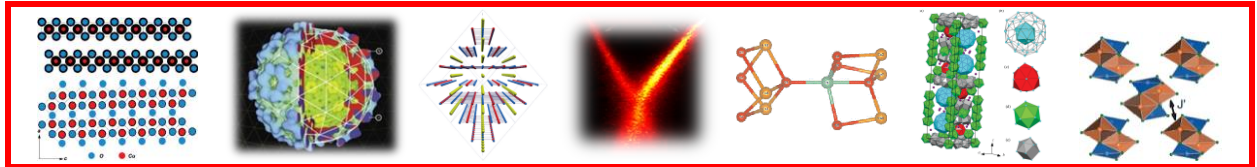


# Institute of Physics Zagreb



## Annual Report 2012.



ZAGREB, 2013.

# Annual Report 2012.

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## **Structure of the Institute**

### **Governing Council**

Dr. sc. Hrvoje Meštrić, MSES, President, (till 19.9.2012)

Prof. dr. Hrvoje Kraljević, Faculty of Sciences, President, (from 20.9.2012)

Prof. dr. Hrvoje Buljan, Faculty of Sciences, member

Dr. sc. Ticijana Ban, IP, representative of employees

Dr. sc. Čedomil Vadla, IP, representative of Scientific Council

### **Office of Director**

Dr. sc. Petar Pervan, Director

Dr. sc. Nazif Demoli, Assistant director

Dr. sc. Damir Starešinić, Assistant director

### **Scientific Council**

Dr. sc. Mladen Movre, chairman

Dr. sc. Ognjen Milat, deputy chairman

### **Scientists**

1. Damir Aumiler, dr. sc., senior research associate

2. Ivica Aviani, dr. sc., senior research associate (from 5.07.2012)

3. Ticijana Ban, dr. sc., senior scientist

4. Osor Slaven Barišić, dr. sc., research associate

5. Robert Beuc, dr. sc., senior scientist (permanent)

6. Katica Biljaković, dr. sc., senior scientist (permanent)

7. Nazif Demoli, dr. sc., senior scientist (permanent) (from 5.07.2012)

8. Đuro Drobac, dr. sc., senior research associate

9. Jadranko Gladić, dr. sc., technical advisor
10. Branko Gumhalter, dr. sc., senior scientist (permanent)
11. Bojana Hamzić, dr. sc., senior scientist (permanent)
12. Mirta Herak, dr. sc., research associate (from 19.01.2012)
12. Berislav Horvatić, dr. sc., senior research associate
13. Vlasta Horvatić, dr. sc., senior scientist
14. Jovica Ivkov, dr. sc., senior scientist
15. Marko Kralj, dr. sc., senior research associate
16. Nikša Krstulović, dr. sc., research associate (from 20.1.2012)
17. Davorin Lovrić, dr. sc., technical advisor
19. Željko Marohnić, dr. sc., technical advisor (from 1.9.2012)
19. Ognjen Milat, dr. sc., senior scientist (permanent)
20. Slobodan Milošević, dr. sc., senior scientist (permanent)
21. Milorad Milun, dr. sc., senior scientist (permanent)
22. Mladen Movre, dr. sc., senior scientist (permanent)
23. Miroslav Očko, dr. sc., senior scientist
24. Petar Pervan, dr. sc., senior scientist (permanent)
25. Goran Pichler, dr. sc., senior scientist (permanent) (retired from 24.10.2012)
26. Mladen Prester, dr. sc., senior scientist (permanent)
27. Krešimir Salamon, dr. sc., higher technical associate (from 31. 8. 2012)
27. Hrvoje Skenderović, dr. sc., senior research associate
28. Ana Smontara, dr. sc., senior scientist
29. Damir Starešinić, dr. sc., senior research associate
30. Antonio Šiber, dr. sc., senior scientist
31. Silvia Tomić, dr. sc., senior scientist (permanent)
32. Eduard Tutiš, dr. sc., senior research associate
33. Katarina Uzelac, dr. sc., senior scientist (permanent)
34. Čedomil Vadla, dr. sc., senior scientist (permanent)
35. Zlatko Vučić, dr. sc., senior scientist (permanent)

36. Tomislav Vuletić, dr. sc., senior research associate
37. Ivica Živković, dr. sc., senior research associate (from 18.12.2012)

### **Higher Assistants**

1. Ivan Balog, dr. sc.
2. Damir Dominko, dipl. ing. (dr. from 25.09.12)
3. Mirta Herak, dr. sc. (until 19.01.12)
4. Tomislav Ivek, dr. sc.
5. Nikša Krstulović, dr. sc. (until 19.01.2012.)
6. Ivo Pletikosić, dipl. ing. (dr. from 14.06.12)
7. Petar Popčević, dr. sc.
8. Krešimir Salamon, dr. sc. (until 31.08.2012)
9. Kristina Šariri, dr. sc.
10. Silvije Vdović, dr. sc.
11. Nataša Vujičić, dr. sc.
12. Juraj Szavitz-Nossan, dr. sc.

### **Assistants**

1. Marijan Bišćan, dipl. ing.
2. Matija Čulo, mag. educ.
3. Ida Delač Marion, mag. phys.
4. Goran Gatalica, mag. educ.
5. Danijel Grgičin, dipl. ing.
6. Ivan Jurić, dipl. ing.
7. Gordana Kregar, dipl. ing.
8. Zlatko Kregar, dipl. ing.
9. Levatić Ivana, mag. phys.
10. Sanjin Marion, mag. phys.
11. Marin Petrović, dipl. ing.

12. Mario Rakić, dipl. ing.
13. Iva Šrut, dipl. ing.
14. Kristijan Velebit, dipl. ing.

### **Tehicians**

1. Damir Altus, mechatronic technician (from 12.3.2012)
2. Ivan Čičko, mechanical workshop
3. Branko Kiš, electronic workshop
4. Josip Pogačić, helium liquifier
5. Franjo Zadavec, mechanical workshop
6. Žarko Vidović, nitrogen liquifier
7. Alan Vojnović, electronic workshop

### **Informatics, Library, Administration, Supporting Personnel**

1. Ivana Bagarić, technical associate, (until 19.1.2012)
2. Mladen Bakale, porter-telephone operator
3. Ivanka Bakmaz, accountancy clerk
4. Ndoc Deda, technical associate, (from 1.5.2012)
5. Berti Erjavec, higher technical associate
6. Mario Juričić, chief of the informatics section
7. Željko Kneklin, dipl. oec., higher economic advisor
8. Nevenka Kralj, accountancy clerk
9. Mirjana Ličina, cleaning lady
10. Renata Macešan, cleaning lady
11. Gordana Matić, cleaning lady
12. Snježana Mostečak, cleaning lady
13. Darko Oštarčević,porter-telephone operator
14. Jadranka Rajić, secretary
15. Marija Sobol, administrative clerk



16. Maja Starček, prof. dipl. bibl. (from 1.3.2012)

17. Nataša Šuput, cleaning lady

18. Draženka Zajec, cleaning lady

19. 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: *Thermoelectric and thermomagnetic properties of strongly correlated materials*

Funded by: MSES

Principal investigator: Veljko Zlatić

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: *Shapes and structures of nanoscale systems dictated by competition of energies*  
Funded by: MSES  
Principal investigator: Antonio Šiber
12. Project title: *Electronic and crystal structure of supported self-organized nanosystems*  
Funded by: MSES  
Principal investigator: Branko Gumhalter
13. Project title: *Laser spectroscopy of cold plasmas for treatment of materials*  
Funded by: MSES  
Principal investigator: Slobodan Milošević
14. Project title: *Thermal and charge transport in strongly frustrated magnets and similar materials*  
Funded by: MSES  
Principal investigator: Ana Smontara
15. Project title: *Materials with electronic structure tailored by the modern techniques of sample preparations*  
Funded by: MSES  
Principal investigator: Miroslav Očko
16. Project title: *Theory of critical phenomena and systems out of equilibrium*  
Funded by: MSES  
Principal investigator: Katarina Uzelac
17. Project title: *Structure–properties relations in advanced materials with controlled dimensionality*  
Funded by: MSES  
Principal investigator: Ognjen Milat
18. Project title: *Physics*  
Funded by: MSES, popularization of science  
Principal investigator: 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: *Study of magnetic order in spin-chain system  $\text{CuSe}_2\text{O}_5$  using magnetic resonance techniques*  
Funded by: CSF  
Principal investigator: Mirta Herak

22. Project title: *Photolithographic synthesis and electronic properties of graphene-based devices and related structures*

Funded by: UKF

Principal investigator: Marko Kralj

23. Project title: *New electronic states driven by frustration in layered materials*

Funded by: UKF

Principal investigator: Eduard Tutiš

24. Project title: *Device for vital tooth bleaching with real time measurement results*

Funded by: BICRO

Principal investigator: Mario Rakić

25. Project title: *Transport properties of (metastable) partially crystalline systems*

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: *Transport and nonequilibrium effects in correlated nanostructures*

Partner country: USA

Principal investigator: Ivica Aviani

3. Project title: *Electrons in two dimensions: Graphene and topological insulators*

Partner country: Germany

Principal investigator: Marko Kralj

4. Project title: *Epitaxial-graphene-enabled tunable metamaterials*

Partner country: USA

Principal investigator: Marko Kralj

5. Project title: *Plasma-assisted synthesis of nanoobjects*

Partner country: Slovenia

Principal investigator: Nikša Krstulović

## 2.3. Cooperation with industry

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

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

**Funded by:** MSES

**Principal investigator:** Robert Beuc

In the last two years we have developed a numerically efficient "semi-quantum" method for calculating the optical spectra of diatomic molecules which were tested on the absorption spectrum of  $K_2$  and  $Rb_2$  molecules. We have shown that this method correctly describes the optical spectra in the case of non-adiabatic mixed electronic molecular states. Using the latest ab-initio calculations of electronic potentials and dipole moments of  $CS_2$  molecules (A. Allouche and M. Aubert-Frécon 2012), we made a numerical simulation of absorption and emission spectra of weakly ionized cesium vapor (600-1500K) in the 600-1200 nm. We have taken into account the contributions of 30 electronic transitions, and we have shown that the "semi-quantum" method of spectral simulation is enough time-efficient for the diagnosis of real systems.

In order to determine the probability of emission or absorption of photons in the diatomic system, in the semi-classical approximation, it is necessary to calculate a typical oscillating integral with one or more saddle points. This type of integral appears in a number of physical problems, e.g. in atom-atom and atom-surface scattering and in various optical phenomena. We proposed an uniform approximation of integrals, based on the method of stationary phase. There the integral with several saddle points is replaced by the sum of integrals containing only one or at most two real saddle points which are easily solvable. In this way we reduce the formal co-dimension in the canonical integrals, "elementary catastrophes", with co-dimension larger than the 1. The validity of the proposed method was tested on examples of integrals with three saddle points (the "cusp" canonical integral) and four saddle points (the "swallow-tail" canonical integral). These integrals are typical integrals, occurring in the semi-classical analysis of optical spectra with three or four Condon points, which allowed us to define a uniform semiclassical model for the optical spectrum of diatomic molecules.

**2. 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).

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

**Funded by:** MSES

**Principal investigator:** Petar Pervan

The focus of the „Electronic and crystal structure of supported self-organized nanosystems,, project was investigation of modified graphene on Ir(111) surface in order to achieve specific electronic properties of graphene. There were several directions of modification – one is intercalation by different atoms as oxygen, hydrogen, europium, alkali metals (Cs, K, Na, Li), second relies on the deformation of graphene induced by stepped surface structure of Ir(332) surface. Also, graphene on flat Ir surface has been altered by sputtering in order to create so called graphene nanomesh. We have studied a many body interactions (electron-phonon coupling) of graphene electrons in  $\pi$  bands around the Fermi level induced by the potassium intercalation. The research has been performed by several experimental techniques: Scanning Tunnelling Microscopy (STM) also in close collaboration with University Köln (T. Michely, C. Busse), Low Electron Energy Diffraction (LEED), Angle Resolved Photoemission Spectroscopy (ARPES) and synchrotron radiation in collaboration with Brookhaven National Laboratory (T. Valla), X-ray Photoelectron Spectroscopy (XPS) in collaboration with University of Rijeka (M. Petravić). The experimental results were complemented by Density Functional Theory modelling (DFT) in collaboration with researchers from Ruđer Bošković Institute (P. Lazić, D. Šokčević, R. Brako) . The results of our research have been presented on different international conferences : 76. Jahrestagung der DPG, JVC-14, ECOSS-29.



**4. Project title:** Quantum Magnets: Competing ground states

**Funded by:** MSES

**Principal investigator:** Mladen Prester

In 2012 our research activities have been grouped mainly around the two main subjects: finalization of the previously initiated work on dynamics of the magnetic system  $\text{Ca}_3\text{Co}_2\text{O}_6$  and preparation of the comprehensive and systematic studies of magnetic nanoparticle dynamics. For the sake of better understanding of the low temperature magnetic phases of  $\text{Ca}_3\text{Co}_2\text{O}_6$  and their dynamics a new series of dynamics hysteresis has been taken by the use of our ac susceptibility setup. The results show that, at variance with interpretation of other authors, there is no quantum tunnelling in the ground state, demonstrating simultaneously the power and the potential of our dynamic hysteresis method for studies of magnetic dynamics. Majority of work has been devoted to dynamics of magnetic nanoparticles. The main experimental task was to design and implement the experimental system for magnetic spectroscopy studies, enabling studies of ac susceptibility of the appropriate samples in frequency domain (at constant temperature). These studies were including relaxation dynamics of other sorts, like those associated with magnetic domain walls and eddy currents. For this purpose large number of magnetic nanoparticle systems (in powder and ferrofluid forms) has been measured both in frequency and in temperature domains. In particular, we did measurements on samples of amorphous and polycrystalline soft ferromagnets (domain-wall dynamics),  $\text{Fe}_3\text{O}_4$  nanoparticles from various sources, carbon-armoured Ni and Fe nanoparticles, commercial ferrofluids (Nanotesla, Ferrolabs and Ferrotec) and elementary Cu rods. Significant insight has been also obtained from measurements on samples supplied from pharmaceutical industry.

