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1. Structure of The Institute of Physics

EXECUTIVE BORD – PRESIDENT

Prof. dr. sc. Hrvoje Kraljević,
Faculty of Sciences, University of
Zagreb

DIRECTOR

v.d. Dr. sc. Petar Pervan
(until 31.5.2013)
Dr. sc. Slobodan Milošević
(from 1.6.2013)

EXECUTIVE BORD

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(until 24.4.2013)
Faculty of Sciences, University of
Zagreb

ASSISTANT DIRECTORS

(until 31.5.2013)
Dr. sc. Damir Starešinić
Dr. sc. Nazif Demoli

Prof. dr. sc. Željko Crljen,
(from 24.4.2013)
„Ruđer Bošković“ Institute, Zagreb

(from 1.6. 2013)
Dr. sc. Marko Kralj
Dr. sc. Damir Aumiler

Prof. dr. sc. Mladen Petravić,
University of Rijeka, Physics
Department

SCIENTIFIC COUNCIL

Dr. sc. Mladen Movre
President until 19.5.2013
Dr. sc. Ivica Živković,
President from 20.5.2013

Dr. sc. Čedomil Vadla
Institute of Physics, Zagreb

Dr. sc. Ticijana Ban,
Institute of Physics, Union
representative

Dr. sc. Ognjen Milat
deputy president until 11.6.2013
Dr. sc. Đuro Drobac,
deputy president from 11.6.2013

SENIOR SCIENTISTS (permanent)

Katica Biljaković, Laboratory for complex systems
Robert Beuc, Group for theoretical atomic physics
Nazif Demoli, Laboratory for coherent optics
Branko Gumhalter, Group for theoretical surface physics
Bojana Hamzić, Laboratory for magnetotransport measurements
Slobodan Milošević, Laboratory for laser spectroscopy of cold plasma
Ognjen Milat, SAXS Laboratory for crystallographic and nanostructure analyses
Mladen Movre, Group for theoretical atomic physics
Petar Pervan, Laboratory for surface science and supported nanostructures
Mladen Prester, Laboratory for magnetic ac susceptibility
Ana Smontara, Laboratory for the physics of transport phenomena
(from 17. 1. 2013)
Silvia Tomić, Laboratory for dielectric spectroscopy in solid state
Katarina Uzelac, Statistical physics group
Čedomil Vadla, Laboratory for laser spectroscopy

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SENIOR SCIENTISTS

Ticijana Ban, Laboratory for femtosecond laser spectroscopy
Vlasta Horvatić, Laboratory for laser spectroscopy
Jovica Ivkov, Laboratory for the physics of transport phenomena
Ana Smontara, Laboratory for the physics of transport phenomena
(until 16.1. 2013)
Antonio Šiber, Group for nanoscience

SENIOR RESEARCH ASSOCIATES

Ivica Aviani, Laboratory for studying strongly correlated electronic systems
Damir Aumiler, Laboratory for femtosecond laser spectroscopy
Đuro Drobac, Laboratory for magnetic ac susceptibility
Berislav Horvatić, Group for theoretical atomic physics
Marko Kralj, Laboratory for surface science and supported nanostructures
Hrvoje Skenderović, Laboratory for femtosecond laser spectroscopy
Damir Starešinić, Laboratory for complex systems
Eduard Tutiš, Group for modelling of electronic processes and devices
Tomislav Vuletić, Laboratory for biological physics
Ivica Živković, Laboratory for magnetic ac susceptibility

RESEARCH ASSOCIATES

Osor S. Barišić, Statistical physics group

Mirta Herak, Laboratory for static magnetic measurements

Nikša Krstulović, Laboratory for laser spectroscopy of cold plasma

EMERITI

Milorad Milun, Laboratory for surface science and supported nanostructures
(retired from 1.1. 2013, emeritus from 16.4.2013)

Goran Pichler, Laboratory for femtosecond laser spectroscopy

Veljko Zlatić, Group for strongly correlated systems

HIGHER ASSISTANTS

Ivan Balog, Statistical physics group

Damir Dominko, Laboratory for complex systems

Tomislav Ivek, Laboratory for dielectric spectroscopy in solid state

Ivo Pletikosić, Laboratory for surface science and supported nanostructures

Petar Popčević, Laboratory for the physics of transport phenomena

Mario Rakić, Laboratory for femtosecond laser spectroscopy (from 16.10.2013)

Juraj Szavits Nossan, Statistical physics group

Kristina Šariri, (until 19.5.2013)

Silvije Vdović, Laboratory for femtosecond laser spectroscopy

Nataša Vujičić, Laboratory for femtosecond laser spectroscopy

ASSISTANTS

Marijan Bišćan, Laboratory for laser spectroscopy of cold plasma

Matija Čulo, Laboratory for magnetotransport measurements

Ida Delač Marion, Laboratory for biological physics & Laboratory for surface science and supported nanostructures

Goran Gatalica, Group for theoretical atomic physics

Danijel Grgičin, Laboratory for dielectric spectroscopy in solid state

Ivan Jurić, Group for modelling of electronic processes and devices

Gordana Kregar, Laboratory for femtosecond laser spectroscopy

Zlatko Kregar, Laboratory for laser spectroscopy of cold plasma

Ivana Levatić, Laboratory for magnetic ac susceptibility

Martina Lihter, Laboratory for soft thin films (until 9.1. 2014)

Sanjin Marion, Group for theoretical surface science

Marin Petrović, Laboratory for surface science and supported nanostructures

Iva Šrut, Laboratory for surface science and supported nanostructures
Vinko Šurija, Laboratory for magnetic ac susceptibility (from 15.3. 2013)
Kristijan Velebit, Laboratory for the physics of transport phenomena

TECHNICAL ADVISORS

Jadranko Gladić, Laboratory for laser interferometric measurements of crystal growth
Davorin Lovrić, Laboratory for laser interferometric measurements of crystal growth
Željko Marohnić, Laboratory for magnetic ac susceptibility

HIGHER TECHNICAL ASSOCIATES

Berti Erjavec, Multimedia laboratory
Krešimir Salamon, SAXS Laboratory for crystallographic and nanostructure analyses

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INFORMATICS

Mario Juričić, chief of the informatics section
Ndoc Deda, technical associate

LIBRARY

Maja Starček, prof. dipl. bibl.
Dijana Đuran, dipl. bibl. (from 1.7.2013)

TECHNICIANS

Damir Altus, mechatronic technician
Branko Kiš, electronic workshop
Ivan Čičko, mechanical workshop
Franjo Zdravec, mechanical workshop
Josip Pogačić, helium liquifier
Žarko Vidović, nitrogen liquifier
Alan Vojnović, electronic workshop

ADMINISTRATION

Ivanka Bakmaz, accountancy clerk
Nevenka Kralj, accountancy clerk
Željko Kneclin, higher economic advisor

Marija Sobol, administrative clerk
Jadranka Rajić, secretary

SUPPORTING PERSONNEL

Mladen Bakale, economist
Ivanka Čosić, cleaning lady (from 9.9. 2013)
Lidija Krištofhandl, , cleaning lady (from 1.7. 2013)
Mirjana Ličina, cleaning lady
Gordana Matić, cleaning lady
Renata Macešan, cleaning lady
Snježana Mostečak, cleaning lady
Darko Oštarčević, porter-telephone operator
Nataša Šuput, cleaning lady (until 7.8.2013)
Draženka Zajec, cleaning lady
Jozo Zovko, janitor

2. Report on progress on the permanent research activities

2.1. Projects

1. Project title: *Physics of atoms and molecules in extreme conditions*
Funded by: MSES
Principal investigator: Robert Beuc
2. Project title: *Modeling physical properties of materials with marked frustration or disorder*
Funded by: MSES
Principal investigator: Eduard Tutiš
3. Project title: *Electronic and crystal structure of supported self-organized nanosystems*
Funded by: MSES
Principal investigator: Petar Pervan
4. Project title: *Quantum Magnets: Competing ground states*
Funded by: MSES
Principal investigator: Mladen Prester
5. Project title: *Complex modulated systems: new ground states, defects and magnetic effects*
Funded by: MSES
Principal investigator: Katica Biljaković
6. Project title: *Strongly correlated inorganic, organic and biomaterials*
Funded by: MSES
Principal investigator: Silvia Tomić
7. Project title: *Materials with electronic structure tailored by the modern techniques of sample preparations*
Funded by: MSES
Principal investigator: Ivica Aviani
8. Project title: *Defects and exchange interactions in low-dimensional ($D < 3$) magnetic systems*
Funded by: MSES
Principal investigator: Đuro Drobac

9. Project title: *Development of digital procedures in holography and interferometry*
Funded by: MSES
Principal investigator: Nazif Demoli
10. Project title: *Femtosecond laser physics of atoms and molecules*
Funded by: MSES
Principal investigator: Goran Pichler
11. Project title: *Laser spectroscopy of cold plasmas for treatment of materials*
Funded by: MSES
Principal investigator: Slobodan Milošević
12. Project title: *Heat and charge transport in strongly frustrated magnets and similar materials*
Funded by: MSES
Principal investigator: Ana Smontara
13. Project title: *Shapes and structures of nanoscale objects dictated by competition of energies*
Funded by: MSES
Principal investigator: Antonio Šiber
14. Project title: *Critical phenomena and systems out of equilibrium*
Funded by: MSES
Principal investigator: Katarina Uzelac
15. Project title: *Spectroscopy of Rydberg atoms and molecules*
Funded by: MSES
Principal investigator: Čedomil Vadla
16. Project title: **PHYSICS (FIZIKA)**
Funded by: MSES, popularization of science
Principal investigator: Berti Erjavec
17. Project title: *Physics as a gift (Fizika na dar)*
Funded by: MSES, popularization of science
Leader: Berti Erjavec
18. Project title: *Night-of-the-Lab-Out*
Funded by: FP7-PEOPLE-2013-NIGHT, popularization of science
Leader: Berti Erjavec

19. Project title: *Complex Magnetic Systems*
Funded by: CSF
Principal investigator: Ivica Živković
20. Project title: *Evaluation of new bioactive materials and procedures in restorative dental medicine*
Funded by: CSF
Principal investigator: Prof. Zrinka Tarle (School of Dental Medicine, University of Zagreb)
Head of the research group: Nazif Demoli
21. Project title: *Teeth whitening device with real time monitoring of whitening process*
Funded by: BICRO
Principal investigator: Mario Rakić
22. Project title: *Transportna svojstva (metastabilnih) djelomicno kristalinicnih sistema*
Funded by: Federal Ministry of Education and Science, Bosnia and Herzegovina
Principal investigator: Dr. Suada Sulejmanović (Faculty of Science, University of Sarajevo)
Head of the research group: Katica Biljaković

2.2. Bilateral projects

1. Project title: *Theoretical modelling and simulations of the structural, electronic and dynamical properties of surfaces and nanostructures in materials science*
Partner country: Japan
Principal investigator: Branko Gumhalter
2. Project title: *Plasma assisted synthesis of nanoobjects*
Partner country: Slovenia
Principal investigator: Nikša Krstulović
3. Project title: *Transport and nonequilibrium effects in correlated nanostructures*
Partner country: USA
Principal investigator: Ivica Aviani

4. Project title: *Signatures of Dirac electrons in BEDT-TTF salts under pressure*
Partner country: Germany
Principal investigator: Silvia Tomić
5. Project title: *Quantum Criticality Between Metal and Charge Order*
Partner country: Germany
Principal investigator: Bojana Hamzić
6. Project title: *Absorptionsspektroskopische Charakterisierung der metastabilen Zustände im Jet einer weichen Ionisierungsquelle fuer organische Molekuele*
Partner country: Germany
Principal investigator: Čedomil Vadla
7. Project title: *Nonadiabatic effects in molecular reaction dynamics studied by femtosecond laser spectroscopy*
Partner country: Chine
Principal investigator: Damir Aumiler
8. Project title: *Electrons in two dimensions: Graphene and topological insulators*
Partner country: Germany
Principal investigator: Marko Kralj

2.3. Research networks

1. European Integrated Centre for the Development of Metallic Alloys and Compounds (C-MAC)
Legal representative: Ana Smontara
2. Memberships in COST actions

COST MP1101 Bio-Plasma
Member of MC: S. Milošević

COST MP1203 X-ray metrology
Member of MC: N. Krstulović

COST TD1208 Plasmas in liquids
Members of MC: S. Milošević, N. Krstulović

COST MP1208 Inertial Con. Fusion
Members of MC: H. Skenderović, S. Vdović

COST MP1302 NanoSpectroscopy
Members of MC: T. Ban, D. Aumiler

COST MP1209 TD in the quantum regime
Member of MC: O. S. Barišić

COST MP1201 Nanoscale Superconductivity
Members of MC: I. Živković, M. Prester

COST MP1204 TERA-MIR Radiation:
Members of MC: T. Ivek, S. Tomić

2.4. Cooperation with industry

Contract-regulated cooperation with industry:

1. Pliva d.o.o.;
2. Sistemprojekt/Cryobind;

2.1. Projects

Project title: *Physics of atoms and molecules in extreme conditions*

Funded by: MSES

Principal investigator: Robert Beuc

Our years-long research of thermally averaged optical spectra of diatomic molecules has reached the final phase. We have completed most of the preliminary investigations and we are now preparing the publication of the results.

The application of the FGH method for determining rovibrational energies and wave functions of diatomic molecules enables full quantum-mechanical calculations of the linear absorption coefficient, with the contributions of bound-bound, bound-free, free-bound, and free-free transitions being treated on the same footing. Using the properties of the WKB approximation of the wave function, we developed the "semiquantum" approximation of the linear absorption coefficient which, owing to its exceptional numerical efficiency, is suitable for the determination of concentration and temperature in hot vapors of diatomic molecules. An article presenting the results of this research has been accepted for publication.

In the case of local thermal equilibrium, the spontaneous emission coefficient and the linear absorption coefficient are related by Kirchhoff's law, which enables the semiquantum approximation of the diatomic molecules' emission spectra as well. We used this method to calculate the emission spectrum of cesium molecules in the case of a homogeneous radiating volume, as well as in the case when the emitted light passes through a uniform absorbing layer containing molecules in the ground electronic state, which leads to selfabsorption of the emitted radiation.

The generalized Airy approximation of the canonical oscillating integrals, developed in the last two years, was applied to the semiclassical calculation of thermally averaged spectral profiles of optical transitions of diatomic molecules, where the characteristic difference potential curve has one, two, or three extrema.

Project title: *Modeling physical properties of materials with marked frustration or disorder*

Funded by: MSES

Principal investigator: Eduard Tutiš

The project activities continued in 2012 along two lanes, one related to layered conductive crystals, and the other related to organic molecular materials:

The research done within the first activity has been reported at several conferences, workshops and seminars in 2012: ISCM 2012, Atlanta, Georgia (invited lecture); PLDC-PP 2012 Zagreb; 2nd NMR workshop, Trogir; two F2E UKF workshops in Zagreb; lectures at EPFL, Lausanne. Project supported the organization of one international conference and several workshops. Research activities were mostly related to the simulations of conduction properties of strongly correlated layered systems. This activity has been partly forked through the UKF project that finished in 2012 (separate report).

The second activity mostly consisted in developing the code and performing the simulations related to dark-injection transient spectroscopy (DITS) in disordered organics. Both 1D and 3D codes were produced and used. This research was partly

supported by the EURAMET grant that covered the stay of I. Jurić at NPL, London, UK (July-December 2012). The work done within this activity was presented at one international conference (SimOEP12, Valencia, Spain) and one workshop (2. TYC Energy Materials, London, UK).

Project title: *Electronic and crystal structure of supported self-organized nanosystems*

Funded by: MSES

Principal investigator: Petar Pervan

Within the project „Electronic and crystal structure of supported self-organized nanosystems project we continue to investigate structural and electronic properties of graphene grown on iridium surface and modified chemically and structurally. The prime interest was focused on the study of possible changes of electronic properties of graphene due to its buckling along specific direction. For this reason graphene on stepped Ir(332) was investigated. Our findings about the temperature influence on the graphene structure on Ir(332) indicate strong rearrangement of the underlying Ir surface and formation of differently corrugated graphene nano-patches. Other properties of graphene deposited on the stepped Ir(332) surface were studied by means of low temperature STM (in collaboration with T. Michely, C. Busse at University Köln) and Angle Resolved Photoemission at SOLEIL synchrotron in Paris. The experimental results are to be complemented by Density Functional Theory modelling (DFT) in collaboration with researchers from Ruđer Bošković Institute (P. Lazić). The results of this research have been presented on International Vacuum Conference IVC-19 in Paris.

