

Questionnaire

Summary of the main activities of a scientific Organisation of the Slovak Academy of Sciences

Period: January 1, 2007 - December 31, 2011

I. Formal information on the assessed Organisation:

1. Legal name and address

Institute of Physics, Slovak Academy of Sciences (IP SAS), Dubravska cesta 9,
84511 Bratislava, Slovakia

2. Executive body of the Organisation and its composition

Directoriat	name	age	years in the position
director	RNDr. Stanislav Hlaváč, CSc	65	1
deputy director	Ing. Peter Švec, D.Sc	57	1
scientific secretary	RNDr. Peter Filip, PhD	42	3

3. Head of the Scientific Board

Assoc. Prof. RNDr. Emil Běták, D.Sc

4. Basic information about the research personnel

- i. Number of employees with a university degree (PhD students excluded) engaged in research and development and their full time equivalent work capacity (FTE) in 2007, 2008, 2009, 2010, 2011 and average number during the assessment period

Year	No of employees	FTE
2007	55	50.6
2008	57	53.4
2009	58	52.7
2010	70	61.2
2011	66	58.25
Average	61.2	55.23

ii. Organisation units/departments and their FTE employees with the university degree engaged in research and development

Research staff	2007		2008		2009		2010		2011		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
organisation in whole	67	50.60	66	53.40	63	52.70	76	61.20	66	58.25	67.6	55.2
Department of Applied Physics	6	5.00	6	5.00	-	-	-	-	-	-	6.00	5.00
Department of Complex Physical Systems	9	6.45	9	8.00	10	9.25	12	9.75	10	9.65	10.00	8.62
Department of Metal Physics	9	7.55	8	7.10	16	13.00	17	14.20	15	13.99	13.00	11.17
Department of Multilayers and Nanostructures	7	4.25	7	5.05	11	8.65	13	10.50	10	9.60	9.60	7.61
Department of Nuclear Physics	12	10.00	12	10.00	10	9.30	12	10.65	12	9.70	11.60	9.93
Department of Solid State Physics	6	3.00	5	3.00	-	-	-	-	-	-	5.50	3.00
Department of Theoretical Physics	7	6.85	7	6.25	8	6.50	9	7.50	8	6.62	7.80	6.74
Department of Thermophysics	3	2.00	4	3.00	-	-	-	-	-	-	3.50	2.50
Research Center for Quantum Information	8	5.00	8	6.00	6	5.00	11	7.60	9	6.42	8.40	6.00
Unaffiliated	-	-	-	-	2	1.00	2	1.00	2	1.00	2.00	1.00

In accord with suggestions of previous assesment, the structure of the Institute was modified in 2008. Three departments were inactivated and their research personnel were integrated in present departments.

5. Basic information on the funding

- i. Total salary budget¹ of the Organisation allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2007, 2008, 2009, 2010, 2011 and average amount for the assessment period

Salary budget	2007	2008	2009	2010	2011	average
total salary budget (millions of EUR)	0.793	0.867	0.882	0.927	0.908	0.875

6. URL of the Organisation's web site

<http://www.fu.sav.sk/>

II. General information on the research and development activity of the Organisation:

1. Mission Statement of the Organisation as presented in its Foundation Charter

IP SAS is a contributory scientific organization established on October 1st, 1955. The mission of the organization is:

- a) experimental and theoretical scientific and research activities in the field of physics of condensed matter, nuclear and subnuclear physics, quantum electronics, optics, electronics, automation and control systems, material engineering and nanotechnologies
- b) consultations and expertise services in the areas mentioned above for domestic and foreign clients including sale of special equipments and materials developed and produced at IP SAS
- c) IP SAS provides PhD studies in the accredited programmes and guarantees participation of researchers in pedagogical activities at universities.
- d) IP SAS takes care of publishing scientific results via periodic and non – periodic press. IP SAS is the publisher of the journal Acta Physica Slovaca.

2. Summary of R&D activity pursued by the Organisation during the assessed period, from both national and international aspects and its incorporation in the European Research Area (max. 10 pages)

Department of Complex Physical Systems

Head: Štefan Olejník

Ján Brndiar, René Derian, Pavol Kalinay, Ľubomír Martinovič, Martin Plesch, Ladislav Šamaj, Ivan Štich, Anton Šurda, Igor Travěnc, Robert Turanský

¹ Objem mzdových prostriedkov bez odvodov do poisťovní so započítaním sumy miezd pracovníkov THS, ktorú organizácii poskytne ETO Úradu SAV. Rozpočet v Sk prepočítajte na eurá podľa konverzného kurzu 1€ = 30,126. (Podobne aj v ďalších tabuľkách.)

Research focuses on theoretical investigations of various complex physical systems by analytical and numerical means. Main results were achieved in the following directions:

Computer modelling of condensed-matter systems

(a) *Mechanochemistry*: Using DFT techniques we investigated properties of organometallic nanojunctions, in particular mechanical vs. thermal activation of the system thiolate-copper, and mechanically vs. opto-mechanically driven molecular switches (azobenzene-metal junctions). The finding was that the form of activation played key role at the fragmentation of investigated nanojunctions. The study of the molecular switch demonstrated that switching can be driven purely mechanically or opto-mechanically, but not purely optically.