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

**Funded by:** MSES

**Principal investigator:** Katica Biljaković

Our research was generally devoted to the investigation of the charge density wave systems (CDW), particularly to the effect of the reduction of the correlated CDW phase domains on their properties. The influence of defects on linear and nonlinear conductivity has been studied in o-TaS<sub>3</sub> samples doped with Nb or irradiated with protons. The complete investigation of dielectric and transport properties of these systems has been presented in the doctoral thesis of D. Dominko. The influence of the reduced dimensionality has been studied in nanocrystalline CDW thin films of K<sub>0.3</sub>MoO<sub>3</sub> deposited by pulsed laser in respect to their transport, structural and morphological properties. We have found the correlation between the film texture and the variable range hopping conductivity characteristics. This part of our research will be presented in the doctoral thesis of M. Đekić from the University of Sarajevo. Within the same collaboration (federal project of Bosnia and Hercegovina) we have started the investigation of amorphous alloys of CuZrAl produced in Sarajevo. In collaboration with A. Salčinović (University of Sarajevo, phd student at Zagreb) we have measured the heat capacity as well as the microhardness for various concentrations. In collaboration with A. Cano from ESRF, Grenoble, France we have pursued the theoretical description of low temperature heat capacity of incommensurate states.

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

**Funded by:** MSES

**Principal investigator:** Silvia Tomić

We have demonstrated the huge negative differential resistance and switching to transient high-conduction states at high dc electric fields within molecular planes in the charge-ordered state of organic 2D solid  $\alpha$ -(BEDT-TTF)<sub>2</sub>I<sub>3</sub>. We have investigated magnetotransport properties of La<sub>1-x</sub>Ca<sub>x</sub>MnO<sub>3</sub> a rare-earth manganese perovskite films for  $x > 0.5$  where the intriguing phenomenon of charge ordering takes place at rather high temperatures.

We have interpreted a prominent dielectric response in the organic Mott insulator with magnetic ordering  $\kappa$ -(BEDT-TTF)<sub>2</sub>Cu[N(CN)<sub>2</sub>]Cl to be due to a novel form of spin-charge coupling. We have started a search to identify the origin of the dielectric response in the organic Mott insulator with no magnetic ordering  $\kappa$ -(BEDT-TTF)<sub>2</sub>Cu<sub>2</sub>(CN)<sub>3</sub>, widely considered as an example of quantum spin liquid in 2D. We have demonstrated that divalent magnesium cations significantly contribute to the DNA self-screening of electrostatic interactions.

Dynamics studies of Na-DNA and Na-hyaluronic acid have been correlated with structural measurements by X-ray scattering and a polyelectrolyte mesh has been described that softens already at 10 mM added salt, as demonstrated by diffusion coefficient measurements of a fluorescent probe molecule. Preliminary dielectric measurements together with infrared characterization (Uni. Stuttgart) in the insulating phases of the two novel  $\kappa$ -systems, the  $\kappa$ -(BEDT-TTF)<sub>2</sub>Hg(SCN)<sub>2</sub>Cl and -Br. identified features which are respectively common with the charge-ordered  $\alpha$ -(BEDT-TTF)<sub>2</sub>I<sub>3</sub> and the Mott insulator  $\kappa$ -(BEDT-TTF)<sub>2</sub>Cu[N(CN)<sub>2</sub>]Cl.

**7. Project title:** Thermoelectric and thermomagnetic properties of strongly correlated materials

**Funded by:** MSES

**Principal investigator:** Veljko Zlatić

We continued our research on the Kondo effect in heavy fermions and initiated the new work on bad metals (oxides) and nano-structured materials.

The charge and heat transport of bad metals has been studied within the simplified Hubbard model in the limit of very large correlation, using the dynamical mean field approximation. Our results explain the linear resistivity observed in many bad metals, we also obtained a very good description of the doping dependence of the thermopower of cuprates. We have shown that the figure of merit of bad metals can be very large which makes them interesting for applications.

We analyzed the intermetallic compounds with Ce, Eu, and Yb ions using the periodic Anderson model with crystal field (CF) split f-states. Our calculations explain the unusually large power factor and 'slow crossover' from the local moment to the Fermi liquid regime observed in YbAl<sub>3</sub>, and the 'rapid crossover' observed in YbInCu<sub>4</sub>. Combining the Fermi liquid theory and the high-temperature perturbation expansion we explained the modifications of the thermopower and the resistivity by pressure, doping or a magnetic field.

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

**Funded by:** MSES

**Principal investigator:** Đuro Drobac

The project research was continued and expanded to several new systems. Magnetic anisotropy of a novel multiferroic system  $K_3Fe_5F_{15}$  was studied using torque magnetometry in low ( $H < 500$  Oe) and medium ( $H < 1$  T) magnetic fields down to  $T = 2$  K. This system is ferroelectric already at room temperature and below 120 K it develops a long range magnetic order thus becoming a multiferroic. Temperature dependence of magnetic anisotropy in paramagnetic state suggests that the magnetic lattice of this system is low-dimensional. Magnetically ordered state is very sensitive to even small applied magnetic fields. Magnetic domains are present in the ordered state and magnetic structure is dominantly antiferromagnetic with small ferromagnetic component, presumably a result of Dzyaloshinskii-Moriya interaction.

In collaboration with Dijana Žilić and Zoran Džolić from Rudjer Bošković Institute (RBI) we started to study a new zero-dimensional spin  $S=1/2$  halogen-mediated dimer systems. We performed a detailed magnetic susceptibility and torque measurements on  $[CuL(-Br)]_2$  ( $L = N$ -benzyl- $N'$ -((2-pyridin-2-yl)methyl)oxalamid). In this compound two Cu spins  $S=1/2$  are bridged by two Br atoms forming a dimer. Organic ligands between dimers serve as separation thus making the interaction between spins from different dimers very small compared to intradimer interaction. Our measurements suggest a small interaction between spins in dimer, of the order of 2 K. Unusual rotation of magnetic axes at low temperatures was also revealed in our measurements, but only in one crystal plane. These systems are ideal for study of the influence of bridging ligands on the exchange interaction, so we also plan to perform measurements on isostructural compound with Cl instead of Br, and two other compounds which also have halogen (Cl or Br) mediated exchange, and which were already synthesized on RBI.

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

**Funded by:** MSES

**Principal investigator:** Nazif Demoli

Scientific activities within this project are focused on experimental optimization as well as the application procedures used in digital holography and both holographic and laser interferometry. For the first time, we investigated the use of an optical fiber bundle (OFB) in digital image plane holography and holographic interferometry of distant objects. Use of optical fiber bundles in digital image plane holography systems is limited due to, first, poor quality of transmitted images through the OFB and, second, further image degradation caused by overlappings in the image (also hologram) plane. Existing systems are aimed at near-distant (order of a centimeter) objects and use demanding procedures to achieving acceptable quality of holographic reconstructions. We found a solution for an OFB based holographic system capable of achieving fast and good-quality holographic and interferometric reconstructions of far-distant (order of a meter) objects. The proposed system is based on performing subtraction operations through the image acquisition interface buffers directly accessed to process the holograms and instantly display the output. The system is analyzed theoretically and its effectiveness is validated by experimental results [1]. In the other activity, we have demonstrated the usefulness of applying different approaches in recognition and classification processes, especially when the properties such as fastness and robustness (as the first step, using optical correlators) can be combined with invariance (as the second step, using Fourier-Jacobi image moments) [2].

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

**Funded by:** MSES

**Principal investigator:** Goran Pichler

Femtosecond (fs) pulses are the backbone of the research activities performed within our project. The power of the femtosecond laser spectroscopy comes from its wideness of applications, enabling research activities in various fields. There are five research activities within our project, some of them are continuation of our previous, well established work (frequency comb, dense alkali vapors) while in others new research fields have been opened (cold atoms, confocal microscopy, optical spectroscopy of solid state samples). A train of ultrashort pulses emitted from a mode-locked femtosecond laser i.e. optical frequency comb is used to control and manipulate the resonance excitation of different atomic velocity groups in room-temperature rubidium and potassium vapors. Moreover, by proposing a new scheme for simultaneous laser cooling of multiple atomic species using an optical frequency comb, frequency comb spectroscopy has been introduced into ultra cold atomic systems. Cold rubidium samples are produced by a standard technique in magneto-optical trap. The optimization and characterization of the cloud was performed and the first demonstration of the mechanical force induced by the frequency comb on the cold rubidium atoms was achieved. Observation of the satellite bands in absorption spectra of dense alkali vapors provides better understanding of long-range molecular potential curves with possible application in the formation of the ultracold molecules through photoassociation process. Emission spectra from high-pressure light sources were studied in our continuous pursuit for the ideal light source. Confocal microscopy based on femtosecond pulses was developed in our laboratory and applied for the measurement of the diffusion constant of DNA molecules in water. Optical spectroscopy of solid samples (mostly thin films) at low temperatures using an optical cryostat is developed and applied for measurements of steady-state absorption and photoluminescence of various samples.

**11. Project title:** Shapes and structures of nanoscale systems dictated by competition of energies

**Funded by:** MSES

**Principal investigator:** Antonio Šiber

The research activities have been mostly directed towards investigation of viruses, in particular the role of protein charges on the assembly and stability of empty and DNA/RNA-filled capsids. We have attempted to compare the charge distributions in different viruses and to statistically analyze them in order to find possible evolutionary relatedness and/or convergence of features of charge distributions due to physical constraints. The results we obtained and published in *Journal of Biological Physics* are ambivalent and further study is needed. We have also published a semi-review *Phys. Chem. Chem. Phys.* paper (containing also some new and unpublished results) explaining in simple terms physical modeling that we have been applying to electrostatic interactions in viruses since year 2007.



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

**Funded by:** MSES

**Principal investigator:** Branko Gumhalter

Using various theoretical methods and algorithms, some of which have been developed within this and the previous project, we have interpreted experimental results of the inelastic scattering on metallic surfaces and adsorbed layers, absorption of the electromagnetic radiation on surface electronic states and ultra-fast dynamics of electronic excitations in surface electronic states.

**13. 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 helium metastable atoms produced upon laser ablation of various targets. The effect has been studied for a large range of helium gas pressures. The possibilities of LIBS method have been studied for detection of heavy metals in fruits and vegetables which was a part of one diploma work (Tibor Bali).

Regarding low pressure inductively coupled plasmas interaction of argon, hydrogen and oxygen plasma early afterglow with polyvinyl chloride (PVC) materials have been studied. New plasma source with post-glow chamber has been completed and tested. In collaboration with IJS Ljubljana (group of Miran Mozetič) experiments were performed on Optical emission characterization of extremely reactive oxygen plasma during treatment of graphite samples and Sodium Hyaluronate Films have been studied in low temperature Inductively Coupled Ammonia. By using ns excimer pulsed laser at 308 nm photoluminescence of nanocrystalline Ti-doped gahnite has been studied in collaboration with IRB group of Biserka Gržeta.

As a part of Vedran Šantak doctoral thesis (co-supervisors S. Milošević and 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.

In total we have published 6 papers, 5 cited in WoS database and 1 in Scopus, as conference proceedings.

**14. Project title:** Thermal and charge transport in strongly frustrated magnets and similar materials

**Funded by:** MSES

**Principal investigator:** Ana Smontara

Activities were focused on the layered systems (transition-metal dichalcogenides and high-T<sub>c</sub> superconducting cuprates), soft ferromagnets and metallic glasses. The investigations included measurements of the thermal and electrical conductivity, thermopower and Hall coefficient under high pressure and magnetic field (<http://condensed-matter.ifs.hr/>). The work on the UKF project “New electronic states driven by frustration in layered materials” (<http://frustrated-electrons.ifs.hr/>) contributed to the organization of the workshop “Collaborative Workshop on Modulation and Nanostructuring in Layered Materials” (<http://mnl2012.ifs.hr/>) and the international conference “Physics of Low-Dimensional Conductors: Problems and Perspectives” (<http://pldc-pp.ifs.hr/>).

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

**Funded by:** MSES

**Principal investigator:** Miroslav Očko

Our work in 2012 were mainly devoted to solve some problems within Kondo/Heavy fermion physics and some problems of the thin films based on polysilicon and of the  $Ta_xN$  thin films.

We offered a solution of one long standing issue in Kondo physics, hidden order in  $URu_2Si_2$ . To make conclusion on underlying physic, we thoroughly investigate some alloys of  $U_xY_{1-x}Ru_2Si_2$  but not directly  $URu_2Si_2$ . Our conclusions were: The U ion is in the form of  $U^{4+}$  and that this ion behaves according to single channel Kondo physics but not according to many various theories predicted to explain hidden order. The unusual effects which lead to “hidden order” are not inherent to  $U_xY_{1-x}Ru_2Si_2$  and even for  $x = 1$ , but is due to existing nanosized ferromagnetic particles of unknown crystal structure. More widely, these investigations cast a doubt on possibility of coexistence of ferromagnetism and Kondo and of coexistence of superconductivity and ferromagnetism at least in the heavy fermion  $URu_2Si_2$ .