Project title: *Quantum Magnets: Competing ground states*

Funded by: MSES

Principal investigator: Mladen Prester

In 2013 the collective spin reversal became a central physical phenomenon of our interest; phenomenology of different magnetic systems, chosen for our experimental studies, has been built around the collective spin reversal. The main research subject was magnetic dynamics of the micro- or nanometric quasi-classical macrospin, like the one building the domain-wall's activation volume or monodomain magnetic nanoparticles. The macrospin is subject to combined action of magnetocrystalline anisotropy and the time dependent Zeeman interaction, introducing the specific form of magnetic relaxations (Arrhenius-Néel-Brown type). The main technique involved in these studies is ac susceptibility being simultaneously the experimental tool as well as a subject of methodological upgrades. The investigated magnetic systems were multiferroic CuO (studied in the nanoparticle and the single-crystalline forms), Cu₄O₃ nanoparticles (synthesized and studied for the first time), nanoparticles of NiCoB-Si (amorphous ferromagnetic core shielded by SiO₂ layer) and the selected Fe-oxides (ferrihydrit, akaganeit, magnetit) in organic matrix, as prepared for their biomedical functionalities. In 2013 the main experimental progress was in the upgrade of ac susceptibility system so that it enables now measurements of magnetic after-effect (time decay of ac susceptibility after demagnetization). The studies of the latter effect have been initiated in the context of defect-migrations studies in ferromagnetic alloys. In Fe-Si steel (electric steel) a broad Snoek relaxation peak in sample's reluctivity has been identified. The latter studies have been motivated by our plans to participate in nuclear fusion projects, related to ITER/DEMO.



Dr. Mladen Prester



Dr. Đuro Drobac



Dr. Željko Marohnić



Dr. Ivica Živković



Laboratory for magnetic ac susceptibility

Project title: *Complex modulated systems: new ground states, defects and magnetic effects*

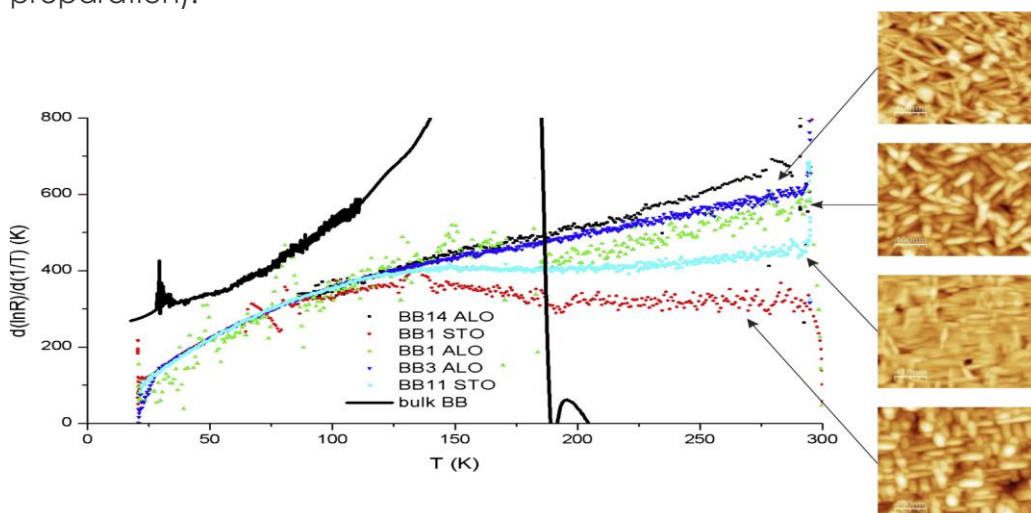
Funded by: MSES

Principal investigator: Katica Biljaković

Our research remains based in the field of charge density wave (CDW) systems with excursions to the field of metallic glasses. We have made significant improvement in the measurements of nonlinear response to ultra-short current pulses with very high electric fields which enabled a detailed investigation of the threshold field in the doped samples of TaS₃ (0.2% and 0.5% Nb) in a wide temperature range (publication in preparation). However, the main focus was on the interpretation of the generic temperature dependence of the thermoelectric power (TEP) of CDW systems in cooperation with dr. Očko. The mechanism of TEP generation in CDW systems was assigned to the phonon drag of free carriers by optical modes close to the CDW energy gap at higher temperatures, featuring a characteristic peak in TEP, and to variable range hopping (VRH) of localized carriers of opposite charge below the CDW glass transition temperature, manifested in the change of the sign of TEP and pronounced minimum at lower temperatures. This generic model quantitatively accounts for the TEP measured in o-TaS₃ (publication submitted).

We continued to investigate the link between the texture of blue bronze films and VRH behaviour of electric transport in collaboration with dr. Jurić and associates from Faculty of sciences, Sarajevo, dr. Đekić and dipl. ing. Salčinović. Dr. Đekić defended the Ph.D. thesis on this subject under supervision of dr. Biljaković. New production of thin films is discussed with PLD group in IJS, Ljubljana.

We have measured the heat capacity of the entire series of ternary amorphous alloys Cu₅₅Hf_{45-x}Ti_x, typical representatives of the family of bulk metallic glasses, in collaboration with prof. Babić from Faculty of sciences, Zagreb, and prof. Remenyi from Institute Neel, Grenoble, in order to find possible relation between the glass forming ability (GFA) and electronic and phonon heat capacities (publication in preparation).



Derivative of the logarithm of the resistance in respect to the inverse temperature for the blue bronze films from the 7th batch of depositions and for BB14ALO from 4th batch compared to bulk. Corresponding AFM images show some correlations between the electrical transport and film textures. (Đekić et al., Vacuum, 2013)

Project title: *Strongly correlated inorganic, organic and biomaterials*

Funded by: MSES

Principal investigator: Silvia Tomić

We have explained a prominent dielectric response in the organic Mott insulator with magnetic ordering κ -(BEDT-TTF) $_2$ Cu[N(CN) $_2$]Cl by short-range discommensurations of the antiferromagnetic phase in the temperature range $30 < T < 50$ K, and by relaxation of charged domain walls in the ferromagnetic structure at lower temperatures. We have characterized the anisotropic charge response in an unconventional Mott insulator with spin liquid κ -(BEDT-TTF) $_2$ Cu $_2$ (CN) $_3$ by DC conductivity, Hall effect and dielectric spectroscopy in 10 Hz - 1 MHz frequency range. We have analyzed the behaviour of magnesium counterions in ds-DNA semidilute solutions by means of dielectric spectroscopy measurements. Our results demonstrate that divalent magnesium cations significantly contribute to the DNA self-screening of electrostatic interactions. However, with magnesium counterions there is as yet no net attraction between DNA segments that would be capable of inducing the full DNA collapse. We have prepared and characterized the structure and dynamics of DNA solutions with manganese counterions by means of UV spectrophotometry and dielectric spectroscopy.

Project title: *Materials with electronic structure tailored by the modern techniques of sample preparations*

Funded by: MSES

Principal investigator: Ivica Aviani

We continued our research on the transport properties of the Ta $_x$ N thin films and thin films based on polysilicon.

We investigated the disorder in the Ta $_x$ N polycrystalline thin films fabricated using reactive sputtering at 450 °C and 4.9 mTorr nitrogen pressures on amorphous substrates. We performed measurements of the transport properties from the liquid helium to the room temperature and the Raman spectra analysis. A non-monotonous concentration dependence of transport properties is attributed to a local minimum in the density of electronic states at the Fermi level. We found that the imperfections that reduce the coherence length contribute to the appearance of the first order Raman spectrum. This enables better understanding the anomalous concentration dependence of the resistivity.

We studied problems in the preparation of the solid solution phase of heavily phosphorus and boron doped polycrystalline silicon. We propose a process of a good-quality thin film preparation and discuss the determination of the current-carrier concentration and sample stability. Our incipient work on the LPCVD obtained polysilicon thin films, annealed in various ways, show the high thermopower of a Si:B sample: +200 μ V/K at room temperature, which has a potential for applications.

Project title: *Defects and exchange interactions in low-dimensional ($D < 3$) magnetic systems*

Funded by: MSES

Principal investigator: Đuro Drobac

Within the project several low-dimensional $S = 1/2$ systems were studied: quasi-one-dimensional CuSe_2O_5 , spin tetramer system CuSeO_3 and spin dimer systems $\text{Cu-L1}(2)(\mu\text{-X})_2$ ($X = \text{Cl, Br}$) where L1 and L2 are organic ligands:

L1 = N-(L-leucine methyl ester)-N'-((2-pyridin-2-yl)methyl)oxalamid and

L2 = N-benzyl-N'-((2-pyridin-2-yl)methyl)oxalamid.

In all studied systems magnetism comes from Cu^{2+} unpaired electron with $S = 1/2$.

Ground state of CuSe_2O_5 was probed by several experimental methods: antiferromagnetic resonance (AFMR), muon spin relaxation (μSR), neutron scattering, magnetic susceptibility and torque magnetometry. All these experiments were performed in previous years. At the beginning of 2013 the analysis of all experiments was finished. A phenomenological model based on the Hamiltonian we proposed in the previous work (Herak et al. PRB 84, 184436, 2011) was developed which allowed a good description of all measurements. We determined the ground state of CuSe_2O_5 [1]: it is antiferromagnetically ordered due to finite interchain interaction with possible small canting between the spins on chain due to Dzyaloshinskii-Moriya interaction. The spin flop observed in magnetization and torque measurements at 1.2 T and also in AFMR was a consequence of the closing of the gap connected to the anisotropies present in the Hamiltonian of this system.

In collaboration with Boris Rakvin and Dijana Žilić from Ruđer Bošković Institute (RBI) and Krešimir Salamon and Ognjen Milat from IF we continued to study magnetism of a novel spin tetramer system CuSeO_3 . In our previous work we determined that temperature dependence of magnetic susceptibility cannot be described by the spin tetramer model in the entire paramagnetic temperature range and that magnetic axes in this system rotate with temperature. In order to determine if this is entirely the contribution of the temperature change of g tensor we performed detailed macroscopic magnetic anisotropy measurements and electron paramagnetic resonance (EPR) spectroscopy measurements on the same sample. This work was the theme of diploma theses of Antonija Grubišić Čabo. We established that $\langle g \rangle$ is temperature-independent and that rotation of g tensor with temperature correlates with the rotation of macroscopic magnetic axes only at temperatures $T > 50$ K. We also determined the structure of antiferromagnetically ordered state and the orientation of easy axis. The manuscript containing the analysis of these results is being prepared and the results were presented on poster at 8th scientific meeting of the Croatian Physical Society (CPS) in Primošten and Thermoelectrics 2013 workshop in Split.

In collaboration with Dijana Žilić and Zoran Džolić from RBI we continued the study of novel organic magnets synthesized at RBI: $\text{Cu-L1}(2)(\mu\text{-X})_2$ ($X = \text{Cl, Br}$) where L1 and L2 are organic ligands (see above). These systems constitute perfect magnetic dimers where two copper $S = 1/2$ are bridged by halogen element $X = \text{Cl}$ or Br and the ligand separate the dimers making the interdimer interaction negligible. We set out to determine the value and sign of interaction (AFM or FM) depending on halogen element and ligand present in the system by employing magnetic susceptibility measurements, torque magnetometry and ESR. The results were presented at the 8th

scientific meeting of CPS, and a more detailed study correlating macroscopic magnetic anisotropy (torque) and microscopic anisotropy (EPR) is planned in the future.

Project title: *Development of digital procedures in holography and interferometry*

Funded by: MSES

Principal investigator: Nazif Demoli

Research activities within this project have been focused on experimental optimization as well as the application procedures used in digital holography and interferometry. We published a paper on the use of an optical fiber bundle in digital image plane holography and holographic interferometry of distant objects. We also published a paper on the recognition of different types of Glagolitic script using two approaches, namely, the optical correlators and Fourier-Jacobi image moment analysis. In collaboration with J. Brozović, digital holographic interferometry has been applied to determine the properties of axially loaded implant-abutment assemblies differing in diameter and brand. Statistical analysis showed the significant effect of implant diameters on deformation values. We continued the development of digital-optical holographic microscope (collaboration with O. Milat) by using holographic interferometry to measure the topography of tungsten film delamination from the substrate.



Laboratory for coherent optics

Dr. Nazif Demoli

Izvor: <http://liderpress.hr/tehnopolis/121890/>

Project title: *Femtosecond laser physics of atoms and molecules*

Funded by: MSES

Principal investigator: Goran Pichler

The research activities have been carried out in two directions, both based on the interaction of the femtosecond (fs) pulses with atoms and molecules.

The first direction was focused on the investigation of the cold rubidium atoms captured in magneto-optical trap (MOT). Using laser cooling and trapping techniques we have obtained a cloud of 2 mm diameter that contains about 8×10^8 ^{87}Rb atoms at temperatures around 150 μK . We have investigated the mechanical force on cold rubidium atoms induced by femtosecond (fs) and continuous-wave (CW) excitation. The force comes as a result of the momentum transfer (from photons to atoms) in the process of excitation followed by spontaneous/stimulated emission.

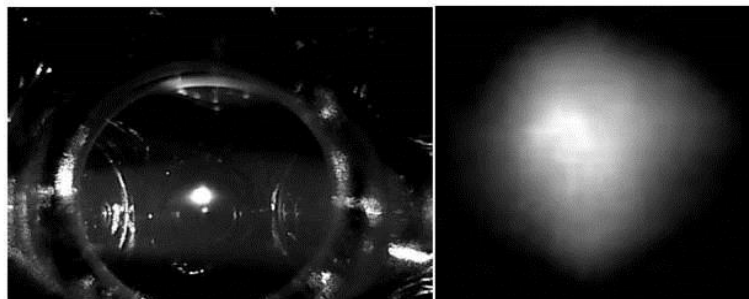
The second direction in the project activities was focused on building an experimental setup for Pump/Probe measurements in condensed matter with femtosecond time resolution in the temperature interval between room temperature and liquid helium temperature. Several major improvements were made. For continuous low-temperature operation, a CCR optical cryostat was put in function. We purchased an AOM which modulates the beam at Lock-in amplifier maximum frequency (100 kHz). Also, a home-made prism pulse compressor was made. All this resulted in sensitivity in reflection measurements of 10^{-6} with time resolution of about 100 fs in temperature range from 6 K to 300 K as established in test measurements on several benchmark samples (GaAs monocrystals, and quasi-1D CDW system - $\text{K}_0.3\text{MoO}_3$). Research will be carried out various quantum materials.

In the scope of the project, research about wave-packet motion in high-lying states of sodium atom excited by three-photon FWM was finished. The origin of oscillatory motion and the lack of signal at positive delays were explained in the paper which was published in *Optics Letters* (Skenderović, Vdović).

A talk at Seminar of OKB Department of IRB was held (Skenderović), as well as talk at HFD Meeting in Primošten (Vdović), and poster on the same Meeting (Skenderović) was presented. An invited talk at Fotonika Workshop on Kopaonik was given (Skenderović).



Laboratory for femtosecond laser spectroscopy



Cold rubidium cloud

Project title: *Laser spectroscopy of cold plasmas for treatment of materials*

Funded by: MSES

Principal investigator: Slobodan Milošević

We studied several types of plasmas and their combinations: plasmas produced by lasers and/or discharge plasmas using electrodeless RF-IC discharge or single-electrode discharge at atmospheric pressures. We focus our research towards in situ diagnostics of various radicals formed in plasmas. Simultaneous uses of complementary laser techniques such as CRDS, LIBS, LA TOF MS or OES provide advances in plasma characterization. Development and optimization of a new plasma sources for various applications in biomedicine, new food preparation technologies or for advanced materials preparation is continuing.

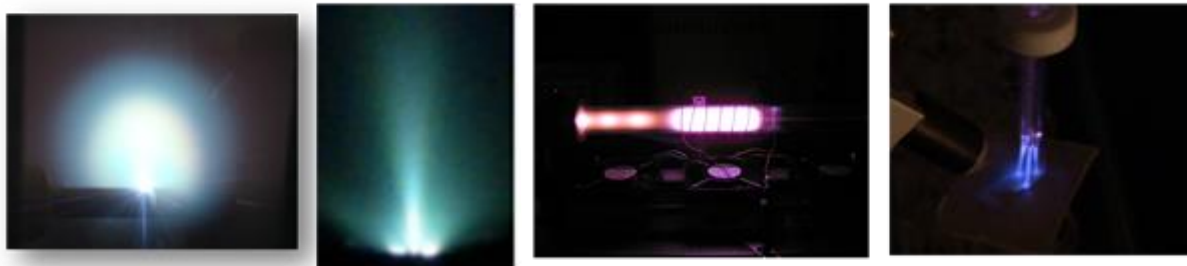
We employed cavity ringdown spectroscopy (CRDS) technique to measure the densities of atoms within stagnation layer of colliding laser produced plasmas. The possibilities of LIBS method have been studied for detection of elemental composition of numizmatologically relevant coins (collaboration with Mandi Orlić PhD). Texture of GaAs nanoparticles deposited by Pulsed Laser Ablation in different atmospheres have been studied.

