. N. Stankov, V. Lj. Marković and S. N. Stamenković <i>The Influence of Pressure on the Post-Discharge Relaxation in Synthetic Air with Teflon Walls</i>	292
3.19. M. Klas, L. Moravský, Š. Matejčik, B. Radjenović and M. Radmilović-Radjenočić <i>Breakdown Voltages of Direct Current Microdischarges in Compressed Air</i>	296
3.20. M. Klas, L. Moravský, Š. Matejčik, B. Radjenović and M. Radmilović-Radjenočić <i>Characteristics of Radio-Frequency Hydrogen Microdischarges</i>	300
3.21. V. Lj. Marković, A. P. Jovanović, M. N. Stankov and S. N. Stamenković <i>Surface Recombination of Nitrogen Atoms on Teflon in Afterglow Studied by the Electrical Breakdown Time Delay</i>	304
3.22. Vincent Morel, Arnaud Bultel, Lazar Gavanski, Zoran Mijatovic and Stevica Djurovic <i>Departure from Equilibrium of Ultrashort Laser-Induced Aluminum or Tungsten Plasmas</i>	308

3.23. Marija Savić, Dragana Marić and Zoran Lj. Petrović <i>Monte Carlo Simulation of Radio Frequency Breakdown in Air and Oxygen</i>	312
3.24. Jelena Sivoš, Nikola Škoro, Dragana Marić, Gordana Malović and Zoran Lj. Petrović <i>Analysis of Transit Time of Ions in Low - Current DC Discharge in Water Vapour</i>	316
3.25. S. N. Stamenković, V. Lj. Marković, A. P. Jovanović and M. N. Stankov <i>The Field Assisted Electron Emission in Neon DC Glow Discharge</i>	320
3.26. M. N. Stankov, A. P. Jovanović, V. Lj. Marković and S. N. Stamenković <i>Spectroscopic Investigation, Photographic Imaging and Numerical Modeling of Glow Discharge in Argon</i>	324
3.27. Vladimir Stojanović, Nikola Škoro, Jelena Sivoš, Gordana Malović, Dragana Marić and Zoran Petrović <i>Modeling Emission from Water Vapor DC Discharge at Low Pressure</i>	328
3.28. M. M. Vasiljević, G. Lj. Majstorović and N. M. Šišović <i>Gas Temperature Measurements in Hydrogen-Argon Mixture Grimm Glow Discharge</i>	332
3.29. D. Bošnjaković, Z. Lj. Petrović and S. Dujko <i>A New Model of Resistive Plate Chambers Based on Hydrodynamic Approximation</i>	336
3.30. L. Ellis-Gibbins, A. Traore, K. Krupa, J. C. Oller, F. Ferreira da Silva, P. Limao-Vieira and G. Garcia <i>Medium to Low Energy Anion Beams and Their Application to Biomolecule Fragmentation</i>	340
3.31. J. Kapaldo, X. Han and S. Ptasinska <i>High Throughput Imaging for Studying the Spatial Effect of Cold Atmospheric Plasma Jets on Cell Cultures</i>	344
3.32. Milica Matijević, Milovan Stoiljković, Miloš Momčilović, Jelena Savović, Jovan Ciganović and Miroslav Kuzmanović <i>Laser-Induced Breakdown Spectroscopy at a Solid-Aqueous Aerosol Interface</i>	348
3.33. Cristóbal Melero, José Muñoz and María Dolores Calzada <i>Microwave Plasmas Applied to the Synthesis of High-Quality Substrate-Free Graphene</i>	352

3.34. Ž. Mladenović, S. Gocić, D. Marić and Z. Lj. Petrović <i>Influence of Electron Energy Distribution Function on Composition of Atmospheric Pressure He/O₂ Plasmas</i>	356
3.35. J. Muñoz, J. A. Bravo, C. Melero and M. D. Calzada <i>Aluminum Surface Cleaning and Activation by an Atmospheric Pressure Ar-N₂ Microwave Afterglow</i>	360
3.36. Nenad Selaković, Nevena Puač, Nevenka Gligorijević, Milena Čavić, Gordana Malović, Radmila Janković, Siniša Radulović and Zoran Lj. Petrović <i>Low Temperature Plasma Needle Reduces the Survival of Cancer Cells</i>	364