We contribute to a comprehensive investigations performed in various laboratories in Europe of an interesting heavy fermion CeGe.

Investigating polysilicon thin films based on doped polysilicon, we faced with the known problem of determination of activated dopant concentration. Namely, the concentration inferred from the Hall effect measurements was much higher than the concentration obtained by SIMS that is impossible. We offered a possibility of the active dopant concentration determination in the range from  $1 \cdot 10^{19} \text{ cm}^{-3}$  up  $2 \cdot 10^{20} \text{ cm}^{-3}$  for the polysilicon doped with P and B that have grains larger than  $200 \text{ }\mu\text{m}$ .

We showed that the properties of thin thins depend on state and kind of substrate and on deposition temperature; particularly in the case of  $Ta_xN$ .

**16. Project title:** Theory of critical phenomena and systems out of equilibrium

**Funded by:** MSES

**Principal investigator:** Katarina Uzelac

Activities of the Statistical physics group included several topics.

(a) Nonequilibrium phenomena: Studies were extended to new classes of models of phase transitions out of equilibrium. Since april 2012 J. Szavits-Nossan continued his part of investigations of nonequilibrium systems in context of the large deviation functional formalism and modelling of biologically motivated experiments at ICMCS, University of Edinbrough.

b) Equilibrium critical phenomena. Character of a ferromagnetic phase transition induced by quenched disorder and peculiar scaling behaviour near criticality was studied by recently formulated euilibrium like invaded cluster algorithm on a simple spin model on a lattice. Importance of inhomogeneities on all scales was found [2], and thermal and disorder fluctuations were further independently analysed [3]. This line of investigations was extended to the study of the random field Ising model applying new nonperturbative renormalisation-group technique, during the stay of I. Balog at LPTMC, Universite Pierre et Marie Curie.

(c) Yang-Lee zeros. Extensive study of the partition function zeros in the complex activity plane, in the two and three state Potts model with infinite range interactions was prepared for publication in collaboration with Z. Glumac, J.J. Strossmayer University, Osijek.

(d) Lowdimensional quantum systems.

In collaboration with experimentalists at the EPFL, ARPES spectra for doped anatase TiO<sub>2</sub> have been analyzed and a theoretical explanation has been developed. Investigations and modeling of strong electron correlations in high-T<sub>c</sub> cuprates have been intensified in collaboration with a group of prof. S. Barisic [1,4,5], with special attention put on experimental results derived from ARPES measurements. With a group of prof. PrelovÅek, analysis of spin chain systems and influence of disorder has been has been continued with few important goals achieved.

**17. Project title:** Structure–properties relations in advanced materials with controlled dimensionality

**Funded by:** MSES

**Principal investigator:** Ognjen Milat

Complexity of advanced materials with reduced structural dimensionality were studied in relation with their unconventional physical properties such as anisotropic charge and/or spin ordering, magnetic susceptibility, optical permittivity, superconductivity, ... Exotic physical properties are usually affected by crystallographic anisotropy and nanostructure. All materials were obtained through collaboration with other groups. Structural studies were performed by using light and electron microscopy, x-ray reflectivity and grazing incidence small angle scattering, and diffraction techniques. Range, type and degree of structural (dis)order in an  $\text{Al}_{1.63}\text{Cu}_{2.24}\text{Co}_{0.13}$  decagonal quasicrystal were studied by electron microscopy and diffraction. An electron diffraction study of a number of rare earth cuprates  $\text{M}_x\text{CuO}_2$ , is presented (for  $\text{M}_x = \text{Ca}_{.83}, \text{Sr}_{.73}, \text{Ba}_{.67}, [\text{Sr}/\text{Ca}_2\text{Cu}_2\text{O}_3]_{.70}$ ). These cuprates belong to class of composite crystals consisting of two subsystems: „CuO<sub>2</sub>-chains“ and „M cations-x“. The lattices of these subsystems have common a and b parameters while the ratio of parameters along chains  $c_M/c_{\text{Ch}}$  varies with  $1/x$ . For M-cations-x =  $[(\text{Ca}/\text{Sr})_2\text{Cu}_2\text{O}_3]_{0.7}$ , it is the case of  $(\text{Sr}/\text{Ca})_{14}\text{Cu}_{24}\text{O}_{41}$  “chain-ladder” compound. Various level of self doping (also related to nonstoichiometry x) affects Cu-valency to vary in the range from +2.66 for  $\text{Ba}_{.67}\text{CuO}_2$ , to +2.30 for  $\text{Ca}_{.85}\text{CuO}_2$ , and even to +3.0 in  $\text{NaCuO}_2$ , and +2.0 in  $\text{Li}_2\text{CuO}_2$ . The hole distribution in  $\text{Sr}_{14}\text{Cu}_{24}\text{O}_{41}$  was studied (in collaboration within six research groups) by low-temperature polarization-dependent OK near-edge x-ray absorption fine-structure measurements and state-of-the-art electronic structure calculations that include core-hole and correlation effects in a mean-field approach. Contrary to all previous analysis, based on semiempirical models, we show that correlations and antiferromagnetic ordering favor the strong chain-hole attraction. For the remaining small number of holes accommodated on ladders, leg sites are preferred to rung sites. The small hole affinity of rung sites explains naturally the one-dimensional to two-dimensional crossover in the phase diagram of  $(\text{La}, \text{Y}, \text{Sr}, \text{Ca})_{14}\text{Cu}_{24}\text{O}_{41}$ .

**18. Project title:** Physics

**Funded by:** MSES

**Principal investigator:** 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)

Nanocharacterisation of graphene (leader Dr. Marko Kralj)

Magnetic interactions (leaders Dr. Ivica Aviani and Berti Erjavec, BSc.)

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.

Demonstration kit for magnetism (Dr. I. Avian and Berti Erjavec, BSc.)

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/>.

**19. Project title:** Complex Magnetic Systems

**Funded by:** CSF

**Principal investigator:** Ivica Živković

Within the first year of the project we have purchased and installed a new low temperature cryostat for liquid helium with a superconducting magnet that can generate magnetic fields up to 9 T. We have also developed an experimental setup for the measurement of magnetic ac susceptibility in high magnetic fields. Several new magnetic systems have been investigated, including a tetramer system  $\text{SeCuO}_3$  and a skyrmion lattice in  $\text{Cu}_2\text{OSeO}_3$ . Using the neutron scattering on Paul Scherrer Institute we have discovered that the skyrmion lattice can be rotated by applying the electric field, which can lead to effective control of individual skyrmions as magnetic memory elements.



**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

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. It is also planned to identify and model the dominant mechanisms which control polymerization of DBs. The materials to be investigated include methacrylate based composite resins, new composite materials with amorphous calcium phosphate, silorane based composite resins, glass-ionomer cements, and giomers. Investigation of the physical-chemical properties of DBs is a basis for establishing the clinical use guidelines. To obtain good clinical results, the DBs should have maximum degree of polymerization and minimum polymerization stress. Magnitude of the polymerization stress of DBs is determined mainly by their volumetric shrinkage (also by viscoelastic behavior, by restrictions imposed to polymerization shrinkage, and by irradiance used during photoactivation). Other relevant properties which have to be investigated include thermal expansion, degree of conversion, color stability, translucency, microhardness, etc.

An optical hybrid system is under development and the preliminary results have been obtained. The system consists of a specially designed sample holder device (particularly suitable for flowable DBs) integrated into setups for interferometric, spectroscopic, and temperature measurements at video sampling frequency (30 fps) within suitable wide time intervals. Additionally, polymerized samples undergo microscopic Vickers test. The preliminary results suggest that the presented approach has a high potential for providing a detailed insight into the relevant properties of DBs [1].

**21. Project title:** Study of magnetic order in spin-chain system CuSe<sub>2</sub>O<sub>5</sub> using magnetic resonance techniques

**Funded by:** CSF

**Principal investigator:** Mirta Herak

This project was realized in collaboration with dr.sc. Denis Arčon, dr. sc. Andrej Zorko, dr.sc. Matej Pregelj, dr. sc. Zvonko Jagličić and dr. sc. Anton Potočnik from JSI in Ljubljana and dr. sc. Oksana Zaharko from Paul Scherrer Institute in Switzerland.

CuSe<sub>2</sub>O<sub>5</sub> is a quasi-one-dimensional spin  $S=1/2$  system with large intrachain interaction  $J=160$  K and small interchain interaction of  $0.1J$ . Our previous work also determined the presence of symmetric and antisymmetric Dzyaloshinskii-Moriya (DM) exchange and staggered g tensor. Quasi-one-dimensional systems are interesting because at low temperature they exhibit long-range magnetic order. Interesting effects can appear in quasi-low-dimensional spin systems with staggered fields which come from DMI and staggered g tensor, such as a dimensional crossover from 3D to 1D induced by magnetic field. In order to understand these phenomena it is important to determine a magnetically ordered structure in zero field and the spin Hamiltonian, which is what we did for CuSe<sub>2</sub>O<sub>5</sub>. Antiferromagnetic resonance (AFMR) measurements in X and Q-band and magnetic susceptibility measurements of CuSe<sub>2</sub>O<sub>5</sub> were performed in Ljubljana. Combining these with previous results of neutron scattering and muon spin relaxation measurements, we used a mean-field based simulation technique developed by group in Ljubljana to simulate all experimental results using spin Hamiltonian we obtained in our previous work published in 2011. We successfully explained our measurements and determined the ground state of this system. We also prepared a manuscript to be submitted to Physical Review B. The project ended on 01.03.2012. It was rated successful by the Croatian Science Foundation by obtaining 92.33/100 points.

**22. Project title:** Photolithographic synthesis and electronic properties of graphene-based devices and related structures

**Funded by:** UKF

**Principal investigator:** Marko Kralj

The first half of 2012 was the final quarter of the 2-year UKF-funded project aimed at developing photolithographic capabilities at the Institute of Physics for fabrication of electronic devices based on graphene and other novel materials, envisioned to replace silicon in future electronics. The motivation for this work came from the fact that the conventional electronics is approaching its limits in achieving ever smaller scale and less power-consumption, and the prospect of significant advances is now associated with reducing devices scales and spintronics, i. e. electronics that manipulates both charge and spin degrees of freedom in which focus two new 2D materials have emerged as promising candidates: graphene and topological insulators. The primary achieved goal was to adapt the existing technologies of synthesis of graphene layers to fabricate devices and other heterostructures based on graphene and similar layers. Fabrication of electronic devices was supposed to more tightly connect different type of expertise existing at the IF and neighboring institutions (transport, electron spectroscopies, optical properties, sample production...). The outcome of the project is 20 m<sup>2</sup> of the clean room space at IF equipped with standard research photolithography equipment, which enables to perform the whole cycle of device micro fabrication, including spin-coating, chemical processing, mask alignment, contact deposition, wire bonding, etc. Through the project, seven participants (five of them being PhD students) gained substantial training related to micro- and nano-fabrication and characterization, including the transfer of knowledge not only related to device fabrication but also to wide scope of expertise available at training facilities BNL and at new partner institution involved in this project, the MPI for Solid State Research in Stuttgart. In the final quarter one paper was submitted and subsequently accepted.

**23. Project title:** New electronic states driven by frustration in layered materials

**Funded by:** UKF

**Principal investigator:** Eduard Tutiš

The project established the high pressure lab for transport measurements. The lab was equipped with two types of pressure cells (non-magnetic self-clamped cell, and diamond anvil cell); the line of equipment required for cell preparation (gasket production), sample mounting, pressing and pressure calibration. The 10 T magnetic field facility is put to use by acquiring variable temperature insert (VTI), adaptation of the lab space; completing the instrumentation; construction of new sample holders, through software production, and through test measurements. The project initiated the development new theoretical methods for addressing textured electronic states, and put to use some ab-initio DFT methods (through workshops, seminars, software installations, and test runs, related to Wien2K, Siesta and AbInit packages). These were followed by their application to several layered systems. The measurements on several layered compound were foreseen and performed in Zagreb, Lausanne and Stuttgart. Two scientific papers with the project label appeared within the project durations, followed by subsequent publications (two additional up to this moment). The project organized several research workshops, one collaborative workshop, initiated and co-organized one international conference, supported numerous dissemination activities, all listed at the project web site. The additional grants were attracted for this purpose. The DAAD grant was awarded to the project member to support the optical measurements in Stuttgart. The momentum gained through the project is maintained in current research.

**24. Project title:** Device for vital tooth bleaching with real time measurement results

**Funded by:** BICRO

**Principal investigator:** Mario Rakić

During the tooth bleaching process chemical reactions occur that bleach the tooth but also cause overheating of the tooth and surrounding structures which leads to its hypersensitivity. The goal of our project is to demonstrate the technical feasibility of the realization of devices that monitor the bleaching process in real time. This device would promptly indicate the need for slowing / pausing the process of bleaching thus preventing the overheating as well as an excessive uncontrollable bleaching. The plan is to start the process of patent protection and subsequently sell the rights for its use.