Regarding low pressure inductively coupled plasmas interaction new plasma source have been calibrated with actinometry and catalytic probes for oxygen and hydrogen plasmas. In collaboration with IJS Ljubljana (group of Miran Mozetič and Uroš Cvelbar) experiments were performed on nanoparticle production by pulsed laser deposition within the low temperature plasmas. By using ns excimer pulsed laser at 308 nm photoluminescence of various powders has been studied in collaboration with IRB group of Biserka Gržeta.

As a part of Vedran Šantak doctoral thesis (co-supervisors S. Milošević and prof. Z. Tarle) a home-built atmospheric plasma source was used for treatment of hard dental tissue, namely a possibility of using He and Ar plasma jets for tooth whitening has been tested giving promising results.

Movable atmospheric plasma jet source was constructed and delivered to the Faculty of Food Technology and Biotechnology (group of prof. Zoran Herceg) where it was used in applications for new food preparation technologies.

In total we have published 2 papers, 1 cited in WoS database and seven conference abstracts. Two PhD thesis have been completed (Z. Kregar, M. Biščan – supervisor S. Milosevic) and one diploma work (D. Kos – supervisor N. Krstulović).



Project title: *Heat and charge transport in strongly frustrated magnets and similar materials*

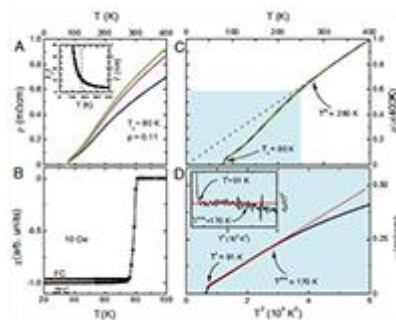
Funded by: MSES

Principal investigator: Ana Smontara

Activities were continued and expanded to several new systems.

Intermetallic Compounds PdIn and PdGa: transport properties of single crystal PdIn have been investigated in correlation with previously studied PdGa-promising compound for selective catalysis. The temperature dependent behavior of electrical resistivity, Hall coefficient and thermoelectric power clearly demonstrates strong metallic-like properties of PdIn and rather complicated temperature dependent interplay of electron-phonon interactions compared to the case of PdGa.

High-quality crystals of Hg1201 - the most desirable cuprate superconductor for experimental study due to its high-symmetry crystal structure. Besides the linear resistive regime at higher temperatures, we demonstrate that the Hg1201 shows a Fermi-liquid-like quadratic temperature regime at lower temperature and further



more, that the doping dependence of the sheet resistance in both the linear and the quadratic T-regimes is remarkably simple, which leads to propose the counter-intuitive scenario that even outside of the pseudogap regime only the near-nodal states contribute to the planar transport (N. Barišić, et.al. PNAS **110**, (2013)12235).

Quantum critical behavior in transport properties of i-AuAlYb: We have studied magnetic field influence on thermoelectric properties of *i*-Au-Al-Yb, intermediate valence compound with majority of Yb ions in trivalent high spin state ($J=7/2$) compared to divalent ($J=0$) Yb ions. It turned out that anomalous low-temperature behavior of electrical resistivity below 50 K tends to vanish in magnetic field. Thermopower is positive at high temperatures but at 12 K changes sign and near 4 K has a minimum. It seems that this minimum and the change of sign are connected to quantum criticality since it disappears in magnetic field. Therefore we propose some peculiar magnetic ordering of high spin Yb ions as ground state of *i*-Au-Al-Yb.

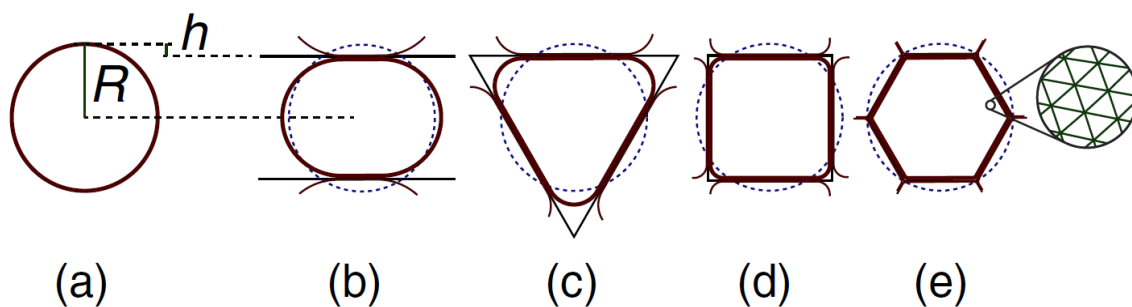
Electronic transport in high quality d-AlCoNi quasiperiodic crystals: Transport properties of *d*-Al₇₃Co_{13.5}Ni_{13.5} along the periodic direction show almost ordinary metallic behavior. Electrical resistivity along the quasiperiodic direction has a PTC/NTC crossover above the room temperature and thermopower is far from the linear like metallic behavior. In both directions at low temperatures, there is a shallow minimum in resistivity indicating the effect of weak localization. Transport properties of *d*-AlCoNi are not very sensitive to crystal composition suggesting that we have studied the true quasiperiodic properties.

Project title: Shapes and structures of nanoscale objects dictated by competition of energies

Funded by: MSES

Principal investigator: Antonio Šiber

We continued with the investigation of physical principles underlying the design and action of viruses. In particular, we applied elements of theory of elasticity of shells in order to detect possible universalities in the architecture and shape of virus capsids. Elasticity on nano- and micro-scale has also been investigated in the context of colloids and we have applied the theory in the regime of non-linear response and large deformations. The electrostatics in the mean-field regime has proven as a useful tool to describe the important features of the energetics and dynamics of viruses and colloids, yet its drawbacks are well known and limit its application in circumstances which are fairly well delineated. One of these corresponds to the neglect of size of screening ions which leads to overestimation of the counterion concentrations in the regions close to the large charge densities. We have modified the Poisson-Boltzmann equation to account for asymmetric sizes of (screening) cations and anions. Mag. phys. Sanjin Marion has made important progress in the explanation of DNA ejection from bacteriophages, modeling it in thermodynamical terms as interplay of free energies of DNA in the virus capsid and in the bacteria.



Project title: Theory of critical phenomena and systems out of equilibrium

Funded by: MSES

Principal investigator: Katarina Uzelac

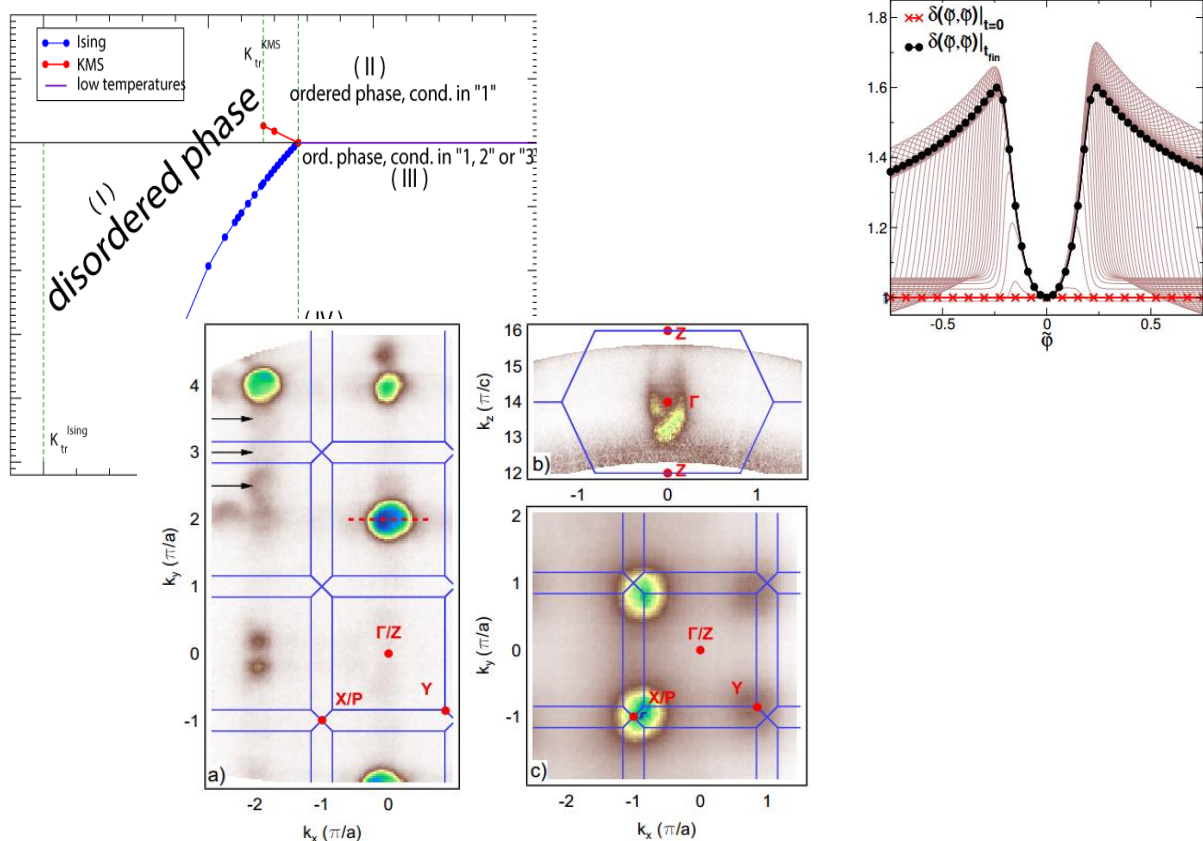
Research activities of Statistical physics group covered several topics.

Disorder and geometrical aspects of phase transitions. Peculiar static and dynamic phenomena near the criticality observed in classical systems and due to the presence of quenched disorder were studied using numerical simulations and different renormalisation procedures, in particular nonperturbative renormalisation group (in collaboration with LPTMC, Université Paris 6).

Yang-Lee zeros. Complete description of critical properties in different critical regimes of the complex phase diagram of the infinite range Potts model was presented in terms of partition function zeroes. Studies of zeros in the complex plane of the relevant parameter were extended to a non equilibrium phase transition within the simple model having also an equilibrium limit.

Nonequilibrium phenomena. Several simple models of phase transitions occurring far from equilibrium were studied by adding to the previously used ones some new techniques such as graphs, the formalism of large deviation functional and the study in the complex plane.

Quantum strongly correlated systems. Investigations have been conducted on three different subjects. In collaboration with the group of prof. Barišić at the PMF quasiparticle properties, relevant for ARPES measurements of high-Tc cuprates, has been calculated within the Emery model. Polaronic effects in anatase TiO₂ have been investigated in collaboration with the experimental group of prof. Forró. In collaboration with the group of prof. Prelovšek at the IJS the role of impurities has been analyzed for spin chains.



Project title: *Spectroscopy of Rydberg atoms and molecules*

Funded by: MSES

Principal investigator: Āedomil Vadla

New method, namely time resolved spectroscopy, has been implemented for the investigation of the helium capillary dielectric barrier discharge (DBD) with the aim of its optimization for soft ionization of organic molecules.

The acquisition of fast operational amplifier (signal rise time: ~ 20 ns) for the measurement of the photomultiplier current signals, and 70-MHz Agilent storage oscilloscope (signal rise time: ~ 14 ns) for recording the amplifier output signals, enabled monitoring of emission signals, i.e. the corresponding excitation and de-excitation processes in DBD on nanosecond scale.

For a series of the positions along the DBD axis, time resolved measurements of the emission intensities of the helium 587 nm and 706 nm lines, as well as the intensities of the N_2^+ molecular band at 391 nm were performed. The obtained results enabled determination of the correlation between excited helium atoms and ionized nitrogen molecules. The understanding of the plasma jet formation, accepted so far, is based on the interpretation that the discharge in the capillary constitutes the source of the helium atoms excited in metastable states, which carried by the helium flow, penetrate the ambient atmosphere where in the collisions with nitrogen molecules the cascade of excitation transfer processes is initiated leading eventually to the formation of protonated water needed for the soft ionization of organic molecules. In this concept, the formation of the plasma jet necessarily follows after the ignition of the discharge in the capillary.

The present results showed that the occurrence of the excited He atoms in the plasma jet precedes their generation in the capillary, i.e. in the region between the electrodes. Because the excited He atoms are created by electron impact, their existence indicates the presence of electrons, i.e. of the current in the plasma jet. In other words, before the discharge in the capillary ignites, the discharge between anode and "ambient mass" occurs, forming the jet which constitutes a discharge independent of that in the capillary which follows after a few microseconds. The described process is observed at rising as well at falling edge of the applied rectangular high voltage, with the time effects of the advance ignition in the jet being much more pronounced at the voltage rising edge.

The described spatiotemporal investigations were performed depending on the value and the shape (rectangular, sinusoidal) of the voltage applied on DBD, as well as on helium flow and purity. Evaluation of the results and drawing the conclusions are currently in progress.

Project: *Popularization of science, Physics (FIZIKA)*

Project type: MZOS, popularization of science

Project name: PHYSICS (FIZIKA)

Venue: Zagreb and other cities

Dates: 16/01/2012 - 03/06/2013.

The amount of financial support: Ministry of Science - 25,000.00 kn

Leader: Berti Erjavec

Physics is a comprehensive program of the Institute of Physics with the aim of popularizing physics especially among the young, gives support to lifelong professional development of teachers. We have developed specialized programs for students, especially those motivated and talented, and finally special program developing of educational content for connecting science and education. This program is in different intensities and in different timeframes already had taking place at the Institute of Physics and consists of several sub-programs:

A Star is born (working with motivated and gifted students)

Through the pilot project, which started last year (2011/2012) in collaboration with XV gymnasium scientists of the Institute of Physics have conducted special activities for exceptionally gifted students.

This school year (2012/2013) the following activities are implemented:

- a) Digital holography (leader Dr. Nazif Demoli)
- b) Nanocharacterisation of graphene (leader Dr. Marko Kralj)
- c) Magnetic interactions (leaders Dr. Ivica Aviani and Berti Erjavec, prof.)

Development of educational kits

Scientists in collaboration with professors and students of physics developed experimental educational kits in the field of scientific interest of the Institute, which serves as a teaching aid in elementary and secondary schools.

- a) Demonstration kit for magnetism (Dr. I. Avian and Berti Erjavec, prof.)
- b) Demonstration kit for spectroscopy (Dr. Slobodan Milosevic)

Open Day 2013

Open Day is recognized as a main popularization event in the year and has generally very large media accompaniment (TV, radio, newspapers, portals). More about Open Days can be found on <http://otvorenidani.ifs.hr/> , and this year's open day is on <http://otvoreni2013.ifs.hr/>.

PROJECT: Popularization of science, Physics as a gift

Project type: MZOS, popularization of science

Project name: Physics as a gift (Fizika na dar)

Venue: Zagreb and other cities Dates: 04/06/2013. - 31/12/2013.

The amount of financial support: Ministry of Science - 20,380.00 KN

Leader: Berti Erjavec, prof.

Physics as a gift is a comprehensive program of the Institute of Physics with the aim of popularizing physics especially among the young, gives support to lifelong professional development of teachers. We have developed specialized programs for students, especially those motivated and talented, and finally special program developing of educational content for connecting science and education. This program is in different intensities and in different timeframes already had taking place at the Institute of Physics and consists of several sub-programs:

Physicist in a visit (lectures and workshops for students)

Students in areas distant from large cities haven't opportunity to be in touch with scientists. For them we organized lectures and workshops in the schools and public. Our scientists have held visits:

- dr. Ivica Aviani: "The amazing water", lecture with experiments, Kistanje, 8. June 2013.
- dr. Đuro Drobac: " AC susceptometer", lecture, Mali Lošinj, 18. June 2013.
- dr. Zlatko Kregar: "Vacuum around us", workshop with lecture, Višnjan , 15. July 2013.

Physics in a classroom (lectures and workshops for teachers)

The best way to introduce teachers with new ideas in science is to make lectures and workshops for them. Our scientists have held workshops and lectures in domain of our scientific expertise. At the end of August it was held a sequence of eight workshops for more than 150 teachers from Zagreb and a Zagreb County.

- dr. Zlatko Kregar, dr. Marijan Biščan, Berti Erjavec: "Vacuum around us", four workshops with lectures, Zagreb, 29.-30. August 2013.
- dr. Ivica Aviani: "Magnetism", four workshops with lectures, Zagreb, 29.-30. August 2013.

A star is born (working with gifted and motivated students)

Through the pilot project, which started in year (2011/2012) in collaboration with XV gymnasium Zagreb and I gymnasium Zagreb scientists of the Institute of Physics have conducted special activities for exceptionally gifted and motivated students. This school year (2013/2014) the following activities are implemented:

- a) Digital holography (leader: Dr. Nazif Demoli)
- b) Polymer Physics (leader: Danijel Grgičin)
- c) Magnetism of Matter (leader Dr. Željko Marohnić)

Development of educational kits

Scientists in collaboration with professors and students of physics developed experimental educational kits in the field of scientific interest of the Institute, which serves as a teaching aid in elementary and secondary schools.