(b) *Nanotribology*: We have studied the different frictional branches identified in static AFM experiments for antimony nanoclusters sliding on HOPG substrate and provided atomic-scale explanation for all frictional branches. The study was based on DFT-D-type of description which captures also dispersion interactions. Study of dispersion interactions and their approximate description by DFT techniques was another important ingredient.

(c) *Non-contact AFM*: Image contrast reversal experimentally observed on Cu(111) was studied using DFT modelling and was attributed to unusually large stability of the tip-substrate nanojunction in copper, as opposed to other related materials, such as gold.

(d) *QMC study of correlations in condensed matter systems*: The methods were applied to ground/excited singlet/triplet states of photo-switchable azobenzene molecule and for determination of spin multiplicity in transition metal-benzene sandwiches and half-sandwiches.

The research was conducted in cooperation with (a) Ruhr. Univ. Bochum, (b) Münster Univ. (project NANOPARMA supported by the European Science Foundation, ESF), (c) Basel Univ., Osaka Univ. and King's College London, and (d) North Carolina State Univ. (NCSU).

Statistical mechanics of Coulomb systems

Important exact results were obtained in the field of equilibrium statistical mechanics of systems of particles interacting via Coulomb pair interaction. For classical 2D Coulomb systems, a number of problems related to the presence of a guest charge inside an electrolyte were solved. In the field of 3D Coulomb systems interacting with electromagnetic radiation, based on exact solution of microscopic models, the 60-years old problem of controversial high-temperature aspects of the Casimir effect was resolved. Further, we investigated systems composed of charged particles with electromagnetic interaction, focusing on electromagnetic-field fluctuations, induced by random thermal motion of particles. In the field of 2D classical Coulomb systems, exact formulas were derived for fluctuations of the induced potential. Other results comprise the derivation of exact sum rules for charge correlation functions of Coulomb systems near an interface between two distinct electrical media, in the quantum and classical cases, taking into account retardation effects. Finally, we derived an effective interaction between macro-ions immersed into an electrolyte at low temperature. The result, in perfect agreement with MC simulations, confirms an effective attraction of equally charged macro-ions. We also published three review articles for *Acta Physica Slovaca* on integrable models of many-body systems. They will soon be published as a monograph by Cambridge Univ. Press. Our research was done in part with scientists from Univ. Paris Sud in Orsay and supported by the ESF project MISGAM.

Transport processes in quasi one-dimensional structures

We studied transport of molecules (particles) in nonhomogeneous narrow channels. Understanding of motion of large particles through channels, along fibres, or passing through membranes, require to reduce the 2D or 3D description to the corresponding mapped 1D evolution equation, governing the linear (1D) particle density along the channel. A rigorous algorithm of such mapping was proposed for diffusion and diffusion driven by external force in a channel with varying cross section, generating systematically corrections to the Fick-Jacobs (1D Smoluchowski) equation, which represents the simplest form of the mapped equation. Results are applicable to transport in biological systems, nanostructures or zeolites, also for description

of specific models, like Brownian pumps or stochastic resonance. If the channel is extremely narrow, particles cannot pass one another and the single-file diffusion is observed. We formulated general theory describing this phenomenon for particles with hard-core interactions. We showed that behavior of the particles diffusing anomalously in a single file can be understood in specific „stretched” coordinates, obtained from real space and time by a nonlinear transformation. The results were obtained in close informal collaboration with a senior researcher from Courant Institute of New York University.

Mechanism of colour confinement in the theory of strong interactions

We proposed an approximate form of the vacuum wave functional of quantum chromodynamics (QCD) in (2+1)-dimensional spacetime in the temporal gauge, and showed in numerical simulations that it is a very good approximation to the true vacuum wave functional of this theory. We also investigated the G(2) lattice gauge theory. We showed a qualitative similarity of SU(N) and G(2) theories, proposed a model of the vacuum structure of gauge theories common for SU(N) and G(2) gauge groups, and verified numerically a specific prediction of the model, Casimir scaling of potentials between different colour charges. Results are partly due to broad informal collaboration with scientists from San Francisco State Univ., Indiana University, Plymouth University, and Tübingen University.

Preparation and utilization of quantum states for secure communications

For preparation of general quantum states an exponential number of elementary operations (quantum gates) is needed. We found a way of preparing quantum states more efficiently compared to previously known results. We also investigated the topic of multipartite entanglement distillation, and showed the effectiveness of this method compared to bipartite distillation in case of global errors. Our research was supported in part by Jubiläumsstipendium of the Action Austria-Slovakia and Marie Curie Fellowship, and conducted in cooperation with scientists from Vienna Univ. and Masaryk Univ. in Brno.