**25. Project title:** Transport properties of (metastabile) partially crystalline systems

**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

This federal project just started at the end of the year 2012. Cu-Zr-Al i Cu-Zr amorphous alloys of various concentrations have been produced at Sarajevo and we started with their characterisation at Zagreb. Within the same project and in continuity with our MSES project we investigated the relationship between the morphology of thin films of blue bronze and their transport properties which should be included in the PhD thesis of mr.sc. Maja Đekić.

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*Charge density waves in nanocrystalline thin films of blue bronze  $K_0.3MoO_3$* ,  
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33. A. Šiber, A. L. Božič, and R. Podgornik,  
*Energies and pressures in viruses: contribution of nonspecific electrostatic interactions*,  
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*The Hall effect in the organic conductor TTF-TCNQ: choice of geometry for accurate measurements of a highly anisotropic system*,  
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35. S. Tomić, D. Grgicin, T. Ivek, T. Vuletić, S. D. Babić, and R. Podgornik,  
*Dynamics and structure of biopolyelectrolytes in repulsion regime characterized by dielectric spectroscopy*,  
Physica B **407**, 1958-1963 (2012).
36. V. M. Trontl, I. Pletikosić, M. Milun, and P. Pervan,  
*Temperature dependence of photo-hole decay in 4d derived Quantum Well States in monolayer Ag(111) films on Pd(111), Ni(111), Mo(110) and Cu(100)*,  
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37. A. Turković, P. Dubček, M. Rakić, M. Lončarić, B. Etlinger, and S. Bernstorff  
*SAXS/DSC/WAXD study of TiO<sub>2</sub> nanoparticles and the effect of gamma-radiation on nanopolymer electrolyte*,  
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38. M. Vrankić, B. Gržeta, V. Mandić, E. Tkalčec, S. Milošević, M. Čeh, and B. Rakvin,  
*Structure, microstructure and photoluminescence of nanocrystalline ti-doped gahnite*,  
J. Alloy. Compd. **543**, 213-220 (2012).
39. J. S. White, I. Levatić, A. A. Omrani, N. Egetenmeyer, K. Prša, I. Živković, J. L. Gavilano, J. Kohlbrecher, H. Berger, and H. M. Ronnow,  
*Electric field control of the skyrmion lattice in  $Cu_2OSeO_3$* ,  
J. Phys.-Condes. Matter **24**, 432201 (7pp) (2012).

40. L. Yan, X. Chen, Q. He, Y. Wang, X. Wang, Q. Guo, F. Bai, A. Xia, D. Aumiler, S. Vdović, and S. Lin,  
*Localized Emitting State and Energy Transfer Properties of Quadrupolar Chromophores and (Multi)Branched Derivatives*,  
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41. I. Živković, D. M. Djokić, M. Herak, D. Pajić, K. Prša, P. Pattison, D. Dominko, Z. Micković, D. Cinčić, L. Forro, H. Berger, and H. M. Ronnow,  
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42. I. Živković, D. Pajić, T. Ivek, and H. Berger,  
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43. V. Zlatić and J. K. Freericks,  
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Phys. Rev. Lett. **109**, 266601 (5pp) (2012).

### 3.2 Publications with address of Institute of Physics cited in Scopus database only for 2012.

1. S. Milošević,  
Laser produced plasma diagnostics by cavity ringdown spectroscopy and applications, in AIP Con.Proc.1438(2012), pp. 149-154.
2. M. Očko, S. Žonja, and M. Ivanda,  
Role of the substrate and the temperature of deposition on the properties of the Ta xN thin films, in *MIPRO 2012 - 35th International Convention on Information and Communication Technology, Electronics and Microelectronics – Proceedings* (2012), pp. 17-18.
3. S. Žonja, M. Očko, M. Ivanda, T. Suligoj, and P. Biljanović,  
On the application of boron and phosphorus heavily doped LPCVD polycrystalline silicon thin films as thermoelectric materials, in *MIPRO 2012 - 35th International Convention on Information and Communication Technology, Electronics and Microelectronics – Proceedings* (2012), pp. 19-20.

### 3.3 Publications in Conference proceedings with address of Institute of Physics not cited in Scopus or WoS databases for 2012.

1. O. Milat, K. Salamon, and I. Milat:

*Order and disorder in AlCuCo quasicrystal; an electron diffraction study*, u Croatian Microscopy Symposium, Pula November 16-17, 2012, ISBN 978-953-57138-1-4, HMD, Zagreb (2012) pp. 33-34.

## 4. Participation at conferences

### 4.1. Plenary lecture

1. Šiber, Antonio.

Condensed DNA toroids in bacteriophage capsids // *From Solid State To BioPhysics VI*. (plenary lecture, abstract, scientific) Cavtat 2012

### 4.2. Invited lecture

1. Milošević, Slobodan.

Laser produced plasma diagnostics by cavity ringdown spectroscopy and applications // AIP Conference Proceedings 1438 / Aggarwal, Kanti ; Shearer, Francesca (ur.). Melville, New York : American Institute of Physics, 2012. 149-154 (invited lecture).

2. Tomić, Silvia; Grgičin, Danijel; Ivek, Tomislav; Vuletić, Tomislav; Dolanski Babić, Sanja; Podgornik, Rudolf.

Dynamics and structure of biopolyelectrolytes in repulsion regime characterized by dielectric spectroscopy // *Physica B: Condensed Matter* (0921-4526) 407 (2012) ; 1958-1963 / Serguei Brazovskii, Natasha Kirova and Pierre Monceau (ur.).

Elsevier, 2012. 1958-1963

(invited lecture).

3. Tomić, Silvia; Complex and nonlinear dynamics in the organic crystals with charge and magnetic orders", International Conference on Science and Technology of Synthetic Metals (ICSM 2012), Atlanta, Georgia, USA (2012).

(invited lecture)

4. 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; // Skup iz bioinformatike i biološke fizike, Hrvatska Akademija znanosti i umjetnosti, 21.studen 2012, Zagreb. / Vladimir Paar (ur.).  
Zagreb : Hrvatska Akademija znanosti i umjetnosti., 2012. 1-13  
(invited lecture).
5. Popčević, Petar; Bilušić, Ante; Dolinšek, Janez; Smontara, Ana.  
Thermal transport properties in complex metallic alloys, Proceedings of C-Mac Days 2012.  
(invited lecture).
6. Šiber, Antonio.  
Viruses as self-assembled nanoparticles // Nanobiotechnology Workshop, JRC Ispra 2012.  
(invited lecture, abstract, scientific).
7. Šiber, Antonio; Lošdorfer Božič, Anže; Podgornik, Rudolf.  
Importance of electrostatic interactions for virus assembly and structure // Workshop on Physical Virology, ICTP.  
(invited lecture)
8. Popčević, Petar; Velebit, Kristijan; Stanić, Denis; Ivkov, Jovica; Bihar, Željko; Bilušić, Ante; Smontara, Ana.  
Thermoelectric properties of quasicrystals // 14th Joint Vacuum Conference - 12th European Vacuum Conference - 11th Annual Meeting of the German Vacuum Society - 19th Croatian – Slovenian Vacuum Meeting.  
(invited lecture).
9. Šiber, Antonio; Lošdorfer Božič, Anže; Podgornik, Rudolf.  
Charge distributions and electrostatic interactions in viruses Toulouse, Francuska, 7-10.05.2012.  
(invited lecture).
10. Tomić, Silvia.  
Charge Dynamics in Quasi-2D Condensed Matter Systems with Strong Correlations // Colloquium“Jean-Paul Pouget days”, 25-26 October 2012, Orsay, France.2012.  
(invited lecture).
11. K. Biljaković, Workshop MATRIX FP7 projekta, Bonn (srpanj 2012) „*Data and information – precondition for hazard and risk assesment*“  
(invited lecture).
12. K. Biljaković, Okrugli stol „Nove siguronosne ugroze i kritična nacionalna infrastruktura“, Policijska akademija, Zagreb (prosinac 2012.) „*Nadgledanje i upravljanje požarima velikih razmjera u posebno opasnim područjima*“.  
(invited lecture).

13. K. Biljaković, D. Starešinić, J. C. Lasjaunias, G. Remenyi, R. Melin, P. Monceau, and S. Sahling, *Charge density glass dynamics - Soft potentials and soft modes*, International workshop on electronic crystals ECRYS2011., Cargese, France, August 2011. *Physica B* **407**, 1741-1745 (2012).  
(published invited lecture).

14. N. Krstulović, Laser Produced Plasmas and Applications in Materials Processing, Pozvano predavanje na 14th Joint Vacuum Conference u Dubrovniku

15. T. Ban, A. Foltynowicz, P. Maslowski, F. Adler and J. Ye, Optical frequency comb – ideal source for ultrasensitive absorption spectroscopy, *Space Time and Matter*, Brijuni, Croatia 27.08-31.08. 2012.  
(invited lecture)

16. Eduard Tutiš, Institute of Physics, Zagreb, Croatia, Strongly correlated kagome system at 1/3 filling - the case of (EDT-TTF-CONH<sub>2</sub>)<sub>6</sub> [Re<sub>6</sub>Se<sub>8</sub>(CN)<sub>6</sub>] International Conference on Science and Technology of Synthetic Metals (ICSM 2012), Atlanta, Georgia, USA (2012)  
(invited lecture)

17. V. Zlatić  
67th Annual Meeting of the Japanese Physical Society in Osaka, Japan,  
Enhancement of the figure-of-merit in strongly correlated multilayers,  
February 2012  
(invited lecture)

18. V. Zlatić  
International conference 'From solid state to biophysics', Cavtat  
Enhancement of the figure-of-merit in strongly correlated multilayers  
June 2012  
(invited lecture)

19. V. Zlatić  
International conference on 'Spin Caloritronics V', Columbus, Ohio, USA.  
Thermoelectric properties of bad metals.  
May 2013  
(invited lecture)

#### 4.3. Lecture

1. M. Biščan, S. Milošević,  
Metastable helium production in laser produced plasma // 14th Joint Vacuum Conference -  
12th European Vacuum Conference - 11th Annual Meeting of the German Vacuum Society -  
19th Croatian - Slovenian Vacuum Meeting, Book of abstracts / Radić, Nikola ; Milošević,  
Slobodan (ur.). Zagreb : Croatian Vacuum Society, 2012. 35-36  
(lecture).

2. M. Bišćan, S. Milošević,  
Metastable helium production in laser produced plasma // 14th Joint Vacuum Conference - 12th European Vacuum Conference - 11th Annual Meeting of the German Vacuum Society - 19th Croatian - Slovenian Vacuum Meeting, Book of abstracts / Radić, Nikola ; Milošević, Slobodan (ur.). Zagreb : Croatian Vacuum Society, 2012. 35-36  
(lecture).
3. M. Đekić, A. Salčinović, D. Dominko, I. Šrut, K. Salamon, D. Starešinić, K. Biljaković, H. Schäfer, J. Demšar, G. Socol, C. Ristoscu, I. N. Mihailescu, Z. Siketić, I. Bogdanović-Radović, H. Šamić and J. Marcus  
*Nanocrystalline thin films with charge density wave ground states*  
JVC-14 / EVC-12 / AMDVG-11 / CroSloVM-19, Dubrovnik, Croatia, 4-8 June 2012  
(lecture).
4. Grgičin, Danijel; Dolanski Babić, Sanja; Ivek, Tomislav; Vuletić, Tomislav; Tomić, Silvia.  
Conformation of DNA in low added salt solutions // „7th Christmas Biophysics Workshop“ (XBW 2012) / Pabst, Georg ; Heftberger, Peter ; Kollmitzer, Benjamin (ur.).Graz 24-24  
(lecture).
5. Ivek, Tomislav; Kovačević, Ivan; Pinterić, Marko; Korin-Hamzić, Bojana; Tomić, Silvia; Dressel Martin; Schweitzer, Dieter.  
 $\alpha$ -(BEDT-TTF)<sub>2</sub>I<sub>3</sub>: Complex electrodynamic response of the charge-ordered phase // Low Energy Electrodynamics in Solids 2012 / D. N. Basov, M. C. Martin (ur.). 2012.  
(lecture).
6. Jazbec, S.; Koželj, P.; Vrtnik, S.; Jagličić, Z.; Popčević, Petar; Ivkov, Jovica; Stanić, Denis; Smontara, Ana; Feuerbacher, M.; Dolinšek, J.  
Physical properties of  $\delta$ -FeZn<sub>10</sub> complex intermetallic, Proceedings of C-MAC Days 2012.  
(lecture).
7. S. Žonja, M. Očko, M. Ivanda, T. Suligoj, P. Biljanović  
*On the application of the boron and phosphorous heavily doped polysilicon thin films as thermoelectric materials*  
35<sup>th</sup> international convention on information and communication technology, electronics and microelectronics, May 21-25, 2012, Opatija, Croatia  
(lecture).
- 8.M. Očko, S. Žonja, M. Ivanda  
*Role of substrate on the properties of the Ta<sub>x</sub>N thin films*  
35<sup>th</sup> international convention on information and communication technology, electronics and microelectronics, May 21-25, 2012, Opatija, Croatia  
(lecture).
9. Popović, Marko; Šiber, Antonio.  
Poisson-Boltzmann approach for sterically asymmetric electrolytes // 7th Christmas Biophysics Workshop (XBW 2012) / Pabst, Georg (ur.). 2012. 6-6  
(lecture).