- a) Demonstration vacuum kit (dr. Zlatko Kregar, dr. Marijan Biščan, Berti Erjavec, prof.)
- b) Demonstration kit for spectroscopy (dr. Slobodan Milosević, Berti Erjavec, prof.)

PROJECT: Popularization of science, Researcher's Night 2013

Project type: FP7-PEOPLE-2013-NIGHT, popularization of science

Project name: Night-of-the-Lab-Out

Venue: Zagreb, Rijeka and Split

Duration : 1/5/2013- 31/10/2013.

Main Event: 27/09/2013

The amount of financial support (total): 45,000.00 €

The amount of financial support (IF): 1,605.00 €, requesting from EU 5,166.32 €

Leader: Berti Erjavec, prof.

On Friday evening, September 27th, 2013, Researchers' Night project is organized in the three largest cities in Republic of Croatia: Zagreb, Split and Rijeka. The main theme of the Researchers' Night 2013 in Croatia was "Science and Technology in Service of Life and Health". Acronym of the project is NLO which stands for "Night-of-the-Lab-Out" and the project aims at bringing researchers closer to the public and proving they are not some strange people closed in their labs, but ordinary people sharing different interests like everyone else. The primary objective of the project NLO is to provide wider public with an opportunity to meet young, outstanding researchers who actively perform research in fundamental and multidisciplinary fields involving knowledge and technologies in service of life and health. Project is organized by nine partners in three largest cities in Croatia: Agency for Mobility and EU Programmes, Society znanost.org, University of Split, University of Rijeka, The Faculty of Medicine and The Faculty of Engineering at the University of Rijeka, University of Zagreb, Ruđer Bošković Institute and Institute of Physics in Zagreb. Different contents during the Night was adjusted to wider audience like various competitions, science act show, carnival parade, researchers on stilts, science cinema marathons, exhibitions, projections, stands and many other surprises.

Institute of Physics activities

Researchers have provided following activities during night in Zagreb:

- Research Station: Nanotrampoline (Marko Kralj, Iva Šrut Rakić, Ida Delač Marion)
- Research Station: Physics of soft matter (Tomislav Vuletić, Danijel Grgičin)
- Research Station: Plasma Medicine (Zlatko Kregar, Marijan Biščan, Domagoj Kos)
- Research Station: Lasers in health (Ticijana Ban, Damir Aumiler, Silvije Vdović, Mario Rakić)
- Research Station: Nitro Ice (Matija Čulo, Goran Gatalica)

Public lecture: Physics of Ice Cream (Petar Pervan)

Public lecture: Hollywood Physics (Tomislav Vuletić)

Project title: *Complex Magnetic Systems*

Funded by: CSF

Principal investigator: Ivica Živković

Within the second year of the project we have used the newly installed equipment to investigate various magnetic materials. One of them was a material showing a skyrmion lattice, a long range ordered pattern of spins containing individual skyrmions which consist of whirls of spins. We have discovered that in Cu_2OSeO_3 , the skyrmion material, some general scaling rules are obeyed which are universal across all physical systems. A detailed investigation of the dissipation mechanisms around the skyrmion phase suggests that even above the ordered phase there are possible liquid-skyrmion states. Second line of investigations dealt with geometrically frustrated system $\text{Ca}_3\text{Co}_2\text{O}_6$ that in a zero magnetic field shows a peculiar and very rare coexistence of a long range and a short range order in an otherwise homogeneous material. We have focused on a metamagnetic transition between the ferrimagnetic and the ferromagnetic state around 3.6 T. Our initial investigation indicates that the transition is performed in two steps, again indicating a presence of a short range order within the matrix of ordered moments. This agrees well with the results from the neutron scattering experiments which look into the microscopic details of magnetism. Also, we have compared the magnetic behavior of two similar compounds, $\text{Co}_7(\text{TeO}_3)_4\text{Br}_6$ and LiNiPO_4 , in terms of their phase transitions. The first order phase transition, which occurs between the two ordered states, exhibits very different behavior in them, which can be linked to slight differences within the states.

Project title: *Evaluation of new bioactive materials and procedures in restorative dental medicine*

Funded by: CSF

Principal investigator: Prof. Zrinka Tarle (School of Dental Medicine, University of Zagreb)

Head of the research group: Nazif Demoli

Within the scope of this program, it is planned to investigate and find guidelines for the refinement of the properties of dental biomaterials (DBs) and of procedures in restorative dental medicine. The laser interferometer was applied for measuring the polymerization shrinkage of both high and low viscosity dental materials. By series of measurements, it has been proven that earlier developed special sample holder is a good solution for flowable DBs. In collaboration with O. Milat, the microhardness was measured by using dedicated microscopic device and Vickers test. The results has been partly published and presented at a scientific conference. We also started measuring other important parameters of DBs such as spectroscopic and temperature changes influenced by curing irradiance during photoactivation process.

Project title: *Teeth whitening device with real time monitoring of whitening process*

Funded by: BICRO

Principal investigator: Mario Rakić

Duration of the project was one year (November 2012 - October 2013). During the 2013 all key measurements were made with high quality results. We have shown that it is possible to monitor the process of teeth whitening in real time. By providing feedback it is even possible to affect the bleaching process by slowing / speeding up the process in a specific segment (part of the jaw). Based on these results, and conducted experiments we have started with writing patent applications. For the purposes of consultation and writing project a licensed patent attorney Dr. Željko Bihar was deployed. On 10.18.2013. an international patent application was registered: PCT/HR2013/000030 *Teeth whitening device with real time monitoring of whitening process*. The next step is to search for investors / commercialization.

Project title: *Transportna svojstva (metastabilnih) djelomicno kristalinicnih sistema*

Funded by: Federal Ministry of Education and Science, Bosnia and Herzegovina

Principal investigator: Dr. Suada Sulejmanović (Faculty of Science, University of Sarajevo)

Head of the research group: Katica Biljaković

2.2. Bilateral projects

Project title: *Theoretical modelling and simulations of the structural, electronic and dynamical properties of surfaces and nanostructures in materials science*

Partner country: Japan

Principal investigator: Branko Gumhalter

Owing to the reorganization of the Department of the Japanese coordinator only one visit from Japan to Zagreb took place in the year 2013. Ph.D. student Kuniyuki Miwa (Osaka University) visited the Institute of Physics in Zagreb in the period 13 June-12 July 2013. During his stay he investigated the interplay between the dynamics of surface plasmons and molecular exciton in STM-induced light emission (STM-LE). In order to make detailed comparison between theoretical predictions and experimental results, it was needed to describe the connection between the tunneling current of STM and photon-emission rate. A theoretical model of the energy-conversion processes in STM-LE has been established: the tunneling current excites surface plasmons which induce creation of molecular exciton, and then photons are emitted by radiative decay of plasmons and excitons. Based on the results of collaborative research, a paper including comparison between theoretical and experimental results of the STM-LE has been prepared and submitted for publication.

Four scientists from Croatia visited Japan in 2013 within the framework of the present Croatian/Japanese bilateral project. Ph.D. student Marin Petrović (Institute of Physics, Zagreb) payed a one month visit (August 2013) to the laboratory of Prof. Y. Matsumoto at Kyoto University. His main task was to demonstrate and introduce the technique of preparation of graphene overlayers to the members of Matsumoto laboratory, which was successfully accomplished. He also participated in the workshop "International Academic Workshop on Dynamics of Molecules on Surfaces" at the Osaka University with a talk entitled "Experimental and theoretical study on the intercalation of graphene on Ir(111)".

Dr. Predrag Lazić (Ruđer Bošković Institute, Zagreb) payed one month study visit to Kasai laboratory at the Osaka University in November 2013. During this period he presented three talks at the departmental workshop on the following topics: (i) Importance of non-local correlation effects in surface adsorption, (ii) Water splitting materials and electrochemical devices, (iii) Insight into thermoelectrics from first principles. In addition to this he had numerous discussions with the members of the Department on the topics of common interest.

Drs. Petar Pervan and Milorad Milun (Institute of Physics, Zagreb) visited the Tokyo University in the period 3-13 August 2013 where they were hosted by Prof. Katsuyuki Fukutani of the Institute for Industrial Physics at Komaba Campus. The main goal of the visit was to discuss experimental photoemission results of hydrogen interaction with AuPd alloy and Au films on Pd(110) obtained by dr. Soshei Ogura and Satoshi Ohno during their visit to Zagreb in 2011. They have also discussed plans for joint work on the problem of hydrogen interaction with graphene on Ir(111) surface. P. Pervan presented a seminar with the title „Stretched or doped: what can we learn from graphene on Ir(111)". Their next visit was to Prof. Fumio Komori of the Institute of Solid State Physics (ISSP), University Tokyo at Kashiwanoha Campus. There they discussed different topics of graphene electronic properties on SiC and Ir(111) with the accent

on graphene on stepped surfaces. There they have used the opportunity to learn more about research infrastructure of the ISSP and visited the laboratories of Prof. Yukio Hasegawa and Prof. Shojiro Takeyama. The stay in Japan was concluded by the tours of the laboratories of Dr. Hikota Akimoto at the Nano-Science Joint Laboratory and Dr. Hitoshi Ohmori at the Materials Fabrication Laboratory at RIKEN.

Project title: *Plasma assisted synthesis of nanoobjects*

Partner country: Slovenia

Principal investigator: Nikša Krstulović

In the second (and final) year of the project pulsed laser deposition of thin films assisted with radio-frequency inductively coupled low pressure oxygen plasma was studied. The deposited films were made of various metals or metallic oxides (Cu, Zn, ZnO, W). The deposited films with nanostructured surfaces (nanoparticles and nanorods) were characterized with various techniques like SEM, EDX, AFM and XPS. In order to monitor the processes of pulsed laser deposition emission spectra UV-VIS-NIR range were acquired using optical emission spectroscopy. It was found that film characteristics like thickness, surface roughness, amount of nanoparticles and its size-distribution strongly depend on deposition parameters like number of laser pulses, pressure of an oxygen background gas, distance between target and substrate. Size-distribution, surface dispersion and density of spherical nanoparticles or quantum dots were optimized by optimizing the deposition parameters. It was found that under certain conditions surface of deposited films is consistent of nanorod-shaped objects interesting for further oxygen plasma treatment in order to additionally grow metal-oxide nanowires.

Travels:

Visits of Slovenian colleagues from Josef Stefan Institute to Institute of Physics:

Gregor Filipič (one visit; 5 days)

Rok Zaplotnik (two visits; 2 days and 3 days)

Visits of Croatian colleagues from Institute of Physics to Josef Stefan Institute:

Ognjen Milat (one visit; 2 days)

Nikša Krstulović (5 visits; one day each)

Project title: *Transport and nonequilibrium effects in correlated nanostructures*

Partner country: USA

Principal investigator: Ivica Aviani

visits: Veljko Zlatić, Department of Physics, Georgetown University, Washington, DC, SAD

13.03.2013.- 15.05.2013.

26.12.2013.- 05.03.2014.

Project title: *Signatures of Dirac electrons in BEDT-TTF salts under pressure*

Partner country: Germany

Principal investigator: Silvia Tomić

We have characterized suitable samples of alpha-(BEDT-TTF)₂I₃ at ambient pressure, and for the first time determined their far-infrared properties at hydrostatic pressures up to 10 kbar. These experiments were followed by sample mounting preparations for optical measurements under uniaxial pressure. Additionally, we have characterized samples of kappa-(BEDT-TTF)₂Hg(SCN)₂Br as well as the charge-ordered kappa-(BEDT-TTF)₂Hg(SCN)₂Cl, and for the latter have taken preliminary vibrational spectra of powder under pressure. Part of the investigation on spin liquid system was conducted within this project.

visits: S. Tomić (Uni Stuttgart 3.6.-12.6.2013); M. Čulo (Uni Stuttgart 16.06.- 14.07.2013 and 17.11.-15.12.2013. training course in infrared spectroscopy, preliminary infrared measurements on kappa-(BEDT-TTF)₂Hg(SCN)₂Br and the study of pressure-induced suppression of charge ordering transition in kappa-(BEDT-TTF)₂Hg(SCN)₂Cl); T. Knoblauch (IF 6.5.-20.5.2013, dielectric investigations on kappa-(BEDT-TTF)₂Cu₂(CN)₃); T. Ivek (IF 6.5.-27.5.2013. and 9.10.-14.10.2014, dielectric investigations on kappa-(BEDT-TTF)₂Cu₂(CN)₃ and transport characterization of the kappa-(BEDT-TTF)₂Hg(SCN)₂Br).

Project title: *Quantum Criticality Between Metal and Charge Order*

Partner country: Germany

Principal investigator: Bojana Hamzić

The preparations of the project started with measurements of magnetotransport properties of organic conductors belonging to the (BEDT-TTF)₂X family with the aim to investigate charge ordering phase transitions at atmospheric pressure. The equipment planned within the project is ordered.



Dr Bojana Hamzić



Laboratory for magnetotransport measurements

Project title: *Absorptionsspektroskopische Charakterisierung der metastabilen Zustände im Jet einer weichen Ionisierungsquelle fuer organische Molekuele*

Partner country: Germany

Principal investigator: Čedomil Vadla

The experimental setup for the emission spectroscopy of the dielectric barrier discharges (DBD), equivalent to that existing in Zagreb, was established in the laboratory at ISAS in Dortmund. Spatially resolved measurements in the helium DBD were performed. Two papers on the investigations performed previously within the frame of the project were written and submitted for publication in WoS journals.

visits: Č. Vadla (ISAS Dortmund 1.6.-30.6.2013., 1.10.-31.10.2013.); V. Horvatić (ISAS Dortmund 1.6.-30.6.2013, 1.10.-31.10.2013.); D. Veža (ISAS Dortmund 1.9.-14.9.2013., 1.10.-31.10.2013.); J. Franzke (IF Zagreb 20.5.-26.5.2013.).

Project title: Electrons in two dimensions: Graphene and topological insulators

Partner country: Germany

Principal investigator: Marko Kralj

This bilateral projects complements the experimental expertise of two partners by the application of angle-resolved photoelectron spectroscopy in Zagreb and low-temperature scanning tunneling microscopy and spectroscopy at the University of Cologne. The main benefit of this collaboration besides complementing the mentioned techniques is the education of young PhD students on both sides.

Research in 2013 was focused to graphene-based hybrids and nanostructures which resulted in several published high-impact papers in Nature Communications, Nano Letters and Physical Review Letters.

Visits of German collaborators to Zagreb: Carsten Busse (07.-13.10.2013.). Visits of Croatian collaborators to Cologne: Iva Šrut Rakić (01.08.-08.09.2013.), Davor Čapeta (08.-14.09.2013.), Borna Pelić (22.-28.09.2013.) and Marko Kralj (19.-25.05. & 29.08.-01.09.2013.).

2.3. Research networks

Network title: European Integrated Centre for the Development of Metallic Alloys and Compounds (C-MAC)

Legal representative: Ana Smontara

The European Integrated Center for the Development of New Metallic Alloys and Compounds - C-MAC has been created in 2009 as a long lasting structure. Twenty one universities or national research institutes - covering twenty five high level laboratories - and one SME, located in thirteen different European countries, are currently members of C-MAC. The different partners work as if they belong to a single European institute, taking advantages of all the synergies and complementarities of skills within the network, and really shift their way of carrying out research from competition to collaboration.

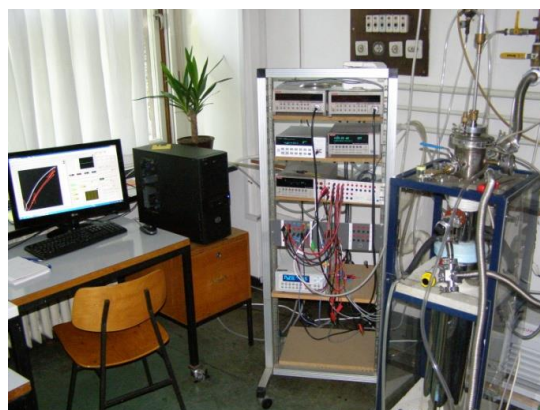
C-MAC partners have access to world-level facilities for material science dedicated to materials preparation, single crystal growth, structural characterization by HRTEM, X-ray diffraction, NMR, synchrotron and neutron diffraction at European centers, surface studies, high- and low-temperature measurements of physical properties (mechanical, magnetic, thermoelectric). The main benefit of these networks beside access to above mentioned facilities is the education of PhD students and young researchers.

Research in 2013 within network was focused on intermetallic compounds M_mPd_n of palladium with $M = Ga$ or In , clathrate $Ba_8Au_xGe_{46-x-y}□_y$ and $i-AuAlYb$ quasicrystals which resulted in two published papers: *MRS Proceedings* **1517** (2013) and *Journal of alloys and compounds* (2013) on line. Also, the results were presented by P. Popčević, Marija Sorić and Ana Smontara at international conferences (*ICQ12*, Krakow, Poland and *New thermoelectrics materials*, Split, Croatia) and international workshops (*C-MAC days 2013*, Ljubljana Slovenia and *C-MAC meeting on complex intermetallic compounds with potential for thermoelectric applications*, Wien, Austria).