Section 4. GENERAL PLASMAS

Invited Lecture

Hiroshi Azechi <i>Status and Future Prospects of Laser Fusion Research at ILE, Osaka</i>	371
---	-----

Topical Invited Lectures

René W. Goosmann, on behalf of the XIPE collaboration <i>X-Ray Polarimetry: A New Way to Probe Astrophysical Plasma</i>	372
G. La Mura, G. Busetto, S. Ciroi, P. Rafanelli, M. Berton, E. Congiu, V. Cracco and M. Frezzato <i>Relativistic Plasmas in Agn Jets: From Synchrotron Radiation to γ-Ray Emission</i>	373
Jinghong Li <i>A Hybrid Transport-Diffusion Simulation in Laser Fusion</i>	374
E. Lyrtzi <i>Investigating the Reasons of Variability in Si IV and C IV Broad Absorption Line Troughs</i>	375

Progress Reports

Bin Li, Zhanjun Liu, Chunyang Zheng, Xiaoyan Hu, Liang Hao and Jiang Xiang <i>Numerical Simulation of Large Scale Laser Filamentation and Beam Smoothing for Inertial Confinement Fusion</i>	376
Ivan Milić <i>Diagnosing Plasma in the Solar Atmosphere Using Spectropolarimetry</i>	377

A. Nina, V. M. Čadež, L. Č. Popović and V. A. Srećković
Diagnostics of Plasma in Ionospheric D-Region by VLF Radio Waves..... 378

Marija Vranić
*Laser-Matter Interaction at the Intensity Frontier: On the Path Towards
Laboratory Astrophysics*..... 379

Contributed Papers

4.1. M. Vlainic, J. Mlynar, O. Ficker, J. Havlicek, V. Weinzettl,
M. Imrisek, R. Panek, J.-M. Noterdaeme and the COMPASS Team
Influence of Runaway Electrons on Discharge Start-Up in COMPASS..... 380

4.2. C. Y. Zheng, C. Z. Xiao, Z. J. Liu and X. T. He
*Competition Between Stimulated Raman Scattering and Two-Plasmon
Decay in Fusion Plasmas*..... 384

4.3. Jovan Bajčetić, Dušan Raičević and Aleksandra Nina
*Solar Ly α and X-Ray Influence on Radio Wave Propagation in
Ionospheric D-Layer Plasma*..... 385

4.4. V. Borka Jovanović, P. Jovanović and D. Borka
*A Short Overview of Our Contribution to Green's Catalogue of Galactic
Supernova Remnants*..... 389

4.5. V. Borka Jovanović, P. Jovanović, D. Borka and S. Capozziello
Fundamental Plane of Elliptical Galaxies and $f(R)$ Gravity..... 393

4.6. D. Jevremović, V. Vujčić, A. A. Mihajlov, V. A. Srećković,
Lj. M. Ignjatović, M. S. Dimitrijević, S. Erkapic and N. Milovanović
*MOL-D: Database for Specific Collisional Processes and Web Service
Within the Serbian Virtual Observatory and the Virtual Atomic and
Molecular Data Center Consortium*..... 397

4.7. Gordana Jovanović
The Nature of Gravitational and Gravity Waves..... 401

4.8. Gordana Jovanović
The Role of Gravity in the Acoustic Waves Reflection..... 405

4.9. Jelena Kovačević Dojčinović and Luka Č. Popović
*Stratification in the Broad Line Region of Active Galactic Nuclei: $H\beta$ vs.
 $H\gamma$ Line Shapes*..... 409

4.10. A. A. Mihajlov, V. A. Srećković, Lj. M. Ignjatović, Z. Simić and
M. S. Dimitrijević
Atom Rydberg-Atom Processes in the Stellar Atmospheres..... 413