10. Rakić, Mario; Pichler, Goran.  
High pressure Cs and Na light sources // Programme and book of abstracts / Radić, Nikola ; Milošević, Slobodan (ur.). Zagreb : Croatian Vacuum Society, 2012. 127-127  
(lecture).
11. Salamon, Krešimir; Krstulović, Nikša; Modic, Martina; Bišćan, Marijan; Milošević, Slobodan; Milat, Ognjen.  
Time delay effect in production of thin Ti films by double-pulse laser deposition // 14th Joint Vacuum Conference - 12th European Vacuum Conference - 11th Annual Meeting of the German Vacuum Society - 19th Croatian - Slovenian Vacuum Meeting, Book of abstracts / Radić, Nikola ; Milošević, Slobodan (ur.). Zagreb : Croatian Vacuum Society, 2012. 126-126  
(lecture).
12. Šiber, Antonio.  
Mean-field electrostatics explained through application to viruses // 11th Greta Pifat-Mrzljak International School of Biophysics: Biomolecular complexes and assemblies / Vuletić, Tomislav ; Tomić, Sanja (ur.). Zagreb, 2012. 59-59  
(lecture).
13. Šiber, Antonio; Zihlerl, Primož.  
Many-body contact repulsion of deformable disks // 7th Christmas Biophysics Workshop (XBW 2012) / Pabst, Georg (ur.). 2012. 6-6  
(lecture).
14. Velebit, Kristijan; Popčević, Petar; Smontara, Ana; Berger, H.; Forró, L.; Dressel, M.; Barišić, Neven.  
THE NANO-TEXTURED PHASE OF 1T-TaS<sub>2</sub> PROBED BY OPTICAL CONDUCTIVITY // Electronic States and Phases Induced by Electric or Optical Impacts. Orsay, 2012.  
(lecture).
15. S. Žonja, M. Očko, M. Ivanda, T. Suligoj, P. Biljanović  
*On the application of the boron and phosphorous heavily doped polysilicon thin films as thermoelectric materials*  
35<sup>th</sup> international convention on information and communication technology, electronics and microelectronics, May 21-25, 2012, Opatija, Croatia  
(lecture).
16. Vrankić, Martina; Gržeta, Biserka; Mandić, Vilko; Tkalčec, Emilija; Milošević, Slobodan; Čeh, Miran; Rakvin, Boris.  
Structure and microstructure of Ti-doped gahnite // Book of Abstracts / Lah, Nina ; Leban, Ivan (ur.). Ljubljana : University of Ljubljana, 2012. 28-28  
(lecture).
17. Vujičić, Nataša.  
Frequency comb polarization spectroscopy of multilevel rubidium atoms // EGAS 44th Conference of the European Group on Atomic Systems / Hanstrop D., Hartman H., Engström L., Nilsson H., Salomonson S. (ur.). Gothenburg : European Physical Society, 2012. 61-61  
(lecture).



18. E.Tutiš, „International conference of Synthetic Metals“ (ISCM) 2012, Atlanta, Georgia, 8-13 srpanj 2012. godine, izlaganje “*Strongly correlated kagome system at 1/3 filling -the case of (EDT -TTFCONH<sub>2</sub>)<sub>6</sub> [Re<sub>6</sub>Se<sub>8</sub>(CN)<sub>6</sub>]*”
19. E.Tutiš, ”Physics of Low-Dimensional Conductors: Problems and Perspectives”, Zagreb, 25-28 ožujak, izlaganje, „*Metal's semiconductor transition for electrons in kagome planes*“
20. I. Pletikosić, International Workshop on the Structural, Electronic and Dynamical Properties of Surfaces and Nanostructures, Osaka, Japan 2012 (lecture).
21. S. Milošević, Bioplazma, 3. radionica Sekcije za primijenjenu i industrijsku fiziku Hrvatskog fizikalnog društva, Zagreb, 30.10.2012. (lecture).
22. S. Milošević, stručni skup za nastavnike fizike osnovnih škola Opatija 2012, lecture „Vakuum“
23. S. Milošević, Marie Curie projekti iz perspektive evaluatora, Info dan o People programu, Split 26.05.2011., Zagreb 2012. (lecture)
21. I. Aviani, *Temeljni koncepti termodinamike*, Državni stručni skup za nastavnike fizike gimnazija i strukovnih škola, OŠ *Rikard Katalinić Jeretov*, Opatija, 4.-6. 04. 2012. (workshop)
24. I. Aviani, *Toplina i temperatura*, Državni stručni skup za učitelje fizike osnovne škole, Gimnazija Eugena Kumičića, Opatija, 2.-4. 04. 2012. (workshop)
25. I. Aviani, *Collaboration among teachers and scientists: Is it possible?* Toward a Platform for Motivated and Gifted Youth, February 24-27, 2012 Čakovec, Croatia (lecture)
26. M. Prester, oral contribution at: Mat & Nano Brokerage day, Warsaw, 18th September 2012.
27. M. Prester, oral contribution at: III radionica Sekcije za primjenjenu i industrijsku fiziku Hrvatskog fizikalnog društva, Zagreb, 30.10.2012. M.Prester, oral contribution at: Skup u povodu obljetnice rođenja prof.dr. Emila Babića, 12.11.2012., Institut za fiziku, Zagreb
28. P. Pervan 'Alkali-metal intercalated graphene on Ir(111)' ECOSS-29, 3-7 September 2012. Edinburgh (lecture)
29. Petar Popčević, A. Bilušić, K. Velebit and A. Smontara, Thermal transport properties of decagonal quasicrystals and their approximants, *2012 MRS Fall Meeting*, Boston, SAD, 25 – 30 November 2012 (talk)

30. Miroslav Očko

*Evidences of the weak localisation and electron-electron interaction in the  $Ta_xN$  thin films ( $0.72 \leq x \leq 0.83$ )*

JVC-14 / EVC-12 / AMDVG-11 / CroSloVM-19, Dubrovnik, Croatia, 4-8 June 2012  
(lecture)

31. Miroslav Očko, Zlatko Samardžija, Sanja Žonja

*Does  $U$  dissolved in  $YRu_2Si_2$  cause single or multi-channel Kondo effect?*

18th International Conference on Solid Compounds of Transition Elements

31 March 2012 to 5 April 2012, Lisbon, Portugal

(lecture).

32. Miroslav Očko

*O nekom pitanjima Kondo fizike danas*

Skup u povodu obljetnice rođenja prof. Dr. Emila Babića

Institut za fiziku i Fizički odsjek Prirodoslovno-matematičkog fakulteta,

Zagreb, 23.11.2012.

#### 4.4. Posters

1. Grgičin, Danijel; Dolanski Babić, Sanja; Vuletić, Tomislav; Tomić, Silvia.  
Comparative study of native and denatured Mg-DNA pure water solutions // 11th Greta Pifat-Mrzljak International School of Biophysics.  
(poster).
2. Popčević, Petar; Jaćimović, J.; Bilušić, Ante; Smontara, Ana; Berger, H.; Batistić, Ivo; Piatek, J.; Tsyrlin, Regnault, L.-P.; N.; Barišić, Neven; Forró, L.  
Electronic Scattering on Frustrated Magnetic System: From Antiferromagnetism to the Kondo State in  $\text{Co}_{1/3}\text{NbS}_2$  Under Pressure, Electronic States and Physers Induced by Electric or Optical Impacts.  
(poster).
3. Popčević, Petar; Velebit, Kristijan; Stanić, Denis; Ivkov, Jovica; Bilušić, Ante; Smontara, Ana.  
Anisotropic Transport Properties of Decagonal Quasicrystals and Their Periodic Approximants // From Solid State Physics to Biophysics VI.  
(poster).
4. Salčinović, Amra; Đekić, Maja; Dominko, Damir; Šrut, Iva; Salamon, Krešimir; Starešinić, Damir; Biljaković, Katica; Schäfer, Hanjo; Demšar, Jure; Socol, Gabriel; Ristoscu, Carmen; Mihailescu, Ion; Siketić, Zdravko; Bogdanović-Radović, Iva; Šamić, Hasnija; Marcus, Jacques.  
Optimal conditions for pulsed laser deposition of  $\text{K}_{0.3}\text{MoO}_3$  thin films.  
(poster).
5. Bišćan, Marijan; Kregar, Zlatko; Krstulović, Nikša; Milošević, Slobodan.  
Spectroscopy of GaAs laser produced plasma // 14th Joint Vacuum Conference - 12th European Vacuum Conference - 11th Annual Meeting of the German Vacuum Society - 19th Croatian - Slovenian Vacuum Meeting, Book of abstracts / Radić, Nikola ; Milošević, Slobodan (ur.).  
Zagreb : Croatian Vacuum Society, 2012. 153-153  
(poster).
6. Car, T.; Jerčinović, M.; Radić, N.; Ivkov, J.  
Connection between activation energy of crystallization and elastic energy of the Al-TE amorphous alloys // JVC 14 / EVC 12 / AMDVG 11 / CROSLOVM 19: PROGRAMME AND BOOK OF ABSTRACT / Radić, N. ; Milošević, S. (ur.).  
Zagreb : Croatian Vacuum Society, 2012. 128-128  
(poster).
7. Damjan Pelc, Sanjin Marion, Mario Basletić, Miroslav Požek.  
Low-frequency impedance spectroscopy: role of microscopic phase separation in gelation of aqueous gelatin // Physics of Cells: From soft to living matter.  
Hyeres, Francuska, 2012. 178-178  
(poster).

8. Ivkov, Jovica; Ristić, Ramir; Babić, Emil; Figueroa, I. A.  
Hall Effect and Resistivity of Cu<sub>55</sub>Hf<sub>45-x</sub>Ti<sub>x</sub> Metallic Glasses // International Symposium on Metastable, Amorphous and Nanostructured Materials. Moskva : National University of Science and Technology, 2012. 183-183  
(poster).
9. Ivkov, Jovica; Velebit, Kristijan; Popčević, Petar; Smontara, Ana; Bilušić, Ante; Berger, H.; Forró, László.  
Transport properties of 1T-TaS<sub>2</sub> single crystal // "Physics of Low-Dimensional Conductors: Problems and Perspectives" Program and Abstracts / Balog, Ivan ; Barišić, Osor, S. ; Smontara, Ana (ur.). Zagreb : Institut za fiziku, 2012. 53-53  
(poster).
10. Jerčinović, M.; Car, T.; Radić, N.; Ivkov, J.  
Relaxation-crystallization processes in Al-TE binary amorphous thin films // JVC 14 / EVC 12 / AMDVG 11 / CROSLOVM 19: PROGRAMME AND BOOK OF ABSTRACT / Radić, N. ; Milošević. S. (ur.). Zagreb : Croatian Vacuum Society, 2012. 69-69  
(poster).
11. Klarić, Eva; Rakić, Mario; Vujičić, Nataša; Janković, Bernard; Negovetić Mandić, Višnja; Tarle, Zrinka.  
Temperature Rise During Experimental Light-Activated Bleaching // Journal of Dental Research, Vol. 91, Special Issue C.2012. 648  
(poster).
12. Kregar, Gordana; Šantić, Neven; Ban, Ticijana.  
Characterization and dynamics of rubidium magneto-optical trap induced by a pushing beam // EGAS 44th Europhysics Conference abstracts / Hanstorp, Dag ; Hartman, Henrik ; Engström, Lars ; Nilsson, Hampus ; Salomonson, Sten (ur.). Gothenburg : University of Gothenburg, 2012. 115-115  
(poster).
13. Kregar, Zlatko; Bišćan, Marijan; Milošević, Slobodan; Mozetič, Miran; Vesel, Alenka. Optical emission spectroscopy of plasma during treatment of polymers // 14th Joint Vacuum Conference - 12th European Vacuum Conference - 11th Annual Meeting of the German Vacuum Society - 19th Croatian - Slovenian Vacuum Meeting, Book of abstracts / Radić, Nikola ; Milošević, Slobodan (ur.). Zagreb : Croatian Vacuum Society, 2012. 89-89  
(poster).
14. Marović, Danijela; Tarle, Zrinka; Hiller, Karl-Anton; Ristić, Mira; Šariri, Kristina; Škrtić, Drago; Schmalz, Gottfried.  
Hybrid Composite Resins Based on Amorphous Calcium Phosphate // Journal of Dental Research, Vol. 91, Special Issue C.2012. 407  
(poster).