Laboratory for the physics of transport phenomena



Thermal and magnetic measurements



High pressure thermoelectric measurements

2.4. Cooperation with industry

1. Contract-regulated cooperation with industry: Pliva d.o.o.;
2. Sistemprojekt/Cryobind;

3. Scientific publications

3.1. Publications with address of Institute of Physics cited in WoS database for 2013

1. K. Afrousheh, Y. Makdisi, J. Kokaj, M. Marafi, J. Marhew, and G. Pichler, [Collision induced modification of spectral line in the first autoionization region of barium](#),
Eur. Phys. J. D **67** (12), 262 (5pp) (2013).
2. H. S. Alagoz, I. Živković, S. T. Muhmud, M. M. Saber, G. Perrin, J. Shandro, M. Khan, Y. Zhang, M. Egilmez, J. Jung, and K. H. Chow, [Competing A-site and B-site doping effects on magneto-transport of RE_{0.55}Sr_{0.45}Mn_{1-x}Ru_xO₃ manganites in the vicinity of the SGI and FMM border](#),
Phys. Status Solidi B **250**, 2158-2162 (2013).
3. N. Barišić, S. Badoux, Mun K. Chan, C. Dorow, W. Tabis, B. Vignolle, G. Yu, J. Béard, X. Zhao, C. Proust, and M. Greven, [Universal quantum oscillations in the underdoped cuprate superconductors](#),
Nature Physics **9**, 761-764 (2013).
4. N. Barišić, M. K. Chan, Y. Li, G. Yu, X. Zhao, M. Dressel, A. Smontara, and M. Greven, [Universal sheet resistance and revised phase diagram of the cuprate high-temperature superconductors](#),
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5. I. Biljan, T. Medančić, M. Kralj, T. Mišić Radić, V. Svetličić, and H. Vančik, [Nitrosoarene dimerization on two- and three-dimensional gold surfaces](#),
Croat. Chem. Acta **86**, 83-94 (2013).
6. M. Bišćan and S. Milošević, [Production of metastable ²³Si helium in a laser produced plasma at low pressures](#),
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7. T. Bituh, Z. Vučić, G. Marović, and I. Prilić, [A new approach to determine the phosphogypsum spread from the deposition site into the environment](#),
J. Hazard. Mater. **261**, 584-592 (2013).

8. A. L. Božič, A. Šiber, and R. Podgornik,
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9. M. Buljan, M. Jerčinović, Z. Siketić, I. Bogdanović-Radović, I. D. Marion, M. Kralj, M. Ivanda, A. Turković, G. Dražić, S. Bernstorff, and N. Radić,
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J. Appl. Cryst. **46**, 1490-1500 (2013).
10. M. Buljan, N. Radić, I. Bogdanović-Radović, Z. Siketić, K. Salamon, M. Jerčinović, M. Ivanda, G. Dražić, and S. Bernstorff,
[Influence of annealing conditions on structural and photoluminescent properties of Ge quantum dot lattices in a continuous Ge + Al₂O₃ film](#),
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11. T. Car, J. Ivkov, M. Jerčinović, and N. Radić,
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Vacuum **98**, 75-80 (2013).
12. F. Craes, S. Runte, J. Klinkhammer, M. Kralj, T. Michely, and C. Busse,
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13. N. Demoli,
[Use of optical fiber bundle in digital image plane holography](#),
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14. N. Demoli, I. Marčela, and K. Šariri,
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15. Đ. Drobac, Ž. Marohnić, I. Živković, and M. Prester,
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17. Z. Glumac and K. Uzelac,
[Yang-Lee zeros and the critical behavior of the infinite-range two- and three-state Potts models](#),
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18. D. Grgičin, S. Dolanski Babić, T. Ivek, and S. Tomić,
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20. A. Horvatić, I. Dodig, T. Vuletić, D. Pavoković, Z. Hameršak, A. Butorac, and M. Cindrić,
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21. E. Klaric, M. Rakić, I. Sever, and Z. Tarle,
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22. Y. Makdisi, J. Kokaj, K. Afrousheh, R. Nair, J. Mathew, and G. Pichler,
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23. Y. Makdisi, J. Kokaj, K. Afrousheh, J. Mathew, R. Nair, and G. Pichler,
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29. M. Petrović, I. Šrut Rakić, S. Runte, C. Busse, J. T. Sadowski, P. Lazić, I. Pletikosić, Z.-H. Pan, M. Milun, P. Pervan, N. Afodiresei, R. Brako, D. Šokčević, T. Valla, T. Michely, and M. Kralj,
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34. H. Schaefer, M. Koerber, A. Tomelj, K. Biljaković, H. Berger, and J. Demsar,
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35. S. Schumacher, T. O. Wehling, P. Lazić, S. Runte, D. F. Förster, C. Busse, M. Petrović, M. Kralj, S. Blügel, N. Atodiresei, V. Caciuc, and T. Michely,
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36. H. Skenderović and S. Vdović,
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37. J. Szavits Nossan,
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38. A. Šiber and P. Ziherl,
[Many-body contact repulsion of deformable disks](#),
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39. I. Šrut, V. M. Trontl, P. Pervan, and M. Kralj,
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Carbon **56**, 193-200 (2013).
40. G. Tarjus, I. Balog, and M. Tissier,
[Critical scaling in random-field systems: 2 or 3 independent exponents?](#),
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41. S. Tomić, M. Pinterić, T. Ivek, K. Sedlmeier, R. Beyer, D. Wu, J. A. Schlueter, D. Schweitzer, and M. Dressel,
[Magnetic ordering and charge dynamics in \$\kappa\$ -\(BEDT-TTF\)₂Cu\[N\(CN\)₂\]Cl](#),
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42. S. Vdović, Y. Wang, B. Li, M. Qiu, X. Wang, Q. Guo, and A. Xia,
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43. E. ViolBarbosa, J. Fuji, V. Mikšić Trontl, G. Panaccione, and G. Rossi,
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44. N. Vujičić, T. Ban, G. Kregar, D. Aumiler, and G. Pichler,
[Velocity-selective double resonance in Doppler-broadened rubidium vapor](#),
Phys. Rev. A **87**, 013438 (7pp) (2013).
45. Y. Wang, S. Long, S. Vdović, and X. Wang,
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[Intramolecular charge transfer and solvation dynamics of thiolate-protected Au₂₀\(SR\)₁₆ clusters studied by ultrafast measurement](#),
Phys. Chem. A **117**, 10294-10303 (2013).

3.2 WoS Publications of Institute employees without Institute address

1. N. Krstulović, S. Shannon, R. Stefanuik, and C. Fanara,
[Underwater-laser drilling of aluminum](#),
Int. J. Adv. Manuf. Technol. **69** (5-8), 1765-1773 (2013).
2. S. Zapf, H. S. Jeevan, T. Ivek, F. Pfister, F. Klingert, S. Jiang, D. Wu, P. Gegenwart, R. K. Kremer, and M. Dressel,
[EuFe₂\(As_{1-x}P_x\)₂: reentrant spin glass and superconductivity](#),
Phys. Rev. Lett. **110**, 237002 (5pp) (2013).

3.3 Publications with address of Institute of Physics cited in Scopus database only for 2013

1. N. Erceg, I. Aviani, and V. Mešić,
[Probing students' critical thinking processes by presenting ill-defined physics problems](#),
Rev. Mex. Fis. E **59**, 65-76 (2013).
2. M. Očko, S. Žonja, and M. Ivanda,
[Some physical problems in the preparation and analysis of the heavily boron and phosphorous doped polysilicon thin films](#),
in *MIPRO 2013 - 36th International Convention on Information and Communication Technology, Electronics and Microelectronics, Proceedings*, (2013), pp. 28-33.
3. V. Zlatić and J. K. Freericks,
[Thermal transport of a delta-doped multilayer with strongly correlated electrons](#),
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3.4 Publications in Conference proceedings with address of Institute of Physics not cited in Scopus or WoS databases for 2013

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[Optical Approach in characterizing dental biomaterials](#),
in *Proc. SPIE Vol. 8792, Optical Methods for Inspection, Characterization, and Imaging of Biomaterials*, 87920G-1 (12pp) (2013).
2. O. Milat, K. Salamon, M. Stubičar, and D. Kunstelj,
[Između nereda i reda; rendgenska i elektronska kristalografija na Institutu za fiziku u Zagrebu](#),
u *Kristalografija u Hrvatskoj, Zbornik radova sa znanstvenog skupa*,
urednik zbornika S. Popović (HAZU, Zagreb, 2013), pp. 339-350.
3. P. Popčević, A. Bilušić, K. Velebit, and A. Smontara,
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in *Mater. Res. Soc. Symp. Proc.* 1517, (7pp) (2013).
4. S. Tomić, D. Grgičin, T. Vuletić, S. Dolanski Babić, T. Ivek, and R. Podgornik,
[DNA in aqueous solutions with repulsive interactions: structure determined on the basis of dielectric spectroscopy measurements](#),

in *Bioinformatics and biological physics: proceedings of the scientific meeting*, editor V. Paar (HAZU, Zagreb, 2013), pp. 159-176.

5. Z. Vučić, J. Gladić, and D. Lovrić,
[Rast kristala superionskih vodiča](#),
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urednik zbornika S. Popović (HAZU, Zagreb, 2013), pp. 351-367.

3.5 Other Publications with address of Institute of Physics

1. P. Dubček, B. Pivac, S. Milošević, N. Krstulović, Z. Kregar, and S. Bernstorff,
[Texture of GaAs nanoparticles deposited by pulsed laser ablation in different atmospheres](#),
ISRN Nanomaterials **2013**, Article ID 576506, (13pp) (2013).
2. N. Radić, S. Milošević, and B. Pivac,
[SPECIAL ISSUE 14th Joint Vacuum Conference/12th European Vacuum Conference/11th Annual Meeting of the Deutsche Vakuum Gesellschaft/ 19th Croatian-Slovenian Vacuum Meeting, 04-08 June 2012, Dubrovnik, Croatia Preface](#),
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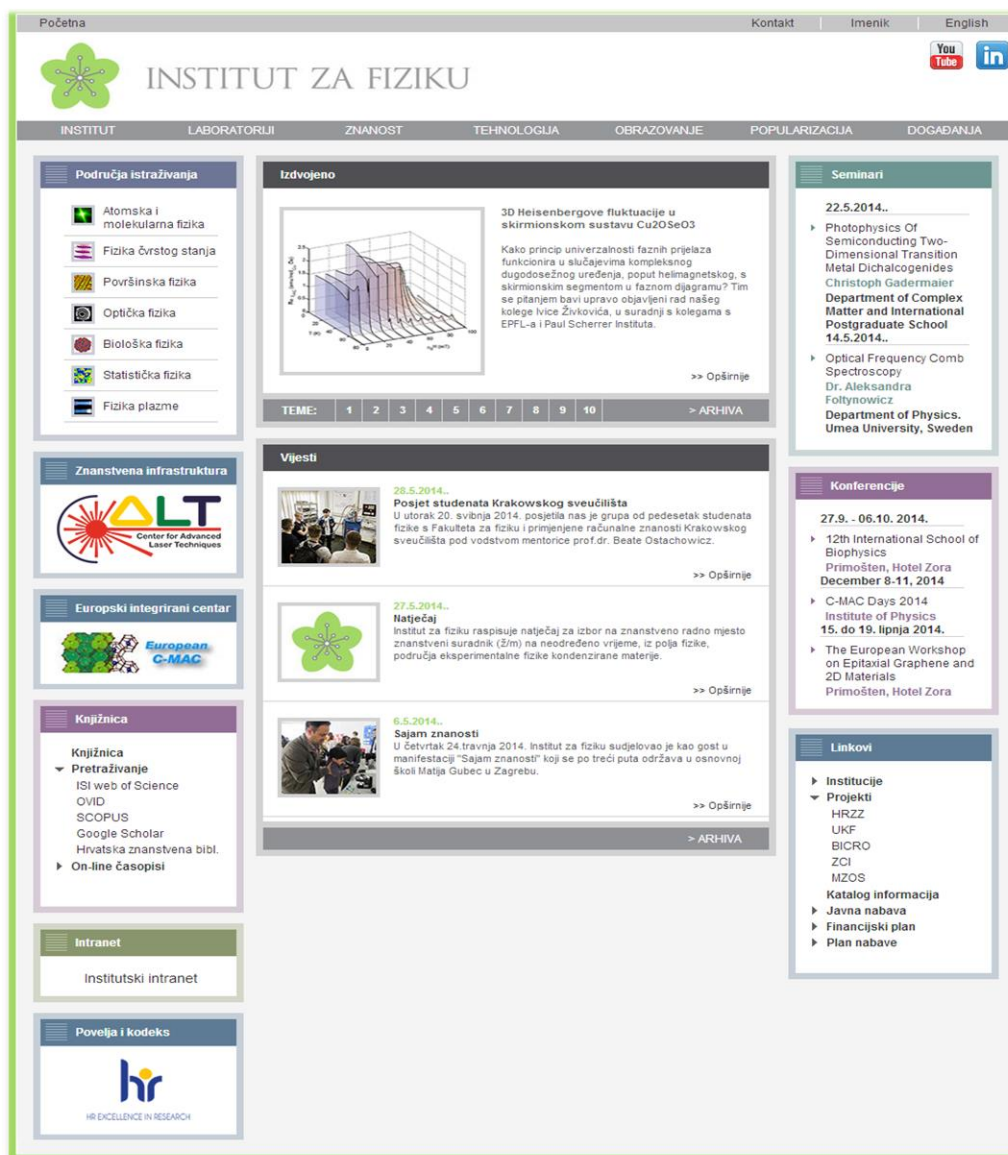
3.6 Editor's books with address of Institute of Physics

1. V. Zlatic and A. Hewson, editors,
[New Materials for Thermoelectric Applications : Theory and Experiment](#),
(Springer, Dordrecht, 2013).

3.7 Books chapters with address of Institute of Physics

1. T. A. Costi and V. Zlatić,
 Charge kondo effect in thermoelectric properties of lead telluride doped with thallium impurities,
 in *New materials for thermoelectric applications : Theory and experiment*,
 edited by V. Zlatić and A. Hewson (Springer, Dordrecht, 2013), pp. 67-80.
2. P. Pervan, M. Milun and R. Brako,
 Quantum well states in metallic films, wires and dots on metals surfaces,
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 edited by K. Wandelt (Wiley-VSH Verlag, Weinheim, 2013), pp. 493-544.

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The screenshot shows the homepage of the Institute of Physics website. The header includes navigation links for 'Početna', 'Kontakt', 'Imenik', and 'English'. The main navigation bar lists 'INSTITUT', 'LABORATORIJI', 'Znanost', 'TEHNOLOGIJA', 'OBRAZOVANJE', 'POPULARIZACIJA', and 'DOGADANJA'. The page is organized into several columns:

- Područja istraživanja:** Lists research areas such as Atomic and molecular physics, Surface physics, Optics, Biophysics, Statistical physics, and Plasma physics.
- Izdvojeno:** Features a 3D plot and text about '3D Heisenbergove fluktuacije u skirmonsom sustavu Cu2OSeO3'.
- Seminari:** Lists seminars, including one on 'Photophysics Of Semiconducting Two-Dimensional Transition Metal Dichalcogenides'.
- Znanstvena infrastruktura:** Promotes the 'ALT Center for Advanced Laser Techniques'.
- Europski integrirani centar:** Promotes the 'European C-MAC' center.
- Knjižnica:** Lists library services like ISI web of Science, OVID, SCOPUS, and Google Scholar.
- Vijesti:** Contains news items, such as 'Posjet studenata Krakowskog sveučilišta' and 'Sajam znanosti'.
- Konferencije:** Lists conferences, including the '12th International School of Biophysics' and 'C-MAC Days 2014'.
- Linkovi:** Provides links to institutions, projects, and catalogs.
- Intranet:** Links to the 'Institutski intranet'.
- Povelja i kodeks:** Promotes the 'HR EXCELLENCE IN RESEARCH' initiative.

4. Participation at conferences

4.1. Plenary lecture

1. Aviani, Ivica.
[Weight in the service of nature](#) // Zbornik XI. hrvatski simpozij o nastavi fizike: Nastava fizike i interdisciplinarnost, Primošten, Hrvatska, 26 - 28. 03. 2013. (plenary lecture, abstract).
2. Movre, Mladen
[100 godina Bohrovog modela – od kvantnih skokova do kvantnog pletera](#) // 11. hrvatski simpozij o nastavi fizike, Primošten 2013. (plenary lecture, abstract).
3. Šiber, Antonio.
[Are electrostatic and elastic properties of viruses tuned by evolution and how?](#) // II Reunion BioFiViNet / de Pablo, Pedro, editor(s). Madrid, 2013. 20-20
(plenary/keynote lecture, abstract, scientific).