4.11. A. Nina, S. T. Mitrović, V. M. Čadež, L. Č. Popović, P. Kolarž, A. Kolarski and J. Bajčetić <i>Detection of Plasma Variations in Period of Earthquake Occurred Near Kraljevo in 2010 by Electromagnetic Waves Propagation</i>	417
4.12. A. Nina, S. Simić, V. A. Srećković, A. Djulaković and L. Č. Popović <i>Short-Term Disturbances of the Low Ionosphere Induced by γ-Ray Bursts</i>	421
4.13. N. M. Sakan, V. A. Srećković, Lj. M. Ignjatović and A. A. Mihajlov <i>Bond - Bound State Transitions in the Frame of Coulomb Cut-Off Model Potential</i>	425
4.14. D. Savić, R. Goosmann, F. Marin, V. L. Afanasiev, L. Č. Popović and D. Ilić <i>Measuring Black Hole Masses in Active Galactic Nuclei Using Polarization in Broad Line Profiles</i>	429
4.15. Zoran Simić, Milan S. Dimitrijević and Vladimir Srećković <i>Stark Broadening of Bismuth IV Spectral Lines in A Type Stellar Atmospheres</i>	433

The Workshop on X-ray Interaction with Biomolecules in Gas Phase (XiBiGP)

Sadia Bari <i>Structure and Dynamics of Gas-Phase Biomolecules</i>	439
M. C. Castrovilli, D. Ayuso, A. Trabattoni, S. De Camillis, A. Palacios, P. Decleva, J. Greenwood, F. Martín, M. Nisoli and F. Calegari <i>XUV Induced Ultrafast Dynamics in Bio-Relevant Molecules</i>	440
A. De Fanis, T. Baumann, M. Ilchen, T. Mazza, M. Meyer, Y. Ovcharenko and H. Zhang <i>The NQS Station (Nano-Size Quantum System), as Part of the SQS Instrument (Small-Quantum-System) at the SASE3 Branch of the European XFEL</i>	441
Sergio Díaz-Tendero <i>Unusual Fragmentation Mechanisms in Ionized Biomolecules in the Gas Phase</i>	442
Ronnie Hoekstra <i>Large Molecules Break-Dancing in the Spot Light</i>	443
F. Holzmeier, I. Fischer, S. Nandi, T. Wolf and M. Gühr <i>Auger Spectroscopy of HNCO Reveals Dissociative Photoionization Dynamics in Thymine</i>	444

Kuno Kooser, Dang Trinh Ha, Marta Tarkanovskaja, Eero Itälä, Helena Levola and Edwin Kukk <i>Size Selective Spectroscopy of Molecular Clusters</i>	445
Robert Seidel <i>Electronic Structure of Small Biologically Relevant Molecules in Aqueous Solutions Studied by Photoelectron Spectroscopy</i>	446
S. D. Tošić, P. Bolognesi, L. Avaldi, R. Richter and B. P. Marinković <i>Fragmentation of Halothane Molecule by Synchrotron Radiation</i>	447

The 4th International Workshop on Non-Equilibrium Processes (NonEqProc)

Roberto Celiberto and Vincenzo Laporta <i>Molecular Excitations by Electron-Impact in Non-Equilibrium Aerospace and Fusion Plasmas</i>	451
L. Ellis-Gibblings, K. Krupa, A. Traore, A. Verkhovtsev and G. Garcia <i>Modelling Low Energy Particle Tracks in Biologically Relevant Media</i>	452
Vasco Guerra, Carlos Teixeira and Daniil Marinov <i>Modelling Heterogeneous Reactions of Oxygen-Containing Plasmas on Silica Surfaces</i>	453
Kinga Kutasi, Cédric Noel, Thierry Belmonte and Vasco Guerra <i>Tuning the Afterglow Plasma Composition in Ar/N₂/O₂ Mixtures: Characteristics and Applications of a Flowing Surface-Wave Microwave Discharge System</i>	454
Svetlana Radovanov <i>New Trends in Low Energy Ion Implantation</i>	455
N. Škoro, D. Marić, V. Stojanović, J. Sivoš, G. Malović and Z. Lj. Petrović <i>Heavy-Particle Processes in Low-Pressure Water Vapour Discharge</i>	456
Vladimir Stojanović <i>Denpoh-Nanbu Theory in Modelling Low Pressure Discharges</i>	457
Peter W. Stokes, Bronson Philippa, Daniel Cocks and Ronald D. White <i>A Generalised Boltzmann Equation for Non-Equilibrium Charged Particle Transport Via Localised and Delocalised States</i>	458
J. P. Sullivan <i>A Positron Reaction Microscope</i>	459