15. Mikšić Trontl, Vesna; Šrut, Iva; Petrović, Marin; Delač, Ida; Pervan, Petar; Kralj, Marko. Growth and atomic structure of graphene on Ir(332) // Abstract Book CMD-24, ECOSS-29, CMMP- 12, ECSCD-11 / Held, Georg ; McCoustra, Martin ; O'Reilly, Eoin ; Reuter, Karsten ; Weightman, Peter (ur.). London : Institute of Physics, 2012. 429-429 (poster).
16. Negovetić Mandić, Višnja; Demoli, Nazif; Šariri, Kristina; Pandurić, Vlatko; Klarić, Eva; Tarle, Zrinka. Holographic Assesment Of Stress During Adhesive Post Cementation // Journal of Dental Research, Vol. 91, Special Issue C.2012. 393 (poster).
17. Pandurić, Vlatko; Marović, Danijela; Šariri, Kristina; Demoli, Nazif; Prskalo, Katica; Tarle, Zrinka. Microhardness Evaluation of Composite-Resin Materials // Journal of Dental Research, Vol. 91, Special Issue C.2012. 418 (poster).
18. Petrović, Marin; Šrut, Iva; Pletikosić, Ivo; Pervan, Petar; Milun, Milorad; Runte, Sven; Busse, Carsten; Michely, Thomas; Sadowski, Jurek; Valla, Tonica; Kralj, Marko; Intercalation of Cs through wrinkles of epitaxial graphene, 76. DPG Frühjahrstagung, Berlin, Germany (poster).
19. Pichler, Goran and Rakić, Mario. 43rd EGAS, Fribourg, Švicarska, 28.6.-2.7.2012. „Atomic spectra of high-pressure Cs and Na light sources and their energy applications”, (poster)
20. Popčević, Petar; Smiljanić, Igor; Bilušić, Ante; Smontara, Ana; Batistić, Ivo; Berger, H.; Jačimović, J.; Forró, L.; Barišić, Neven; Tutiš, Eduard. Magnetic ordering of Co<sub>0.33</sub>NbS<sub>2</sub> under pressure "Physics of Low-Dimnesional Conductors: Problems and Perspectives" Program and Abstracts / Balog, Ivan ; Barišić, Osor S. ; Smontara, Ana (ur.). Zagreb : Institut za fiziku, 2012. 56-56 (poster).
21. Prskalo, Katica; Spajić, Jelena; Šariri, Kristina; Demoli, Nazif; Janković, Bernard; Klarić, Eva; Tarle, Zrinka. Laser Interferometry Measuring of Glass Ionomer Dimensional Changes // Journal of Dental Research, Vol. 91, Special Issue C. 2012. 430 (poster).
22. Salamon, K.; Milat O.; Radić, N.; Dubček, P.; Jerčinović, M.; Bernstorff, S. X-ray study of structure and morphology of magnetron sputtered W thin films // JVC 14 / EVC 12 / AMDVG 11 / CROSLOVM 19: PROGRAMME AND BOOK OF ABSTRACT / Radić, N.; Milošević. S. (ur.). Zagreb : Croatian Vacuum Society, 2012. 67-67 (poster).

23. Sović, Ivica; Drobac, Đuro.  
Gradual decrease of the intensity attenuation function // European Seismological Commission 33rd General Assembly - Book of Abstracts / Alexey Zavyalov (ur.). Moskva, 2012. 339-339 (poster).
24. Šariri, Kristina; Sović, Ivica.  
Application of image moment analysis on the microseismic noise spectra // European Seismological Commission 33rd General Assembly - Book of Abstracts / Alexey Zavyalov (ur.). Moskva, 2012. 180-180 (poster).
25. Šrut, Iva; Mikšić Trontl, Vesna; Petrović, Marin; Delač, Ida; Pervan, Petar; Kralj, Marko.  
"Controlling the growth of graphene on a stepped Iridium surface", Poster on 4th Joint Vacuum Conference, 12th European Vacuum Conference, 11th Annual Meeting of the German Vacuum Society, 19th Croatian - Slovenian Vacuum Meeting, Dubrovnik, Croatia, June 2012.  
(poster).
26. Tarle, Zrinka; Pandurić, Vlatko; Mrakučić, Maja; Marović, Danijela; Šariri, Kristina; Demoli, Nazif; Sović, Ivica. Dimensional Changes of Methacrylate/Silorane-based Composites Measured by Laser Interferometry // Journal of Dental Research, Vol. 91, Special Issue C. 2012. 520  
(poster).
27. Velebit, Kristijan; Popčević, Petar; Tutiš, Eduard; Smontara, Ana; Berger, H.; Forró, L.; Eichler, M.; Wu, D.; Barišić, Neven; Dressel, M. Optical conductivity of the nano-textured phase in 1T-TaS<sub>2</sub> "Physics of Low-Dimensional Conductors: Problems and Perspectives", Program and Abstracts, Balog, Ivan ; Barišić, Osor, S. ; Smontara, Ana (ur.). Zagreb : Institut za fiziku, 2012.  
(poster).
28. Vrankić, Martina; Gržeta, Biserka; Kurajica, Stanislav; Mandić, Vilko; Tkalčec, Emilija; Milošević, Slobodan; Čeh, Miran; Rakvin, Boris.  
Structural properties and photoluminescence of nanocrystalline gahnite doped with titanium // SIWAN5 5th Szeged International Workshop on Advances in Nanoscience / Konya, Z., Kukovecz, A. (ur.). Budapest : Akademiai Kiado, 2012. 175-175  
(poster).
29. A. Salčinović, M. Đekić, D. Dominko, I. Šrut, K. Salamon, D. Starešinić, K. Biljaković, H. Schäfer, J. Demšar, G. Socol, C. Ristoscu, I. N. Mihailescu, Z. Siketić, I. Bogdanović-Radović, H. Šamic and J. Marcus  
*Optimal conditions for plasma laser deposition of K<sub>0.3</sub>MoO<sub>3</sub> thin films*  
JVC-14 / EVC-12 / AMDVG-11 / CroSloVM-19, Dubrovnik, Croatia, 4-8 June 2012  
(poster).

## 4.5. Participation

1. S. Milošević COST action MP1101: Biomedical Applications of Atmospheric Pressure Plasma Technology (1st workshop Bari, Italija 15-17.2.2012.).  
(Participation)

2. S. Milošević COST action MP1101: Biomedical Applications of Atmospheric Pressure Plasma Technology (2nd workshop Dublin, Irska 22.10.2012.).  
(Participation)

3. Ana Smontara,  
Collaborative Workshop on Modulation and Nanostructuring in Layered Materials, 28 - 31 March 2012, Institute of Physics, Zagreb, Croatia  
(Participation, chair person)

4. Ana Smontara,  
International conference *Physics of low dimensional conductors: Problems and perspective* 25 – 28 March 2012, Institute of Physics, Zagreb, Croatia  
(Participation, workshop organizer )

5. Jovica Ivkov  
Collaborative Workshop on Modulation and Nanostructuring in Layered Materials, 28 - 31 March 2012, Institute of Physics, Zagreb, Croatia  
(Participation)

6. Kristijan Velebit  
Collaborative Workshop on Modulation and Nanostructuring in Layered Materials, 28 - 31 March 2012, Institute of Physics, Zagreb, Croatia  
(Participation)

## 4.6. Seminars

20.12.2012.  
Primjena ultrabrze spektroskopije u proučavanju molekularnog prijenosa energije  
Dr. sc. Silvije Vdović.  
Institut za fiziku.

7.12.2012.  
Quo vadis condensed matter physics?  
Prof. László Forró.

29.11.2012.  
Ultrabrza spektroskopija u srednjem infracrvenom valnom području  
Dr. sc. Hrvoje Skenderović.  
Institut za fiziku, Bijenička 46, Zagreb.

8.11.2012.

Povijest i budućnost elektromagnetskih metamaterijala - od žičica i podložnih pločica do nano-cijevi i kvantnih točaka

Prof. dr. sc. Silvio Hrabar.

Fakultet elektrotehnike i računarstva, Sveučilište u Zagrebu, Unska 3, Zagreb.

6.11.2012.

Znanstvenik kao autor i njegova prava

Dr. sc. Daniela Živković.

Odsjek za informacijske znanosti, Filozofski fakultet Sveučilišta u Zagrebu.

3.10.2012.

Introduction to the multi-disciplinary laboratory for microscopy and microanalysis at the University of Pretoria

Prof. dr. André Botha.

Laboratory for Microscopy and Microanalysis, University of Pretoria, South Africa.

26.9.2012.

First steps into the big snow - Marie Sklodowska Curie: The life of fighting against discrimination

Prof. Dr. Mimoza M. Ristova.

Physics Department at Faculty of natural Sciences and Mathematics,

UKIM, Skopje, R. Macedonia.

10.7.2012.

Epitaxial graphene on Ir(111) - a playground for the fabrication of graphene hybrid materials

Prof. Dr. Thomas Michely.

II. Physikalisches Institut, Universität zu Köln, Germany.

28.6.2012.

Enhancement of the figure-of-merit in strongly correlated multilayers

Dr. Veljko Zlatić.

Max Planck Institute, Dresden, Njemačka.

12.6.2012.

Theoretical spectroscopy of graphene and carbon nanotubes

Dr. Duncan John Mowbray.

Nano-Bio Spectroscopy Group and ETSF Scientific Development Centre,

Departamento de Física de Materiales, Universidad del País Vasco UPV/EHU and

DIPC (Donostia International Physic Center), E-20018 San Sebastián, Spain.



30.4.2012.

Proučavanje magnetskog uređenja u sustavu sa spinskim lancima  $\text{CuSe}_2\text{O}_5$  tehnikama magnetske rezonancije

dr.sc. Mirta Herak.

Institut za fiziku, Zagreb.

20.4.2012.

Enhancement of the figure-of-merit in strongly correlated multilayers

Dr. Veljko Zlatić.

Joint Institute for Atomic Energy, Tokay, Japan.

16.4.2012.

Enhancement of the figure-of-merit in strongly correlated multilayers

Dr. Veljko Zlatić.

Yukawa Institute, Kyoto, Japan.

12.4.2012.

Kondo effect of heavy fermions

Dr. Veljko Zlatić.

Physics Department Hiroshima University, Japan.

## **5. 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;**

1. Contract on collaboration between IP and Faculty for Natural Sciences, University of Zagreb, signed 14.03.2012.
2. Agreement on scientific and technological collaboration between IP Zagreb and PMF University Sarajevo, BIH. Signed 14.03.2012.

**6. 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);**

6.1. Evidence of Undergraduate Teaching in Academic Year 2011/2012

prezime, ime	zvanje	institucija	naziv kolegija	sati	nositelj	suglas .
Aumiler	VZS	PMF	Osnove atom i mol.fizike	15		NE
Aviani	ZS	PMF ST	Fizika 1		Dr Aviani	IF PMF ST
Aviani	ZS	PMF	Multimedil. prezentacije	15		NE
Beuc	ZSV	Zdrav. Veleučil.	Fizika	60		NE
Biljaković	ZSV	PMF RI	Fizika materijala 1			IF PMF RI
Čulo, M.	asistent	PMF	Fizički praktikum 3	60	Dr.sc. E. Tafra	DA
Čulo, M.	asistent	PMF	Fizički praktikum 4	60	Dr.sc. E. Tafra	
Delač, I.	asistent	PMF	Napredni fizički praktikum 1	60		DA
Delač, I.	asistent	PMF	Napredni fizički praktikum 2	60		
Erjavec	Viši str.sur.	PMF	Multimed. prezenatcije	45		NE
Grgičin	asistent	PMF	Napredni fizički praktikum 1	60		NE
Grgičin	asistent	PMF	Napredni fizički praktikum 2	60		DA
Herak	viši asistent	PMF	Fizički praktikum za kemičare	60	D. Pajić	NE
Herak	viši asistent	PMF	Praktikum iz moderne fizike 4.	60	I. Kokanović	
Jurić	asistent	PMF	Statistička fizika	15		DA
Levatić	asistent	PMF	Fizički praktikum 1	60		DA
Marion	asistent	PMF	Napredni Fizički praktikum 2	60		NE

Milat	ZSV	PMF RI	Fizika materijala 1			IF PMF RI
Nossan	viši asistent	PMF	Hidrodinamika	15	Prof. Batistić	DA
Uzelac	ZSV	PMF	Napredna stat. Fizika 4	30	K. Uzelac	NE
Velebit	asistent	PMF	Praktikum iz fizike	60	Dr.sc. D. Pajić	NE
Vujičić	asistent	PMF	Elektrodinamika	45		DA

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OPTEREĆENJE 900

## 6.2. Evidence of Undergraduate Teaching in Academic Year 2012/2013

prezime, ime	zvanje	institucija	naziv kolegija	sati	nositelj	suglas .
Aumiler, Damir	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+4 5		DA
Biljaković	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. prezentacije	45		DA
Grgičin, D.	asistent	PMF	Napredni fizički praktikum 1	60	E. Tafra	DA
Herak, M.	ZS	PMF	Praktikum iz moderne	45		

			fizike			
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

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1080

### 6.3. Evidence of Postgraduate Teaching in Academic Year 2011/2012

prezime, ime	zvanje	institucija	naziv kolegija	sati	nositelj	suglas .
Ban, Tacijana	ZSV	PMF	Femtosek.laserska spektros.	45	Ban, Tacijana	NE
Beuc, Robert	ZSV	PMF	Teorija optičkih spektara dvoatomskih 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 spektroskop.	45		NE
Tutiš, Edo	VZS	PMF	Fizika poluvodiča	22	Tutiš, Edo	NE
Šiber, Antonio	ZSV	PMF	Molekularna biofizika		Šiber, Antonio	NE

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#### 6.4. Evidence of Postgraduate Teaching in Academic Year 2012/2013

prezime, ime	zvanje	institucija	naziv kolegija	sati	nositelj	suglas
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	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 spektroskop.	45		NE
Tutiš, Edo	VZS	PMF	Fizika poluvodiča	22	Tutiš, Edo	NE
Šiber, Antonio	ZSV	PMF	Molekularna biofizika		Šiber, Antonio	NE

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## 7. Lists of supervision of graduate theses and supervision of postgraduate (PhD) programmes for 2012.

### 7.1. Diploma theses

1. Bali, Tibor.

LIBS spektroskopija i primjene / završni rad - diplomski/integralni studij.

Zagreb : Prirodoslovno-matematički fakultet, 09.07. 2012, 51 str. Voditelj: Milošević, Slobodan.

2. Krajinović, Ivan.

Zakrivljeni grafen ; Modulacija elektronskih svojstava / završni rad - diplomski/integralni studij. Zagreb : Prirodoslovno-matematički fakultet, 21.09. 2012, 59 str. Voditelj: Kralj, Marko.