4.2. Invited lecture

1. Gumhalter, Branko.
[Transient excitons as primary excitations in ultrafast MPPE spectroscopy of metal surfaces](#) // Ultrafast Surface Dynamics 8, Estes Park, Colorado, 27-31 May 2013 (invited talk).
2. Krstulović, Nikša.
[Underwater laser synthesis of nanoparticles](#) // Book of Abstract of 20th International Scientific Meeting on Vacuum Science and Technologies / Miran Mozetič, Alenka Vesel, editor(s). Ljubljana : Infokart d.o.o., 2013. 11-11 (invited talk, abstract, scientific).
3. Milošević, Slobodan.
[New challenges in application of plasma in air and liquids](#) // Knjiga sažetaka, Osmi znanstveni sastanak Hrvatskog fizikalnog društva / Požek, Miroslav, editor(s). Zagreb : Hrvatsko fizikalno društvo, 2013. 24-24 (invited talk, abstract, scientific).

4. Petrović, Marin.
[Understanding intercalation of epitaxial graphene](#) // 20th International scientific meeting on vacuum science and techniques, Jeruzalem, Slovenia, 2013. (invited lecture).
5. Skenderović, Hrvoje.
[Ultrafast transient absorption spectroscopy](#) // Radionica Fotonike, Kopaonik, Srbija, 4 - 8.3.2013. (invited talk, unpublished, scientific).
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[Some physics of viruses and the grand questions still unanswered](#) // Kolokvij Instituta Jožef Stefan, Ljubljana, Slovenija, 6. 3. 2013. (invited by prof. dr. Primož Zihelr).
7. Šoštar, Marko; Pletikapić, Galja; Aumiler, Damir; Vuletić, Tomislav.
[Diffusion of nanoparticles probes the mesh formed by the biopolyelectrolytes](#) // International Workshop on recent advances in Nanobiotechnology, Ispra, Italija, 03.-05.12.2013. (invited talk, unpublished, scientific).
8. Tomić, Silvia; Grgičin, Danijel; Vuletić, Tomislav; Dolanski Babić, Sanja; Ivek, Tomislav; Podgornik, Rudi.
[DNA in Aqueous Solutions with Repulsive Interactions : Structure Determined on the Basis of Dielectric Spectroscopy Measurements](#) // Bioinformatics and biological physics : proceedings of the scientific meeting / Paar, Vladimir, editor(s). Zagreb : Croatian Academy of Sciences and Arts, 2013. 159-177 (invited talk, published, expert).
9. Tomić, Silvia.
[15th anniversary of the European Physical Journal](#) // 8.znanstveni sastanak Hrvatskog fizikalnog društva / Požek, Miroslav, editor(s). Zagreb : Hrvatsko fizikalno društvo, 2013. 54-54 (invited talk, abstract, expert).
10. Tomić, Silvia; Pinterić, Marko; Čulo, Matija; Ivek, Tomislav; Korin-Hamzić, Bojana; Dressel, Martin.
[Electrodynamics in Two-Dimensional BEDT-TTF Solids](#) // 10th International Symposium on Crystalline Organic Metals, Superconductors and Magnets / Bourbonnais, Claude, editor(s). Sherbrooke : Universite de Sherbrooke, 2013. 49-49 (invited talk, abstract, scientific).

11. Živković, Ivica.

[Skirmioni – topološki uređeni magneti](#) //

8. Znanstveni sastanak Hrvatskog fizikalnog društva, Primošten, Hrvatska (invited lecture).

4.3. Lectures and seminars on conferences

1. Aviani, Ivica; Zlatić, Veljko.

[Novi termoelektrični materijali](#)

Međunarodna znanstvena radionica, Split, Medils, 2013. (lecture).

2. Barišić, N.; Chan, M. K.; Yu, G.; Li, Y.; Zhao, X.; Dressel, M.; Smontara, A.; Greven, M.

[Universal sheet resistance of the cuprate superconductors](#) // Bulletin of the American Physical Society, APS March Meeting 2013 Volume 58, Number 1.

(lecture, international peer-review, abstract, scientific).

3. Bišćan, Marijan; Milošević, Slobodan.

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19. Pervan, Petar.
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20. Petrović, Marin.
[Experimental and theoretical study on the intercalation of graphene on Ir\(111\)](#) // International Academic Workshop in Dynamics of Molecules on Surfaces, Osaka, Japan, 2013. (lecture).
21. Petrović, Marin.
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22. Pogrebna, Anna; Vujičić, Nataša; Xu, Z.A.; Cao, G; Mertelj, Tomaž.
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[Growth of graphene on a stepped iridium surface: morphology, domains and electronic fingerprints](#) // Verhandlungen der Deutschen Physikalischen Gesellschaft.
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Zagreb, 2013. 55-55 (lecture, abstract, scientific).
30. Velebit, Kristijan; Popčević, Petar; Smontara, Ana; Berger, Helmuth; Forro, Laszlo; Batistić, Ivo; Barišić, Neven; Dressel, Martin; Tutiš, Eduard.
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2013. (lecture, domestic peer-review, abstract, scientific).
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[Quantum effects on a macroscopic scale: rotation of magnetic axes due to a singlet formation in a monoclinic SeCuO₃.](#)
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4.4. Posters

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[Laser cooling of atoms using the optical frequency comb](#) // Knjiga sažetaka Osmog znanstvenog sastanka Hrvatskog fizikalnog društva / Požek, Miroslav, et. al. , editor(s).
 Zagreb : Hrvatsko fizikalno društvo, 2013. 123 (poster,abstract,scientific).
2. Beuc, Robert; Gatalica, Goran; Movre, Mladen.
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 Zagreb : Hrvatsko fizikalno društvo, 2013. 141-141 (poster,abstract).
3. Biščan, Marijan; Erjavec, Berti; Kregar, Zlatko; Milošević, Slobodan.
[Vacuum workshop for primary and secondary schools teachers](#) // Programme and Book of Abstracts, 20th International Scientific meeting on Vacuum science and techniques / Mozetič, Miran ; Vesel, Alenka , editor(s).
 Ljubljana : Slovenian Society for Vacuum Technique, 2013. 49-49 (poster,abstract,expert).
4. Biščan, Marijan; Kregar, Zlatko; Orlić, Maja; Jelovica Badovinac, Ivana; Orlić, Nada; Milošević, Slobodan.
[Effects of ambient gases on LIBS of metallic alloys](#) // Programme and Book of Abstracts, 20th International Scientific meeting on Vacuum science and techniques / Mozetič, Miran ; Vesel, Alenka , editor(s).
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5. Borzda, Tetiana; Vujičić, Nataša; Topolovšek, Peter; Mertelj, Tomaž; Gadermaier, Christoph; Mihailović, Dragan.
[Photoinduced charge transfer in a conjugated polymer/MoS₂ bulk heterojunction](#) // Book of Poster Abstracts: Flatlands Beyond Graphene 2013.
 Bremen, 2013. 15-15 (poster,abstract,scientific).
6. Car, Tihomir; Ivkov, Jovica; Radić, Nikola; Jerčinović, Marko.
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[Model of relaxation and crystallization kinetics of amorphous Al-\(Mo, W\) thin films under isochronal heating](#) // 19th International Vacuum Congress : Abstract book.
 Paris, 2013. 2252-2252 (poster,international peer-review,abstract,scientific).

8. Čulo, Matija; Basletić, Mario; Tafra, Emil; Hamzić, Amir; Korin-Hamzić, Bojana.
[Magnetotransport study of manganites \$\text{La}_{1-x}\text{Ca}_x\text{MnO}_3\$ \(\$x > 0.5\$ \)](#) // Knjiga sažetaka 8. znanstvenog sastanka Hrvatskog fizikalnog društva / Požek, Miroslav ; Ban, Ticijana ; Bilušić, Ante ; Dominis Prester, Predrag ; Gajović, Andrea ; Kumerički, Krešimir ; Kurečić, Ivana ; Pavin, Nenad ; Radolić, Vanja ; Szilner, Suzana ; Tutiš, Eduard , editor(s).
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10. Grubišić Čabo, Antonija; Herak, Mirta; Rakvin, Boris.
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13. Ivkov, Jovica; Radić, Nikola; Salamon, Krešo; Sorić, Marija.
[Al-Mo thin films prepared by magnetron sputtering](#) // C-MAC days 2013. (poster,international peer-review,abstract,scientific).
14. Ivkov, Jovica; Ristić, Ramir; Babić, Emil; Figueroa, Ignacio A.
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15. Juraić, Krunoslav; Gracin, Davor; Meljanac, Daniel; Drašner, Antun; Plaisier, Jasper Rikkert; Skenderović, Hrvoje.
[Strukturna i optička svojstva ZnO:Al tankih filmova pripremljenih magnetronskim rasprašenjem](#) // Knjiga sažetaka, 8. znanstveni sastanak Hrvatskog fizikalnog društva.
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16. Kadović, Andrea; Tutiš, Eduard.
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17. Kadović, Andrea; Tutiš, Eduard.
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[Colliding Laser Produced Plasmas](#) // Knjiga sažetaka 8. znanstvenog sastanka Hrvatskog fizikalnog društva / Miroslav Požek, Ticijana Ban, Ante Bilušić, Predrag Dominis Prester, Andreja Gajović, Krešimir Kumerički, Ivana Kurečić, Nenad Pavin, Vanja Radolić, Suzana Szilner, Eduard Tutiš , editor(s).
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20. Kregar, Zlatko; Biščan, Marijan; Zaplotnik, Rok; Milošević, Slobodan.
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[Comparison of spectroscopic and catalytic probe characterization of afterglow oxygen and hydrogen plasma](#) // 10th Frontiers in Low Temperature Plasma Diagnostics, Rolduc, Kerkrade, Nizozemska, 28.04.-02.05.2013. (poster).
22. Krstulović, Nikša.
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25. Milat, Ognjen; Salamon, Krešimir; Kovačević, Zorana; Dubček, Pavo; Jerčinović, Marko; Radić, Nikola.
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26. Milat, Ognjen; Demoli, Nazif; Radić, Nikola.
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27. Očko, Miroslav.
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28. Popčević, Petar; Gille, Peter; Smontara, Ana.
[Electronic transport in high quality d-AlCoNi quasiperiodic crystals](#) // C-MAC Days 2013.
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30. Popčević, Petar; Barišić, Neven; Krellner, Kornelius; Buehler-Paschen, Silke; Grin, Yuri; Smontara, Ana.
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31. Salamon, Krešimir; Očko, Miroslav; Žonja, Sanja; Ivanda, M; Lei, Y.; Newman, N.
[Investigation of the disorder in the TaxN thin films; on the first order Raman spectrum of tje rock-salt crystal structure.](#)
Ljubljana : Društvo za vakuumsko tehniko Slovenije, 2013. 32 (poster).
32. Salamon, Krešimir; Aumiler, Damir; Pabst, Georg; Vuletić, Tomislav.
[Probing the mesh formed by the semirigid polyelectrolytes](#) // EBSA Congress Lisbon 13-17.07.2013. (poster).
33. Smontara, Ana.
[Physical properties of bimetallic PdIn catalysts](#) // ICQ12, Book of abstracts.
(poster,international peer-review,abstract,scientific).

34. Šantić, Neven; Kregar, Gordana; Vekić, Vedran; Aumiler, Damir; Buljan, Hrvoje; Ban, Ticijana.
[Imaging and characterization of cloud dynamics in a magneto-optical trap induced by external forces.](#)
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36. Šoštar, Marko; Aumiler, Damir.
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37. Šrut, Iva; Mikšić Trontl, Vesna; Petrović, Marin; Delač, Ida; Pervan, Petar; Kralj, Marko.
[Controlling the growth of graphene on a stepped iridium surface](#) // Programme and book of abstract, 20th Slovenian and Croatian vacuum meeting. (poster).
38. Vučić, Zlatko; Gladić,Jadranko; Demoli, Nazif; Pandurić, Vlatko; Lovrić, Davorin; Marović, Danijela; Tarle, Zrinka.
[Introduction to the new method for measuring linear polymerization shrinkage](#) // CED IADR Abstract Book #507.
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39. Vučić, Zlatko; Gladić,Jadranko; Demoli, Nazif; Pandurić, Vlatko; Lovrić, Davorin; Marović, Danijela; Tarle, Zrinka.
[Uređaj za mjerenje polimerizacijskog skupljanja dentalnih kompozita niske viskoznosti](#) // Zbornik sažetaka radova Osmog znanstvenog sastanaka HFD-a, Primošten 2013. 64 (poster).

4.5. Participation

1. Bišćan, Marijan.
Plasma to Plasma! Workshop, 7.-10. 1. 2013. Leiden, Netherlands
2. Bišćan, Marijan.
Scientific Kick-off meeting of the COST Action MP1203 "Advanced spatial and temporal X-ray metrology, 4-5 April 2013, Paris, France
3. Bišćan, Marijan.
20th International Scientific meeting on Vacuum science and techniques, 9.-10. 5. 2013. Jeruzalem, Slovenia
4. Bišćan, Marijan.
18th European Summer School "Low Temperature Plasma Physics: Basics and Applications" and "Master Class: Biomedical Applications of Cold Plasmas", Bad Honnef, Germany, 2013.
5. Dominko, Damir.
„New Thermoelectric Materials“, Workshop 28. 09. – 2. 10. 2013. Split, Croatia
6. Marion, Sanjin
Physics of complex colloids (COMPLOIDS 2013), Ljubljana, Slovenija, 14.-18.5. 2013
7. Starešinić, Damir
„New Thermoelectric Materials“, Workshop 28. 09. – 2. 10. 2013. Split, Croatia
8. Uzelac, Katarina
MECO 38, 25 - 27 March 2013, ICTP, Trieste, Italy

5. Seminars at Institute of Physics

1. 20.12.2013.
[Correlation Effects and Itinerant Particles](#)
dr.sc. Neven Barišić.
Institute of Solid State Physics, Vienna University of Technology, Wiedner Hauptstr. 8-10, 1040 Vienna, Austria.
2. 4.12.2013.
[Condensation transition: from shaken granular gases to bankruptcy of an insurance company](#)
Juraj Szavits-Nossan.
School of Physics and Astronomy, University of Edinburgh, Scotland
Institute of Physics, Zagreb, Croatia.
3. 27.11.2013.
[Uređaj za vitalno izbjeljivanje zubi s mjerenjem rezultata izbjeljivanja u realnom vremenu](#)
Dr. sc. Mario Rakić.
Institut za fiziku.
4. 26.11.2013.
[Quartz Crystal Microbalance with Dissipation monitoring \(QCM-D\) and its application in surface characterization](#)
Aleš Doliška.
University of Maribor, Laboratory for Characterization and Processing of Polymers.
5. 20.11.2013.
[Mnogo-čestični efekti u kontaktnom međudjelovanju mekih diskova](#)
Dr. sc. Antonio Šiber.
Institut za fiziku.
6. 8.7.2013.
[The use of cyanine dyes in solid state organic heterojunction solar cells](#)
Prof. F. A. Nüesch.
Laboratory for Functional Polymers, Empa, Swiss Federal Laboratories for Materials Science and Technology, 8600 Dübendorf, Switzerland.

7. 29.4.2013.
[Suvremena kristalografija kvaziperiodičnih kristala](#)
Ognjen Milat.
IFS.
8. 4.6.2013.
[Proizvodnja i karakterizacija tankih filmova kvazi-jednodimenzionalnih sistema sa valovima gustoće naboja](#)
Dr. Maja Đekić.
Odsjeku za fiziku Prirodno-matematičkog fakulteta u Sarajevu, BiH.
9. 22.5.2013.
[O prognozi potresa](#)
Ivica Sović.
PMF, Zagreb.
10. 16.4.2013.
[Two-photon frequency comb spectroscopy of the hydrogen 1S-3S transition](#)
Dylan Yost.
Max Planck Institute of Quantum Optics.