J. G. Wang, L. Liu, Y. Wu, S. B. Zhang and R. K. Janev <i>Atomic Collision Processes in Hot, Dense Plasmas</i>	460
Achim Czasch <i>Single-Particle Counting: Applications in Atomic and Molecular Physics</i>	463
Author Index.....	467

INTERACTIONS OF CHARGED PARTICLES WITH DOUBLE-LAYER GRAPHENE

Vito Despoja¹, Ivan Radović² and Zoran L. Mišković³

¹*Department of Physics, University of Zagreb, Bijenička 32, HR-10000 Zagreb, Croatia*

²*VINČA Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*

³*Department of Applied Mathematics, and Waterloo Institute for Nanotechnology, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1*

Nowadays we are witnesses of a development of one promising branch of applied physics, called plasmonics. Especially interesting issue is plasmonics in quasi-two-dimensional (q2D) crystals deposited on various dielectric substrates. Here arise the main questions: how to increase the 2D plasmon propagation length and how to excite 2D plasmon most efficiently. We will focus on describing the interaction between electronic excitations in two graphene layers with phonons in aluminium oxide (Al_2O_3) slab on which the graphene layers are deposited. Special attention will be paid to explain the hybridization between 2D plasmons and surface (TO) phonons. Because of multiple intersections of 2D plasmons and TO phonons the 2D plasmon moves to lower energies which allows it to be excited by charged particles moving at subthreshold speeds, $v < v_F$ [1]. We will present the results for wake potential induced by a charged particle which moves parallel to the graphene/dielectric interface. It will be shown how various substrates modify the efficiency of particle/plasmon coupling. The electronic excitations in graphene are obtained by using plane wave approach where we have addressed the problem of calculation of EELS spectra in the optical limit ($Q \rightarrow 0$) and how to avoid intersubband Coulomb interaction [2].

REFERENCES

- [1] T. Marinković, I. Radović, D. Borka, Z. L. Mišković, *Plasmonics* **10** 1741-1749 (2015).
- [2] V. Despoja, D. Novko, K. Dekanić, M. Šunjić, L. Marušić, *Phys. Rev. B* **87**, 075447 (2013).

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

537.56(082)
539.186.2(082)
539.121.7(082)
533.9(082)

SUMMER School and International Symposium on the Physics of Ionized Gases
(28 ; 2016 ; Beograd)

Contributed Papers & Abstracts of Invited Lectures, Topical Invited Lectures, Progress Reports and Workshop Lectures / 28th Summer School and International Symposium on the Physics of Ionized Gases - SPIG 2016, [August 29 - September 2], 2016, Belgrade ; editors Dragana Marić ... [et al.]. - Belgrade : University of Belgrade, Faculty of Physics, 2016 (Beograd : Skripta Internacional). - 474 str. : ilustr. ; 24 cm

Tiraž 200. - Str. 5: Preface / editors Dragana Marić ... [et al.]. - Napomene i bibliografske reference uz tekst. - Bibliografija uz svaki rad. - Registar.

ISBN 978-86-84539-14-6

1. Marić, Dragana, 1973- [уредник] [аутор додатног текста]

а) Јонизовани гасови - Зборници б) Атоми - Интеракција - Зборници
с) Плазма - Зборници

COBISS.SR-ID 225356044