3. Marelja, Marko.

Simulacija ne-sfernih zrcala i anamornih slika metodom praćenja svjetlosnih zraka / završni rad - diplomski/integralni studij. Zagreb : Prirodoslovno-matematički fakultet, 13.12 2012, 62 str. Voditelj: Šiber, Antonio.

4. Vurnek, Damir.

Manning kondenzacija na DNK fragmentima sa monovalentnim i divalentnim protuionima / diplomski rad. Zagreb : PMF, 27.09. 2012, 32 str. Voditelj: Vuletić, Tomislav

5. B. Dimić: Primjena fluorescentne korelacijske spektroskopije u istraživanju molekularne dinamike / diplomski rad, PMF - Fizički odsjek, smjer prof. fizike (24.10.2012.), D.Aumiler

6. M. Šoštar: Fluorescentna korelacijska spektroskopija biomolekula Diplomski rad, PMF - Fizički odsjek, smjer dipl. inž. fizike (27.06.2012.), D.Aumiler

7. N. Šantić, Lasersko hlađenje atoma, - Diplomski rad, srpanj 2012., T. Ban

8. Damir Huljenić, "Primjena vremenski usrednjene holografske interferometrije na vizualiziranje modova titranja tanke pravokutne ploče", Sveučilište u Zagrebu, PMF, obrana: 13.06.2012., N. Demoli

9. Šurija, Vinko,

Magnetska dinamika kvazi-2D sustava Fe<sub>8</sub>Te<sub>12</sub>O<sub>32</sub>Cl<sub>6</sub> / završni rad - diplomski/integralni studij. Zagreb : Prirodoslovno-matematički fakultet, 19.12. 2012., 49 str. Voditelj: Živković, Ivica.



## 7.2. Defended doctorates

1. Dominko, Damir.

Utjecaj kristalnih defekata na fazna pobuđenja u valovima gustoće naboja / doktorska disertacija. zagreb : PMF-fizički odsjek, 25.9.2012 2012, 146 str. Voditelj: dr. sc. Damir Starešinić.

2. Pletikosić, Ivo.

Electronic States of Epitaxial Graphene on Iridium from almost neutral to highly doped graphene / doktorska disertacija.

Zagreb : Prirodoslovno matematički fakultet, 14.06. 2012, 82 str. Voditelj: Pervan, Petar.

## 7.3. Doctorates in progress

G. Pichler

M. Rakić, PhD student, Physics Department, Faculty of mathematics and natural sciences, University of Zagreb.

T. Ban

Gordana Kregar, Ph.D. student, Physics Department, Faculty of mathematics and natural sciences, University of Zagreb.

S. Milošević

Zlatko Kregar. doctoral study 3rd year

Department of Physics, Faculty of Science, University of Zagreb

Marijan Biščan, doctoral study 2nd year

Department of Physics, Faculty of Science, University of Zagreb

Vedran Šantak, doctoral study 2nd year

School of dental medicine, University of Zagreb

co-mentor prof. Zrinka Tarle

R. Beuc

G. Gatalica, doctoral thesis

Department of Physics, Faculty of Science, University of Zagreb

N. Demoli

J. Spajić, doctoral study

Comparison of dimensional changes and mechanical properties of bioactive restorative materials

School of Dental Medicine, University of Zagreb

M. Mrakužić, doctoral study

Analysis of physical properties of photopolimerization composite materials with various organic matr

School of Dental Medicine, University of Zagreb

E. Tutiš  
Ivan Jurić, Ph. D. student, 5th year

S. Tomić  
D. Grgičin, doctoral study, Physics Department, Faculty of Science, Univ. of Zagreb

B. Hamzić  
M. Čulo, doctoral study, Physics Department, Faculty of Science, Univ. of Zagreb

T. Vuletić  
I. Delač Marion, doctoral study, Physics Department, Faculty of Science, Univ. of Zagreb

A. Smontara  
K. Velebit, doctoral study in physics Department of Physics, Faculty of Science, University of Zagreb

K. Biljaković  
M. Đekić, doctoral thesis "Production and characterization of thin films of quasi-1D systems with charge density waves" Department of Physics, Faculty of Science, University of Sarajevo  
Alma Salčinović, Department of Physics, Faculty of Science, University of Sarajevo

M. Kralj  
mentor to PhD students:  
Marin Petrović  
Iva Šrut

I. Živković,  
I. Levatić, doctorat in progress

T. Vuletić  
Diploma thesis: Marija Sorić 20/12/2012, Ana Sučić 19/12/2012

## 8. List of lectures at foreign universities

1. M. Kralj, "Doing fundamental research on epitaxial grapheme: Paving the way for applications", 3rd August 2012, at the Department of Chemistry - Kyoto University, Kyoto, Japan
2. M. Kralj, "Doing fundamental research on epitaxial grapheme: Paving the way for applications", 9th August 2012, at the Department of Chemistry - Osaka University, Osaka, Japan
3. M. Petrović, "*Cesium on graphene on Ir(111): A detailed study of a graphene hybrid system*"  
Columbia University, New York, USA, November 26, 2012
4. J. Szavics-Nossan, Totally asymmetric exclusion process with slow sites: a netzuork theory approach, *teorijski seminar, 13.6.2012., ICMCS, Univeristy of Edinburgh*
5. J. Szavics-Nossan, *Ito vs. Stratonovich dilemma*, teorijski seminar, 7.11.2012., ICMCS, Univeristy of Edinburgh
6. S. Tomić, "Dynamics and Structure of Bioplyelectrolytes characterized by Dielectric Spectroscopy" Department of Physics, Chatolic University of America, Washington D.C. (July 2012).
7. S. Tomić, "Complex and nonlinear dynamics of charge and spin structures in strongly correlated systems", Physikalisches Institut, Johann Wolfgang Goethe-Universitaet Frankfurt (November 2012)
8. N. Vujičić, '*Resonant interaction of multilevel alkali atoms with optical frequency comb*'. Odsjek za kompleksnu materiju Instituta Jožef Stefan u Ljubljani

## 9. List of outreach activities

r.b.	Autor ili izvođač	Mjesto održavanja, naslov časopisa, događaja ili emisije	Vrijeme	Naslov predavanja, radionice, emisije, članka ili aktivnosti	Vrsta aktivnosti	Napomena ili link
1.	Aviani Ivica	Sisak, Gradska knjižnica	26.11.	Fizika i fotografija	Izložba nagrađenih fotografija	<a href="http://www.sisak.hr/clanak/_14916/program-sisacke-knjiznice">http://www.sisak.hr/clanak/_14916/program-sisacke-knjiznice</a>
2.	Aviani Ivica	Rijeka, Festival znanosti	23.4.	Fizika i fotografija	Izložba nagrađenih fotografija	<a href="http://www.festivalznanosti.hr/2012/rijeka/utorak">http://www.festivalznanosti.hr/2012/rijeka/utorak</a>
3.	Aviani Ivica	Kistanje, Fešta o' fizike	26.5.	Fizika i fotografija	Izložba nagrađenih fotografija	<a href="http://aviani.ifs.hr/photos/kistanje2012/index_3.html">http://aviani.ifs.hr/photos/kistanje2012/index_3.html</a>
4.	Šiber Antonio	Zagreb, Institut za filozofiju	7.12.	'Odnos znanosti i filozofije	Javno predavanje -tribina	<a href="http://www.youtube.com/watch?v=NJM4UHgRjik">http://www.youtube.com/watch?v=NJM4UHgRjik</a>
5.	Šiber Antonio	Split, Nanochannels EU Commission Project	21.4.	'Intervencija u biologiju: nano-bio-materijali i evolucija super-čovjeka, nano-kiborga'	Javno predavanje -tribina	<a href="http://www.antoniosiber.org/splificani_zele_biti_supermeni.html">http://www.antoniosiber.org/splificani_zele_biti_supermeni.html</a>
6.	Drobac Đuro	Sinj, Festival znanosti	24.10.	'Galileo-svjetlo novog doba'	Javno predavanje -tribina	<a href="http://festivalznanostisinj.org/index.php/sazetci-predavanja/26-dario-drobac-galileo-svjetlo-novog-doba">http://festivalznanostisinj.org/index.php/sazetci-predavanja/26-dario-drobac-galileo-svjetlo-novog-doba</a>
7.	Drobac Đuro i ostali	Sinj, Festival znanosti	24.10.	'Slučaj Galileo - sukob crkve i znanosti'	Javno predavanje -tribina	
8.	Aviani Ivica	Rijeka, Festival znanosti	27.4.	'Log 10^10'	Javno predavanje -tribina	<a href="http://www.festivalznanosti.hr/2012/rijeka/petak/26-rijeka/sazetak/210-log-10-10">http://www.festivalznanosti.hr/2012/rijeka/petak/26-rijeka/sazetak/210-log-10-10</a>
9.	Aviani Ivica	Split, Festival znanosti	23.4.	'Apsolutna nula'	Javno predavanje -tribina	
10.	Aviani Ivica	Kistanje, Fešta o' fizike	26.5.	'Zašto su poluvodiči dobri termoelektrici'	Javno predavanje -tribina	<a href="http://aviani.ifs.hr/photos/kistanje2012/index_3.html">http://aviani.ifs.hr/photos/kistanje2012/index_3.html</a>
11.	Aviani Ivica	Kunjevci (Vinkovci), Proletna škola fizike	19.5.	'Hod po vodi'	Javno predavanje -tribina	
12.	Aviani Ivica	Virovitica, Proletna škola fizike	11.5.	'Fizika na sceni'	Javno predavanje -tribina	
13.	Aviani Ivica	Čakovec, konferencija "Toward a Platform for Motivated and Gifted Youth"	25.2.	Collaboration among teachers and scientists: Is it possible?	Javno predavanje -tribina	<a href="http://aviani.ifs.hr/doc/abs/aviani_cakovec_2012.pdf">http://aviani.ifs.hr/doc/abs/aviani_cakovec_2012.pdf</a>
14.	Ban Ticijana	Zagreb, Festival znanosti	24.4.	'Forenzika molekula'	Javno predavanje -tribina	<a href="http://www.festivalznanosti.hr/2012/component/content/article/8-zagreb/261-forenzika-">http://www.festivalznanosti.hr/2012/component/content/article/8-zagreb/261-forenzika-</a>

						molekula
15.	Popčević Petar	Kutina, kutinski dani znanosti i umjetnosti	24.10.	'Što su kvazikristali'	Javno predavanje -tribina	<a href="http://www.portal53.hr/vijesti/sisacko-moslavacka-zupanija/98-smz/6128-kutinski-dani-znanosti-i-umjetnosti.html">http://www.portal53.hr/vijesti/sisacko-moslavacka-zupanija/98-smz/6128-kutinski-dani-znanosti-i-umjetnosti.html</a>
16.	Vdović Silvije	Zagreb, Zvezdarnica Zagreb	12.12.	'Ultrahladna plazma'	Javno predavanje -tribina	<a href="http://www.zvezdarnica.hr/index.php?option=com_content&amp;task=view&amp;id=367">http://www.zvezdarnica.hr/index.php?option=com_content&amp;task=view&amp;id=367</a>
17.	Ban Ticijana	Korčula, Državno natjecanje i smotra iz fizike	13.-16.5.	Eksperimentalni radovi srednjih škola, predsjednica povjerenstva	Ocjenjivanje eksperimentalnih radova, suradnja s AOO	<a href="http://natjecanja.hfd.hr/smotra_natjecanje/2011-12/index.php">http://natjecanja.hfd.hr/smotra_natjecanje/2011-12/index.php</a>
18.	Marohnić Željko	Zagreb, Državni turnir mladih fizičara	5.2.	Član povjerenstva	Ocjenjivanje radova i priprema kandidata za Međunarodni turnir, suradnja s AOO	<a href="http://turnir.hfd.hr/2011-12/">http://turnir.hfd.hr/2011-12/</a>
19.	Aviani Ivica i Erjavec Berti	Zagreb, Institut za fiziku	siječanj - prosinac 2012.	Projekt FIZIKA, aktivnost "Magnetske interakcije", potpora MZOS-a	Pilot projekt za darovite učenike u suradnji s 15. gimnazijom Zagreb	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
20.	Kralj Marko i suradnici	Zagreb, Institut za fiziku	siječanj - prosinac 2012.	Projekt FIZIKA, aktivnost "Grafen", potpora MZOS-a	Pilot projekt za darovite učenike u suradnji s 15. gimnazijom Zagreb	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
21.	Demoli Nazif	Zagreb, Institut za fiziku	siječanj - prosinac 2012.	Projekt FIZIKA, aktivnost "Izrada holograma", potpora MZOS-a	Pilot projekt za darovite učenike u suradnji s 15. gimnazijom Zagreb	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
22.	Demoli Nazif	Zagreb, Institut za fiziku	siječanj - prosinac 2012.	Projekt FIZIKA, aktivnost "Digitalna holografija", potpora MZOS-a	Pilot projekt za darovite učenike u suradnji s 15. gimnazijom Zagreb	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
23.	Milošević Slobodan i Erjavec Berti	Zagreb, Institut za fiziku	siječanj - prosinac 2012.	Projekt FIZIKA, aktivnost "Spektroskopija", potpora MZOS-a	Pilot projekt za darovite učenike u suradnji s 15. gimnazijom Zagreb	Projekt FIZIKA 16/01/2012 - 03/06/2013. ostavaren uz potporu MZOS-a
24.	Erjavec Berti	Čakovec, konferencija "Toward a Platform for Motivated and Gifted Youth"	24.-27.2.	Physics projects for Gifted students: Experience and first results	Predavanje i sudjelovanje u radionicama	<a href="http://iszd.hr/2012/01/tpmgv/">http://iszd.hr/2012/01/tpmgv/</a>
25.	Aviani Ivica	Zagreb, Međužupanijski stručni skup za nastavnike fizike	31. 01.	'Molekularno kinetička teorija'	Predavanje za nastavnike fizike, suradnja s AOO	
26.	Aviani Ivica	Zagreb, Međužupanijski stručni skup za nastavnike	23.2.	'Toplina u svijetu molekula'	Predavanje za nastavnike fizike, suradnja s AOO	