6. List of contracts defining the co-operation with higher education, research institutions, businesses, and others, with a brief description of the nature and extent of co-operation;

7. List of courses offered or co-organized by members of the institution (including the name of researcher, course, higher education institution, and number of classes per semester);

7.1. Evidence of Courses on Undergraduate and Graduate Studies in Academic Year 2012/2013

PREZIME, IME	ZVANJE	INSTITUCIJA	NAZIV KOLEGIJA	SATI	NOSITELJ	SUG.
AUMILER, D.	VZS	PMF	Osnove atom.i mol. fizike	15	Dr.sc.D. Veža	DA
AVIANI, I.	VZS	PMF RI	Magnetski materijali i primjene		Dr.sc. I.Aviani	IF PMF RI
AVIANI, I.	VZS	PMF ST	Fizika čvrstog stanja		Dr.sc. I.Aviani	IF -PMF ST
AVIANI, I.	VZS	PMF	Multimed.prezentacije	15+45		DA
BILJAKOVIĆ, K.	ZSV	PMF ST	Fizika šumskih požara	30		IF PMF ST
BIŠĆAN M.	asistent	PMF	Početni fizički praktikum 2	60		DA
ČULO, M.	asistent	PMF	Fizički praktikum 3	60	E. Tafra	DA
ČULO, M.	asistent	PMF	Fizički praktikum 4	60	Basletić	DA
ČULO, M.	asistent	PMF	Napredni fizič praktikum 2	45	E. Tafra	NE
ERJAVEC, BERTI	Viši str.sur.	PMF	Multimed. prezenatcije	45		DA
GRGIČIN, D.	asistent	PMF	Napredni fizički praktikum 1	60	E. Tafra	DA
HERAK, M.	ZS	PMF	Praktikum iz moderne fizike	45		
HERAK, M.	ZS	PMF	Praktikum iz fizike za kem	60	D. Pajić	DA
KREGAR, Z.	asistent	PMF	Početni fizički praktikum 2	60		DA
LEVATIĆ, I.	asistent	PMF	Fizički praktikum 2	60		DA
LEVATIĆ, I.	asistent	PMF	Fizički praktikum 1	60	G.Jerebić-Zorc	DA
MARION, I.D.	asistent	PMF	Napredni fizički praktikum 1	60	E. Tafra	DA
MARION, S.	asistent	PMF	Napredni fizički praktikum 1	60	E. Tafra	DA
MARION, S.	asistent	PMF	Napredna statistička fizika	15	K.Uzelac	DA

MILUN, M.	ZSV	FKIT	Kemijska i fizikalna svojstva površina i nanostruktura	120		DA
PETROVIĆ, M.	asistent	PMF	Početni fizički praktikum 2	60		DA
STAREŠINIĆ, D.	VZS	PMF ST	Fizika šumskih požara	15		IF PMF ST
UZELAC, K.	ZSV	PMF	Napredna statistička fizika	45	K. Uzelac	DA
VUJIČIĆ, N.	Viši asistent	PMF	Elektrodinamika	45	D. Horvatić	DA
UKUPNO OPTEREĆENJE				1080		

7.2. Evidence of Courses on Undergraduate and Graduate Studies in Academic Year 2013/2014

PREZIME, IME	ZVANJE	INSTITUCIJA	NAZIV KOLEGIJA	SATI	NOSITELJ	SUG
AVIANI, IVICA	VZS	PMF	Multimedijske prezentacije	15+45	Aviani, Ivica	DA
DOMINKO, DAMIR	Viši asistent	PMF	Početni fizički praktikum 1	60		DA
ERJAVEC, BERTI	Viši str.surad	PMF	Multimedijske prezentacije	45	Erjavec, Berti	DA
KRSTULOVIĆ, NIKŠA	ZS	PMF	Početni fizički praktikum 1	60		DA
ŠRUT RAKIĆ IVA	asistentica	PMF	Napredni fizički praktikum 1	60		DA
UZELAC, KATARINA	ZSV	PMF	Napredna statistička fizika	45	Uzelac, Katarina	DA
RAKIĆ MARIO	poslijedr	FER	Fizika lasera	75		DA
UKUPNO OPTEREĆENJE				405		

7.3. Evidence of Courses on Doctoral Studies in Academic Year 2012/2013

PREZIME, IME	ZVANJE	INSTITUCIJA	NAZIV KOLEGIJA	SATI	NOSITELJ	SUG
BAN, TICIJANA	ZSV	PMF	Femtosek.laserska spektros.	45	Ban, Ticijana	NE
BEUC, ROBERT	ZSV	PMF	Teorija optičkih spektaradvoatomskih sudara	45	Beuc, Robert	NE
DEMOLI, NAZIF	ZSV	PMF	Optika i holografija	45	Demoli, Nazif	NE
GUMHALTER, BRANKO	ZSV	PMF	Lokalizirani i dinamički procesi na površinama	45	Gumhalter, Branko	NE
MILOŠEVIĆ, SLOBODAN	ZSV	PMF	Metode atomskih i molekularnih snopova	45	Milošević, Slobodan	NE
MILUN, M.	ZSV	PMF	Nanotehnologije	45	Milun, M.	NE
MILUN, M.	ZSV	FKIT	Kemijska i fizikalna svojstva površina i nanostruktura	30		
MOVRE, MLADEN	ZSV	PMF	Fizika hladnih sudara Zagreb	45	Movre, Mladen	NE
MOVRE, MLADEN	ZSV	PMF	Kvantna teor.atoma i mol.	45	Movre, Mladen	NE
G. PICHLER	ZSV	PMF	Atomska fizika i spekoskop.	45		NE
TUTIŠ, EDO	VZS	PMF	Fizika poluvodiča	22	Tutiš, Edo	NE
ŠIBER, ANTONIO	VZS	PMF	Molekularna biofizika		Šiber, Antonio	NE
UKUPNO OPTEREĆENJE				457		

7.4. Evidence of Courses on Doctoral Studies in Academic Year 2013/2014

PREZIME, IME	ZVANJE	INSTITUCIJA	NAZIV KOLEGIJA	SATI	NOSITELJ	SUG
AUMILER, DAMIR	VZS	PMF	Femtosek.laserska spektros.	15+30+0	Aumiler, Damir	DA
BAN, TICIJANA	ZSV	PMF	Femtosek. laserska spektros.	15+30+0	Ban, Ticijana	DA
BEUC, ROBERT	ZSV	PMF	Teorija optičkih spektaradvoatomskih sudara	30+15+0	Beuc, Robert	DA
DEMOLI, NAZIF	ZSV	PMF	Optika i holografija	15+30+0	Demoli, Nazif	DA
GUMHALTER, BRANKO	ZSV	PMF	Lokalizirani i dinamički procesi na površinama		Gumhalter, Branko	mirovina
MILOŠEVIĆ, SLOBODAN	ZSV	PMF	Metode atomskih i molekularnih snopova	15+30+0	Milošević, Slobodan	DA
MOVRE, MLADEN	ZSV	PMF	Fizika hladnih sudara Zagreb	30+15+0	Movre, Mladen	DA
MOVRE, MLADEN	ZSV	PMF	Kvantna teor.atoma i mol.	45+20+0	Movre, Mladen	DA
TOMIĆ, SILVIA	ZSV	PMF	Dielektrična spektroskopija	6+10+0	Tomić, Silvia	DA
TUTIŠ, EDO	VZS	PMF	Fizika poluvodiča		Tutiš, Edo	NE
ŠIBER, ANTONIO	VZS	PMF	Molekularna biofizika	20+10+0	Šiber, Antonio	DA
VULETIĆ, TOMISLAV		PMF	Dielektrična spetoskopija	6+10+0	Vuletić, Tomislav	DA
UKUPNO OPTEREĆENJE				397		

8. Lists of supervision of graduate theses and supervision of doctoral (PhD) programmes for 2013.

8.1. Graduation thesis

1. Golubović, Mares.
[Disorder effects on transport properties of charge density wave systems](#) / pre-Bologna graduate thesis.
Zagreb : Prirodoslovno-matematički fakultet-fizički odsjek, 11.12. 2013, 55 pages. Mentor: Starešinić, Damir.
2. Grubišić Čabo, Antonija.
[Magnetic anisotropy of a spin tetramer system CuSeO3](#) / graduate thesis.
Zagreb : Prirodoslovno-matematički fakultet, 20.09. 2013., 55 pages.
Mentor: Herak, Mirta.
3. Kos, Domagoj.
[Spectroscopic analysis of laser produced colliding plasmas](#) / graduate thesis.
Zagreb : Prirodoslovno-matematički fakultet, 24.09. 2013, 58 pages.
Mentor: Krstulović, Nikša.
4. Krešić, Ivor.
[Sterically modified Poisson-Boltzmann equation](#) / graduate thesis.
Zagreb : Prirodoslovno-matematički fakultet, 11.03. 2013, 49 pages.
Mentor: Šiber, Antonio.
5. Kuprešak, Mario.
[Računalni program za kontrolu i upravljanje CCD kamerom pri snimanju digitalnih holograma](#) / graduate thesis.
Zagreb : Fakultet elektrotehnike i računarstva, 05.07.2013.
Mentor: L. Bistričić; neposredni voditelj: N. Demoli.
6. Šilović, Ivan.
[Računalni program za prihvat i obradu digitalnih holograma](#) / graduate thesis.
Zagreb : Fakultet elektrotehnike i računarstva, 05.07.2013.
Mentor: L. Bistričić; neposredni voditelj: N. Demoli.

8.2. Defended doctorates

1. Bišćan, Marijan.
[Influence of atomic and molecular gases on laser produced plasmas](#) / doctoral thesis.
Zagreb : Prirodoslovno-matematički fakultet, 19.12. 2013, 113 pages.
Mentor: Milošević, Slobodan.
2. Đekić, Maja.
[Production and characterization of thin films of quasy-onedimensional systems with charge density wave ground state.](#) / doctoral thesis.
Sarajevo : Prirodoslovno-matematički fakultet- odsjek za fiziku, 30.12 2013, 96 pages. Mentor: Biljaković, Katica.
3. Erceg, Nataša.
[Students' strategies for solving non-traditional physics problems](#) / doctoral thesis.
Sarajevo : Prirodno-matematički fakultet, 15.01. 2013, 170 pages.
Mentor: Aviani, Ivica.
4. Jurić, Ivan.
[Electronic transport and recombination in amorphous organic semiconductors](#) / doctoral thesis.
Zagreb : Prirodoslovno matematički fakultet, 23.10. 2013, 253 pages.
Mentor: Tutiš, Eduard.
5. Kregar, Zlatko.
[Spatially and temporally resolved spectroscopic characterization of low pressure cold plasmas](#) / doctoral thesis.
Zagreb : Prirodoslovno-matematički fakultet, 17.12. 2013, 146 pages.
Mentor: Milošević, Slobodan.
6. Rakić, Mario.
[Applications of selected hot alkali vapors](#) / doctoral thesis.
Zagreb : Prirodoslovno - matematički fakultet, 20.09. 2013., 80 pages.
Mentor: Pichler, Goran.

8.3. Doctorates in progress

1. **Čulo, Matija**
Institution: Institute of Physics
Supervisor: Dr. Bojana Hamzić, Laboratory for magnetotransport measurements
2. **Delač Marion, Ida**
Institution: Institute of Physics
Supervisor: Marko Kralj, Laboratory for surface science and supported nanostructures and
Tomislav Vuletić, Laboratory for dielectric spectroscopy in solid state
3. **Gatalica, Goran**
Institution: Institute of Physics
Supervisor: Dr. Robert Beuc, Group for theoretical atomic physics
4. **Grgičin, Danijel**
Institution: Institute of Physics
Supervisor: Dr. Silvia Tomić, Laboratory for dielectric spectroscopy in solid state
5. **Kregar, Gordana**
Institution: Institute of Physics
Supervisor: Dr. sc. Ticijana Ban, Laboratory for femtosecond laser spectroscopy
6. **Levatić, Ivana**
Institution: Institute of Physics
Supervisor: Dr. Ivica Živković, Laboratory for magnetic ac susceptibility
7. **Marion, Sanjin**
Institution: Institute of Physics
Supervisor: Dr. Antonio Šiber, Group for nanoscience
8. **Petrović, Marin**
Institution: Institute of Physics
Supervisor: Dr. Marko Kralj, Laboratory for surface science and supported nanostructures
9. **Šrut Rakić, Iva**
Institution: Institute of Physics
Supervisor: Dr. Marko Kralj, Laboratory for surface science and supported nanostructures

10. **Šurija, Vinko**

Institution: Institute of Physics

Supervisor: Dr. Ivica Živković, Laboratory for magnetic ac susceptibility

11. **Velebit, Kristijan**

Institution: Institute of Physics

Supervisor: Dr. Ana Smontara, Laboratory for the physics of transport phenomena

8.4. External

1. **Brozović, Juraj**

Institution: School of Dental Medicine, University of Zagreb

Supervisors: : M. Sušić, SFZG; N. Demoli, IF

2. **Mrakužić, Maja**

Institution: School of Dental Medicine, University of Zagreb

Supervisors: V. Pandurić, SFZG; N. Demoli, IF

3. **Spajić, Jelena**

Institution: School of Dental Medicine, University of Zagreb

Supervisors: K. Prskalo, SFZG; N. Demoli, IF

4. **Sorić, Marija**

Institution: Faculty of Textile Technology, University of Zagreb

Supervisor: Dr. Ana Smontara, Laboratory for the physics of transport phenomena

5. **Šantić, Neven**

Institution: Physics Department, University Zagreb

Supervisor: Dr. sc. Ticijana Ban, Laboratory for femtosecond laser spectroscopy

6. **Šantak, Vedran**

Institution: School of Dental Medicine, University of Zagreb

Supervisors: prof. dr. sc. Zrinka Tarle, S. Milošević

9. List of lectures or seminars at foreign institutions

1. Ban, Ticijana
[Dynamic of the perturbed magneto- optical trap of rubidium atoms](#)
Institutu Jozef Štefan; 20.11.2013.
Ljubljana, Slovenia
2. Ban, Ticijana
[Radiative forces of fs pulse train on cold rubidium atoms](#)
Institute of Physics, Nicolaus Copernicus University; 04.09.2013.
Torun, Poland
3. Ban, Ticijana
[Radiative forces of fs pulse train on cold rubidium atoms](#)
Umea, University; 13.02.2013.
Umea, Sweden
4. Dominko, Damir
[Influence of crystal defects on charge density waves phase excitations](#)
University of Konstanz; 24.5.2013
Njemačka
5. Dominko, Damir
[Influence of crystal defects on charge density waves phase excitations](#)
University of Stuttgart; 31.5.2013
Njemačka
6. Kralj, Marko
[Electronic bands of epitaxial graphene: Getting to know them and making them susceptible to tailor-made solutions](#)
Institut Néel CNRS; 24th June 2013
Grenoble, France (invited by Johann Coraux)
7. Kralj, Marko
[Sweeping around and under the thinnest rug: Epitaxial graphene on Ir\(111\)](#)
CINaM – Centre Interdisciplinaire de Nanoscience de Marseille; 25th June 2013
Marseille, France (invited by Conrad Becker)

8. Pervan, Petar
[Stretched or doped: what can we learn from graphene on Ir\(332\)](#)
Institute for Industrial Physics, University Tokyo at Komaba Campus, 5. 7. 2013
Tokyo, Japan
9. Pervan, Petar
[Stretched or doped: what can we learn from graphene on Ir\(332\)](#)
University Toko at Kashiwa Campus. 11. 7. 2013
Tokyo, Japan
7. Rakić, Mario
[Applications of selected hot alkali vapors](#)
University of Kuwait. 5. - 15. 10. 2013
State of Kuwait

10. List of outreach activities

R.B.	AUTORI ILI IZVOĐAČI	MJESTO ODRŽAVANJA, NASLOV ČASOPISA, DOGAĐAJA ILI EMISIJE	VRIJEME	NASLOV PREDAVANJA, RADIONICE, EMISIJE, ČLANKA ILI AKTIVNOSTI	VRSTA AKTIVNOSTI	LINK	NAPOMENA
1.	Ban Ticijana, Aumiler Damir, Vdović Silvije	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Laserska harfa, radionica	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/lab-oratoriji	
2.	Ban Ticijana	Samobor, Gradska knjižnica, Ljetna škola znanosti	24.7.	Forenzika molekula	Javno predavanje -tribina		
3.	Ban Ticijana, Aumiler Damir, Vdović Silvije, Rakić Mario	Zagreb, Noć istraživača, FP7 projekt	27.9.	Fizika u službi zdravlja, istraživačka postaja	Javno predavanje -tribina	http://www.ifs.hr/News.aspx?ID=169	Projekt sufinanciran sredstvima Europske Unije (FP7)
4.	Bišćan Marijan, Kregar Zlatko	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Vakuuum oko nas, radionica	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/radionice	Projekt Vakuum u osnovnoj i srednjoj školi, suradnja HVD-a i IF-a
5.	Bišćan Marijan, Zlatko Kregar, Berti Erjavec	Zagreb, ŽSV nastavnika fizike, OŠ A.G. Matoš, Projekt:Fizika na dar	29. i 30.8.	Vakuuum oko nas, radionica za nastavnike	Projekt: Fizika na dar, Aktivnost: Fizika u nastavi, suradnja s AOO	http://www.ifs.hr/Page.aspx?p=160	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a