		fizike				
27.	Aviani Ivica	Zagreb, Međuzupanijski stručni skup za nastavnike fizike	17. 04.	'Treći zakon termodinamike''	Predavanje za nastavnike fizike, suradnja s AOO	
28.	Aviani Ivica	Zagreb, Međuzupanijski stručni skup za nastavnike fizike	24.5.	'Termodinamički principi toplinskih strojeva''	Predavanje za nastavnike fizike, suradnja s AOO	
29.	Aviani Ivica	Pula, Županijsko stručno vijeće županije profesora fizike Istarske županije	3.12.	'Temeljni koncepti termodinamike''	Predavanje za nastavnike fizike, suradnja s AOO	
30.	Aviani Ivica	Garešnica, Županijsko stručno vijeće Bjelovarsko-bilogorske županije	7.3.	'O silama i o tome kako postupati s njima''	Predavanje za nastavnike fizike, suradnja s AOO	<a href="http://aviani.ifs.hr/doc/abs/Osilama_i_o_tome_kako_postupati_s_njima.pdf">http://aviani.ifs.hr/doc/abs/Osilama_i_o_tome_kako_postupati_s_njima.pdf</a>
31.	Milošević Slobodan	Opatija, Državni stručni skup za učitelje fizike osnovnih škola	2.4.	'Vakuum''	Predavanje za nastavnike fizike, suradnja s AOO	
32.	Šiber Antonio	Zagreb, Institut za fiziku	20.2.	'Načinjeno od grafena''	Predavanje za učenike	<a href="http://www.youtube.com/watch?v=4U1ubnd9_bY">http://www.youtube.com/watch?v=4U1ubnd9_bY</a>
33.	Drobac Đuro	Sinj, Franjevačka klasična gimnazija	25.10.	'Priča o magnetizmu''	Predavanje za učenike	<a href="http://www.fra-gimnazija-sinj.com/index.php?option=com_content&amp;view=article&amp;id=320:dr-sc-uro-drobac-pria-o-magnetizmu-predavanje&amp;catid=44:desni-moduli">http://www.fra-gimnazija-sinj.com/index.php?option=com_content&amp;view=article&amp;id=320:dr-sc-uro-drobac-pria-o-magnetizmu-predavanje&amp;catid=44:desni-moduli</a>
34.	Aviani Ivica	Virovitica, Proletna škola fizike	11.5.	'Fizika na površini vode'	Predavanje za učenike	
35.	Vuletić Tomislav	Mali Lošinj, 27. ljetna škola mladih fizičara	21.6.	'DNK ima atmosferu''	Predavanje za učenike	<a href="http://ljskola.hfd.hr/ljskola.php">http://ljskola.hfd.hr/ljskola.php</a>
36.	Ban Ticijana	HR1, Divni novi svijet	9.4.2012. i 16.4.2012.	'Laseri''	Radio emisija o prirodnim znanostima	Održane dvije emisije
37.	Erjavec Berti	Zagreb, 15. gimnazija, Aktiv nastavnika fizike grada Zagreba	22.5.	Gibanje i međudjelovanje	Radionica za nastavnike gimnazija, suradnja s AOO	

38.	Erjavec Berti	Opatija, Državni stručni skup za učitelje fizike osnovnih škola	2.-4.4.	Gibanje i međudjelovanje	Radionica za nastavnike osnovnih škola, suradnja s AOO	Održane tri radionice za oko 90 nastavnika
39.	Aviani Ivica	Opatija, Državni stručni skup za učitelje fizike osnovnih škola	2.-4.4.	Toplina i temperatura	Radionica za nastavnike osnovnih škola, suradnja s AOO	<a href="http://aviani.ifs.hr/doc/abs/Toplina_i_temperatura_Aviani.pdf">http://aviani.ifs.hr/doc/abs/Toplina_i_temperatura_Aviani.pdf</a>
40.	Aviani Ivica	Opatija, Državni stručni skup za nastavnike fizike strukovnih škola i gimnazija	4.-6. 04.	Temeljni koncepti termodinamike	Radionica za nastavnike strukovnih škola i gimnazija, suradnja s AOO	<a href="http://aviani.ifs.hr/doc/abs/Temeljni_koncepti_termodinamike_Aviani.pdf">http://aviani.ifs.hr/doc/abs/Temeljni_koncepti_termodinamike_Aviani.pdf</a>
41.	Erjavec Berti	Mali Lošinj, 27. ljetna škola mladih fizičara	19.6.	Poigravimo se magnetima	Radionica za učenike	<a href="http://ljskola.hfd.hr/ljskola.php">http://ljskola.hfd.hr/ljskola.php</a>
42.	Erjavec Berti	Osijek, 8. Zimska škola fizike	11.2.	"Poigravimo se magnetima"	Radionica za ukupno 80 učenika osnovne škole, suradnja s AOO	<a href="http://www.ifs.hr/Poigravimosemagnetima/index.html">http://www.ifs.hr/Poigravimosemagnetima/index.html</a>
43.	Aviani Ivica i suradnici	Zagreb, Institut za fiziku	siječanj - lipanj	'Konceptualna termodinamika', 6 radionica za nastavnike osnovnih i srednjih škola	Radionice i predavanja za nastavnike organizirane u suradnji s AOO	<a href="http://www.ifs.hr/News.aspx?ID=111">http://www.ifs.hr/News.aspx?ID=111</a>
44.	Aviani Ivica	Sarajevo, Prirodno-matematički fakultet	6.11.	'Hod po vodi: fizika supervodoodbojnosti'	Seminar za nastavnike Kantona	<a href="http://aviani.ifs.hr/doc/abs/Hod_po_vodi_Sarajevo.pdf">http://aviani.ifs.hr/doc/abs/Hod_po_vodi_Sarajevo.pdf</a>
45.	Vujčić Nataša, Erjavec Berti	HTV1, Moć boja	1.8.	Fizikalni aspekt boja	TV emisija, dokumentarni program	<a href="http://www.youtube.com/watch?v=LLAnf5IxOLU&amp;feature=youtu.be">http://www.youtube.com/watch?v=LLAnf5IxOLU&amp;feature=youtu.be</a>
46.	Šiber Antonio	HTV1, Među nama	20.3.	'Nove tehnologije u službi zdravlja'	TV emisija, obrazovni program	<a href="http://www.youtube.com/watch?feature=player_detailpage&amp;list=UUJQeNh4-zhUAtneINViedQ&amp;v=blm7aZsaxLA">http://www.youtube.com/watch?feature=player_detailpage&amp;list=UUJQeNh4-zhUAtneINViedQ&amp;v=blm7aZsaxLA</a>
47.	Erjavec Berti	HTV2, Puni krug	8.6.	Fizika sladoleda	TV emisija, obrazovni program	<a href="https://www.youtube.com/watch?v=EgIAOGpO70k&amp;feature=plcp">https://www.youtube.com/watch?v=EgIAOGpO70k&amp;feature=plcp</a>
48.	Erjavec Berti	HTV 2, Školski sat	14.12.	'Kako nastaje oblak'	TV emisija, obrazovni program	<a href="http://www.youtube.com/watch?v=IQ0vgUOgMck&amp;list=UUJQeNh4-zhUAtneINViedQ&amp;index=2">http://www.youtube.com/watch?v=IQ0vgUOgMck&amp;list=UUJQeNh4-zhUAtneINViedQ&amp;index=2</a>
49.	Aviani Ivica	HTV 2, Školski sat	6. 02.	'Termodinamika'	TV emisija, obrazovni program	<a href="http://www.youtube.com/watch?v=56fbpCVhQSQ&amp;list=UUJQeNh4-zhUAtneINViedQ&amp;index=3&amp;feature=plcp">http://www.youtube.com/watch?v=56fbpCVhQSQ&amp;list=UUJQeNh4-zhUAtneINViedQ&amp;index=3&amp;feature=plcp</a>

50.	Aviani Ivica	HTV 2, Školski sat	26.3.	'Toplo - hladno'	TV emisija, obrazovni program	<a href="http://www.youtube.com/watch?list=UUJ0ueNh4-zhUAtneINViedQ&amp;v=7KMoQTi bLG8&amp;feature=player_detailpage">http://www.youtube.com/watch?list=UUJ0ueNh4-zhUAtneINViedQ&amp;v=7KMoQTi bLG8&amp;feature=player_detailpage</a>
51.	Aviani Ivica	HTV 2, Školski sat	28.5.	'Što sve može toplina?'	TV emisija, obrazovni program	<a href="https://www.youtube.com/watch?v=Z5DMHW1Pwi0&amp;feature=plcp">https://www.youtube.com/watch?v=Z5DMHW1Pwi0&amp;feature=plcp</a>
52.	Aviani Ivica	HTV 2, Školski sat	3.9.	'Elektrostatika	TV emisija, obrazovni program	
53.	Aviani Ivica	HTV 2, Školski sat	18.10.	'Fizika novčića'	TV emisija, obrazovni program	<a href="http://www.youtube.com/watch?v=pT5L1ZhnQ7k">http://www.youtube.com/watch?v=pT5L1ZhnQ7k</a>
54.	Demoli Nazif	HTV 1, Trenutak spoznaje	9.2.	'Interpretacija i primjena holografskog koncepta'	TV emisija, obrazovni program	
55.	Demoli Nazif	HTV 2, Školski sat	26.1.	Hologram asteroida	TV emisija, obrazovni program	
56.	Šiber Antonio	HTV 1, Znanstvena petica	12.10.	'Virusi'	TV emisija, znanstveni program	<a href="http://www.youtube.com/watch?list=UUJ0ueNh4-zhUAtneINViedQ&amp;feature=player_detailpage&amp;v=QIvUieBg1c">http://www.youtube.com/watch?list=UUJ0ueNh4-zhUAtneINViedQ&amp;feature=player_detailpage&amp;v=QIvUieBg1c</a>
57.	Živković Ivica, Prester Mladen	HTV 1, Trenutak spoznaje	11.10.	'Znanost i tehnologija'	TV emisija, znanstveni program	<a href="http://www.hrt.hr/index.php?id=en&amp;tx_ttnews%5Bcat%5D=540&amp;cHash=370ecd75be">http://www.hrt.hr/index.php?id=en&amp;tx_ttnews%5Bcat%5D=540&amp;cHash=370ecd75be</a>
58.	Erjavec Berti	Matematičko-fizički list, LXIII 1/249, 2012./2013., 60-62.	2012.	'Što je zapravo sila?'	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Publicdocuments/BErjavec-mfl1-249.pdf">http://www.ifs.hr/Publicdocuments/BErjavec-mfl1-249.pdf</a>
59.	Aviani Ivica	Universitas broj 29, 2012.	2012.	"Apsolutna nula"	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Publicdocuments/Apsolutna_nula_Aviani_universitas_br_29.pdf">http://www.ifs.hr/Publicdocuments/Apsolutna_nula_Aviani_universitas_br_29.pdf</a>
60.	Čulo Matija	Matematičko-fizički list, LXII 3/247, 2011./2012., 154-162.	2012.	"Ferrotekućine"	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Publicdocuments/Ferrotekucine.pdf">http://www.ifs.hr/Publicdocuments/Ferrotekucine.pdf</a>
61.	Popčević Petar	Matematičko-fizički list, LXIII 1/249, 2012./2013., 63-64.	2012.	"Prozirne solarne ćelije"	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Publicdocuments/PPopcevic-mfl1-249.pdf">http://www.ifs.hr/Publicdocuments/PPopcevic-mfl1-249.pdf</a>
62.	Popčević Petar	Matematičko-fizički list, LXII 3/247, 2011./2012., 147-153.	2012.	"Osvrt na Nobelovu nagradu za otkriće kvazikristala"	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Publicdocuments/mfl-201206.pdf">http://www.ifs.hr/Publicdocuments/mfl-201206.pdf</a>
63.	Popčević Petar	Matematičko-fizički list, LXIII 2/250, 2012./2013., 141-142..	2012.	"Ultranke leće"	Znanstveno - popularni članak	<a href="http://www.ifs.hr/Publicdocuments/mfl2-250-popcevic.pdf">http://www.ifs.hr/Publicdocuments/mfl2-250-popcevic.pdf</a>
64.	Smontara, Popčević, Erjavec	Matematičko-fizički list	2012./2013.	Članovi uređivačkog odbora	Znanstveno popularni časopis za popularizaciju matematike, fizike i informatike	<a href="http://web.math.pmf.unizg.hr/mfl/ured.htm">http://web.math.pmf.unizg.hr/mfl/ured.htm</a>



65.	Aviani Ivica	E-škola fizike	2012.	Urednik portala	Znanstveno popularni portal za popularizaciju fizike	<a href="http://eskola.hfd.hr">http://eskola.hfd.hr</a>
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