6.	Bišćan Marijan, Kregar Zlatko, Kos Domagoj	Zagreb, Noć istraživača, FP7 projekt	27.9.	Plazma medicina, istraživačka postaja	Javno predavanje -tribina	http://www.ifs.hr/News.aspx?ID=169	Projekt sufinanciran sredstvima Europske Unije (FP7)
7.	Čulo Matija, Gatalica Goran	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Ferotekućine, demonstracijski pokusi	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/pokusi	
8.	Čulo Matija, Gatalica Goran	Zagreb, Noć istraživača, FP7 projekt	27.8.	Nitroled, sladoled pomoću tekućeg dušika, radionica	Javno predavanje -tribina	http://www.ifs.hr/News.aspx?ID=169	Projekt sufinanciran sredstvima Europske Unije (FP7)
9.	Kralj Marko, Delač Marion Ida, Šrut Rakić Iva	Zagreb, Noć istraživača, FP7 projekt	27.9.	Nanotrampolin, istraživačka postaja	Javno predavanje -tribina	http://www.ifs.hr/News.aspx?ID=169	Projekt sufinanciran sredstvima Europske Unije (FP7)
10.	Demoli Nazif	Zagreb, IF, Projekt: Fizika	1.1. -3.6.	Aktivnost: Zvijezda je rođena, Digitalna holografija	Rad s darovitim i motiviranim učenicima	http://www.ifs.hr/Page.aspx?p=336#zvijezda_je_rodjena	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
11.	Demoli Nazif	Zagreb, IF, Projekt: Fizika na dar	4.6.- 31.12.	Aktivnost:Zvijezda je rođena, Digitalna holografija	Rad s darovitim i motiviranim učenicima	http://www.ifs.hr/Page.aspx?p=335#zvijezda_je_rodjena	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a
12.	Demoli Nazif, Gladić Jadranko	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Holografija: Logotip	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/lab-oratoriji	

Instituta i
učnički radovi

13.	Dominko Damir, Rakić Mario, Marion Sanjin, Altus Damir	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Teslina zavojnica	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/pokus	
14.	Prester Mladen, Živković Ivica, Dominko Damir	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Kriogene tekućine	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/lab/oratoriji	
15.	Grgičin Danijel	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Fizika DNK, Laboratorij za biološku fiziku	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/lab/oratoriji	
16.	Vuletić Tomislav, Grgičin Danijel, Dolanski Sanja	Zagreb, Noć istraživača, FP7 projekt	27.9.	Mekana nanoznanost, istraživačka postaja	Javno predavanje -tribina	http://www.ifs.hr/News.aspx?ID=169	Projekt sufinanciran sredstvima Europske Unije (FP7)
17.	Hamzić Bojana	Banja Luka, BIH, Human Resources Strategy for Researches	13.6.	Proces implementacije C&C na Institutu za fiziku u Zagrebu	Javno predavanje -tribina	http://www.euraxess.ba/bs/?n=100	

18.	Herak Mirta	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Organizator Otvorenog dana	Organizacija Otvorenog dana	http://otvoreni2013.ifs.hr/	
19.	Horvatić Vlasta	Zagreb, Hrvatsko fizikalno društvo	1.1. - 31.12.	web stranice Hrvatskog fizikalnog društva	Urednica web stranica	http://www.hfd.hr	
20.	Kralj Marko	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Nanotrampolin , predavanje	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/predavanja	
21.	Milošević Sloboda, Kregar Zlatko, Berti Erjavec	Zagreb, Prirodoslovna škola Vladimir Prelog	11.1.	Vakuum u osnovnoj i srednjoj školi	Predavanje i radionica za nastavnike fizike, suradnja s AOO	http://www.cro-vacuum.hr/vrhvd.html	Projekt Vakuum u osnovnoj i srednjoj školi, suradnja HVD-a i IF-a
22.	Kregar Zlatko	Višnjan, Znanstveni kamp mladih, Projekt: Fizika nadar	15.7.	Aktivnost:Fizičar u gostima,Vakuum oko nas, radionica	Predavanje i radionica za učenike	http://www.ifs.hr/Page.aspx?p=160	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a
23.	Krstulović Nikša	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Svjetlost-oruđe 21. stoljeća	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/predavanja	
24.	Marion Sanjin	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Možemo li razlikovati tehnologiju od magije ?	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/predavanja	
25.	Marion Sanjin	Matematičko-fizički list, LXIV 1/253, 2013./2014., 67.- 68.	2013	Korak prema pametnijim staklima	Znanstveno - popularni članak	http://www.ifs.hr/PublicDocuments/mfi-marion.pdf	
26.	Milošević Slobodan	Jeruzalem, 20th International Scientific meeting on	9.-10.05.	Vacuum workshop for primary and	Poster, sažetak	Mozetič, Miran ; Vesel, Alenka (ur.), Ljubljana:Slovenian Society	

		Vacuum science and techniques		secondary school teachers		for Vacuum Tehnique, 2013. 49-49	
27.	Kralj Marko i suradnici	Zagreb, IF, Projekt: Fizika	1.1. -3.6.	Zvijezda je rođena, Nanokarakterizacija grafena	Rad s darovitim i motiviranim učenicima	http://www.ifs.hr/Page.aspx?p=336#zvijezda_je_rodna	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
28.	Petrović Marin, Šrut Rakić Iva	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Nano-Cafe, prezentacija laboratorija za površinsku fiziku	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/laboratoriji	
29.	Popčević Petar	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Kvazikristali-od otkrića do danas-zanimljivosti i kontraverze	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/predavanja	
30.	Popčević Petar	Matematičko-fizički list, LXIII (3), 205 - 206 (2012-2013).	2013	Proizvodnja vodika iz vode pomoću nanosilicija	Znanstveno - popularni članak	http://www.ifs.hr/Images/mfl3-251/popcevic.pdf	
31.	Šiber Antonio	Zagreb, Movie pub, Skeptici u pubu	7.12.	Tamo gdje se sreću fizika i biologija i živo i neživo:virusi	Javno predavanje -tribina	https://twitter.com/pavelgregoric/status/408530827840991234	
32.	Šiber Antonio	Pula, Festival znanosti, Zajednica tehničke kulture	22.4.	Virusi: stvorenja niotkuda	Javno predavanje -tribina	http://asiber.ifs.hr/virusi_stvorenja_niotkuda.html	
33.	Smontara Ana, Velebit Kristijan, Popčević	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Slojasti materijali - Laboratorij za istraživanje	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/laboratoriji	

	Petar, Ivkov Jovica			transpornih svojstava		
34.	Damir	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Od kristala do stakla	Javno predavanje -tribina	<a href="http://otvoreni2013.ifs.hr/pre
davanja">http://otvoreni2013.ifs.hr/pre davanja
35.	Velebit Kristijan	Matematičko-fizički list, LXIII (3), 149-152 (2012- 2013)	2013.	Fotonaponske čelije na temelju listova fleksibilnog grafena	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Images/mfl
3-251/velebit.pdf">http://www.ifs.hr/Images/mfl 3-251/velebit.pdf
36.	Aviani Ivica	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Termoelektrici	Javno predavanje -tribina	<a href="http://otvoreni2013.ifs.hr/pre
davanja">http://otvoreni2013.ifs.hr/pre davanja
37.	Drobac Đuro	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Elektromagnet ska kupelj	Javno predavanje -tribina	<a href="http://otvoreni2013.ifs.hr/pre
davanja">http://otvoreni2013.ifs.hr/pre davanja
38.	Milun Milorad	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Što je, a što nije znanstveno istraživanje i zašto je to uopće važno?	Javno predavanje -tribina	<a href="http://otvoreni2013.ifs.hr/pre
davanja">http://otvoreni2013.ifs.hr/pre davanja
39.	Levatić Ivana, Šurija Vinko	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Kvantni magneti, Laboratorij za magnetsku ac susceptibilnost	Javno predavanje -tribina	<a href="http://otvoreni2013.ifs.hr/lab
oratoriji">http://otvoreni2013.ifs.hr/lab oratoriji
40.	Milat Ognjen, Salamon Krešimir	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Elektronskim mikroskopom do molekula i atoma, Sax laboratorij	Javno predavanje -tribina	<a href="http://otvoreni2013.ifs.hr/lab
oratoriji">http://otvoreni2013.ifs.hr/lab oratoriji

41.	Margetić Neva, Milašin Petra	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Čudesni svijet magneta, radionica	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/radionice	
42.	Marohnić Željko	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Kelvinov elektrostatski generator	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/pokus	
43.	Kos Domagoj	Zagreb, Otvoreni dan, Fizika na dar	22.3.	Vakuumsko zvono	Javno predavanje -tribina	http://otvoreni2013.ifs.hr/media/naslovna/program.pdf	
44.	Drobac Đuro	Mali Lošinj, 28. ljetna škola mladih fizičara, Projekt: Fizika na dar	16.-22.6.	Aktivnost: Fizičar u gostima, AC susceptometar	Predavanje za učenike	http://www.ifs.hr/Page.aspx?p=160	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a
45.	Aviani Ivica	Kistanje, Fešta o' fizike, Projekt: Fizika na dar	8.6.	Fizičar u gostima, Nevjerojatna voda	Javno predavanje -tribina	http://www.ifs.hr/Page.aspx?p=160	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a
46.	Marohnić Željko	Zagreb, IF, Projekt: Fizika na dar	4.6. - 31.12.	Aktivnost: Zvijezda je rođena, Magnetizam tvari	Rad s darovitim i motiviranim učenicima	http://www.ifs.hr/Page.aspx?p=335#zvijezda_je_rodjena	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a
47.	Marohnić Željko	Zagreb, Državni turnir mladih fizičara	19.1.	Član povjerenstva	Ocjenjivanje radova i priprema kandidata za Međunarodni turnir, suradnja s AOO	http://turnir.hfd.hr/2012-13/index.php	
48.	Aviani Ivica	Zagreb, ŽSV nastavnika fizike, OŠ	29. i 30.8.	Aktivnost: Fizika u nastavi, Magnetizam,	Predavanje i radionica za	http://www.ifs.hr/Page.aspx?p=160	Projekt Fizika na dar 4/6/2013 - 31/12/2013.

		A.G. Matoš, Projekt:Fizika na dar		radionica za nastavnike	nastavnike fizike, suradnja s AOO		ostavaren uz potporu MZOS-a
49.	Grgičin Danijel	Zagreb, IF, Projekt: Fizika na dar	4.6. - 31.12.	Aktivnost:Zvijez da je rođena, Fizika polimera	Rad s darovitim i motiviranim učenicima	http://www.ifs.hr/Page.aspx?p=335#zvizегда_je_rodена	Projekt Fizika na dar 4/6/2013 - 31/12/2013. ostavaren uz potporu MZOS-a
50.	Aviani Ivica	Zadar, ŽSV nastavnika fizike zadarske županije	11.11.	Svojstva elektriziranih tijela: nositelji naboja u izolatorima i vodičima	Predavanje za nastavnike, suradnja s AOO		
51.	Aviani Ivica	Umag, Festival znanosti u vrtiću	26.5.	Fizika na dar, radionica za djecu	Radionica za djecu vrtićke dobi	http://prirodopolis.hr/umag.html	
52.	Aviani Ivica	Split, Festival znanosti	26.4.	Budućnost energije – energija budućnosti	Javno predavanje -tribina	http://www.festivalznanosti.hr/2013/2013-04-06-23-04-04/petak	
53.	Ban Ticijana	Biograd na moru, Državno natjecanje i smotra iz fizike	2. -5.5.	Eksperimentaln i radovi srednjih škola, predsjednica povjerenstva	Ocjenjivanje eksperimentalnih radova, suradnja s AOO	http://natjecanja.hfd.hr/smotra_natjecanje/2012-13/index.php	
54.	Aviani Ivica	HTV 2, Školski sat	17.1.	Svi oblici i veličine sile	TV emisija, obrazovni program	http://www.youtube.com/watch?v=MaCISfR_8Ks&feature=share&list=UUJOueNh4-zhUAtnelNViedQ&index=16	
55.	Aviani Ivica	HTV 2, Školski sat	14.3.	Težina i sila teža	TV emisija, obrazovni program	http://www.youtube.com/watch?v=xnozmSA4FMo&feat	

						ure=share&list=UUJOueNh4-zhUAtnelNViedQ&index=15
56.	Demoli Nazif	HTV 2, Trenutak spoznaje	21.2.	Bioaktivni materijali u dentalnoj medicini	TV emisija, znanstveni program	http://youtu.be/kcLv6oiS4gs
57.	Bišćan Marijan, Silvije Vdović i drugi	HTV 2, Puni krug	29.3.	Prilog o Otvorenom danu Instituta za fiziku	TV emisija, obrazovni program	http://youtu.be/i7XbWvdZmvQ
58.	Krstulović Nikša	HTV 2, Trenutak spoznaje	18.4.	Svjetlost, plazma i spektroskopija	TV emisija, znanstveni program	http://youtu.be/tsn813UGOOQ
59.	Aviani Ivica	HTV 2, Školski sat	19.9.	Što je fizika ?	TV emisija, obrazovni program	http://youtu.be/LtK7PW-tNnM
60.	Aviani Ivica	HTV 2, Školski sat	23.5.	Zašto je težina teška ?	TV emisija, obrazovni program	http://youtu.be/o7IXGW0OYsg
61.	Gatalica Goran, Bišćan Marijan	Mreža TV, Vijesti	28.9.	Prilog o Noći istraživača	TV emisija, informativni program	http://youtu.be/S5dbUWPHfZY
62.	Gatalica Goran	HTV 1, Dobro jutro Hrvatska	27.9.	Najava Noći istraživača	TV emisija, zabavno-informativni program	http://youtu.be/3_SronfAx_w
63.	Gatalica Goran i drugi sudionici	Nova TV, Dnevnik	27.9.	Prilog o Noći istraživača	TV emisija, informativni program	http://youtu.be/FQf3YJ7pz-U

64.	Ban Ticijana, Gatalica Goran	HTV 1, Dnevnik 3	27.9.	Prilog o Noći istraživača	TV emisija, informativni program	http://youtu.be/F0UocxLCnaQ
65.	Kralj Marko, Šrut Rakić Iva	HTV 3, Treći element	3.10.	Grafen - čudesni materijal budućnosti	TV emisija, znanstveni program	http://www.youtube.com/watch?v=vpLFr26eytE&feature=share&list=UUJOueNh4-zhUAtneINViedQ&index=3
66.	Šiber Antonio	HTV 3, Treći element	21.11.	Meka i vlažna nanoznanost	TV emisija, znanstveni program	http://www.youtube.com/watch?v=FLrWeSotROE&feature=share&list=UUJOueNh4-zhUAtneINViedQ&index=2
67.	Popčević Petar, Smontara Ana	HTV 3, Treći element	6.12.	Kvazikristali i kvaziznanstven ici	TV emisija, znanstveni program	http://youtu.be/QE7HI0xq8qw
68.	Aviani Ivica	HTV 2, Školski sat	17.10.	Fizika u zraku	TV emisija, obrazovni program	http://youtu.be/Qh_EpL_ITaA
69.	Aviani Ivica	HTV 2, Školski sat	12.12.	Fizika svijeće	TV emisija, obrazovni program	http://youtu.be/x6RL6TijLRQ
70.	Erjavec Berti	Matematičko-fizički list, LXIII 2/250, 2012./2013., 136-139.	2013.	Newtonovi zakoni ili aksiomi	Znanstveno - popularni članak	http://www.ifs.hr/Publicdocuments/mfl2-250-erjavec.pdf
71.	Aviani Ivica	Matematičko-fizički list, LXIII 3/251, 2012./2013., 189-190	2013.	Kako možemo pokazati da se sile zbrajaju kao vektori	Znanstveno - popularni članak	http://www.ifs.hr/Images/mfl3-251/aviani.pdf
72.	Herak Mirta	Matematičko-fizički list, LXIII 4/252, 2012./2013., 268- 269	2013.	Fizika na dar	Znanstveno - popularni članak	http://www.ifs.hr/PublicDocuments/mfl4-252/Herak-clanak.pdf

73.	Pervan Petar	Zagreb, Noć istraživača, FP7 projekt	27.9.	Fizika sladoleda	Javno predavanje s pokusima -tribina	http://www.ifs.hr/News.aspx?ID=169
74.	Vuletić Tomislav	Zagreb, Noć istraživača, FP7 projekt	27.9.	Hollywood Physics	Javno predavanje-tribina	http://www.ifs.hr/News.aspx?ID=169
75.	Marion Sanjin	HR1, Oko znanosti	28.3.	Otvoreni dan, Fizika na dar	Radio emisija, znanstveni program	http://otvoreni2013.ifs.hr/media/naslovna/OKO_ZNANOS_Tl_28.3.2013.mp3
76.	Erjavec Berti	Matematičko-fizički list, LXIV 1/253, 2012./2013., 138.	2013.	Noć istraživača 2013- Zagreb, Split, Rijeka	Znanstveno - popularni članak	http://www.ifs.hr/Page.aspx?p=71
77.	Smontara, Popčević, Erjavec	Matematičko fizički list	2012./2013.	Članovi uređivačkog odbora	Znanstveno popularni časopis za popularizaciju matematike, fizike i informatike	http://web.math.pmf.unizg.hr/mfl/ured.htm
78.	Aviani Ivica	E-škola fizike	2012.	Urednik portala	Znanstveno popularni portal za popularizaciju fizike	http://eskola.hfd.hr