Department of Metal Physics

Head: Peter Švec

Vlastimil Boháč, Róbert Brunner, Pavol Butvin, Beata Butvinová, Emília Illeková, Dušan Janickovič, Marián Krajčí, Ludovít Kubičár, Igor Maťko, Marek Mihalkovič, Peter Mrafko, Emil Pinčík, Jaroslav Rusnák, Vladimír Štofánik, Gabriel Vlasák, Viliam Vretenár

Ab-initio calculations

In cooperation with foreign partners we have developed methods implementing approximations of ab-initio quantum-mechanical approaches, classical computations and special techniques of modelling of complex alloy structures for realistic prediction of their properties. The methods were intensely applied in assessing the feasibility of new complex metallic alloys and in quantification of their structure and physical properties. Using ab-initio predictions and experimental methods we have developed new Al-Cr-Fe alloys and have identified and quantified new structures formed in these systems, their thermodynamic behaviour and thermal stability. In cooperation with IMMM SAS Bratislava we have succeeded in compaction of these alloys into bulk shapes with high strength and mechanical stability to elevated temperatures.

Using ab-initio computations we have determined the effects of self-organization of selected atom species on surfaces of icosahedral AlPdMn quasicrystal. The results were found to correspond well with experimental investigations, leading to formulations of realistic models of the adsorption process. Further development of the methods has lead to successful identification of surface properties of Al-Co quasicrystal approximants. Using density functional method we have constructed an atomistic scenario for the complex multi-step hydrogenation process (co-adsorption of alkynes and molecular hydrogen, dissociation of hydrogen, reaction between atomic hydrogen and hydrocarbon molecules and intermediates) catalyzed by complex intermetallic compound Al₁₃Co₄.

Rapidly quenched amorphous and nanocrystalline systems

Significant progress was achieved in understanding the principles of formation, stability and transformation behaviour in numerous rapidly-quenched systems of the types (Fe-Co)-Mo-Cu-B, (Fe-Co)-Nb-B and (Fe-Ni)-Nb-B. Based on rich experience with Si-lacking compositions, the former two systems have been thoroughly inspected as to the sensitivity of soft-magnetic properties to the conditions of thermal treatment. Significant effects coming from different behaviour of surfaces and ribbon interior were revealed and elucidated. Modification of transformation behaviour and of short-range order has been predicted and experimentally confirmed in Fe-B system alloyed with small amounts of Sn; critical composition for transformation kinetics as well as structure–magnetic properties relationships were identified. Substitution of Nb by Mo has been successfully assessed in nanocrystalline Fe-Cu-Nb-Si-B system without deterioration of their soft magnetic behaviour. The effect of additions of nucleation-enhancing atomic species (Cu, P) has been used in preparation of new nanocrystal-forming Fe-B systems with high saturation magnetization. First results were obtained in development and studies of bulk and pseudobulk (in form of ribbons with multiple layers) metallic glasses. Knowledge-based algorithms of thermoelectromagnetic processing of soft magnetic nanocrystal-forming systems have been developed and applied for tailoring of magnetic properties.

International cooperation (ENSC Paris) has led to development of new Ti-Zr-(Co/Fe/Ni/Cr) systems with enhanced biocompatibility related to formation of quasicrystals in amorphous matrix and their transformation into Laves phases. Interaction of Ti, Al and Mg with different gasses has been used in determining of e. g. peculiarities of decomposition of TiH₂ powder used in preparation of Al based foams or oxidation behaviour of atomized Al powders and Mg-based composites.

Si-based photovoltaics and investigation of advanced types of MOS structures

Basic research of MOS structures of ultrathin and very thin SiO₂/Si, a-Si:H, mc-Si:H, a-SiC:H, very thin SiO₂/6H SiC and thin SiO₂/6H SiC has been performed in cooperation with SEMIKRON and ISIR Osaka, partly also with Univ. of Zilina and HMI Berlin, focusing on passivation of surface and interface defect states and different annealing processes. Numerous modern methods of analysis were applied or modified, e. g. charge version of DLTS, C-V, photoluminescence at 6K, spectral ellipsometry, different modes of FTIR, in more modes, AFM, STM, and optical reflectance. New quantum mechanics approach to evaluation of experimental C-V dependences has been developed. The results were applied in development of both small size (2 cm x 2 cm) and larger size (15.5 cm x 15.5 cm) solar cells prepared on two types of substrates: c-Si and poly-Si, reaching conversion efficiency of 17% and 13%, respectively on small cells and 14% and 12%, respectively on large cells.

Thermophysical properties of materials

Two thermophysical sensors have been developed based on hot ring method and hot ball method. While former is aimed for precise measurement of thermophysical parameters the latter is aimed for industrial purposes. Sensor based on hot ring method consists of concentric rings where outer ring represents a heater and inner a thermometer. Sensor measures thermal conductivity, thermal diffusivity and specific heat of a broad range of materials. Both elements are sandwiched between Kapton foils. Thermal conductivity sensor based on hot-ball method integrates heat source and thermometer into a single measuring element, allowing monitoring of a range of technological procedures (polymerisation, concrete setting, vulcanization, freezing and thawing, etc.) and determination of moisture content in common building materials from temperature response. In addition, a number of measuring devices have been developed for automatic registration of temperature and moisture in masonry and plaster of monuments and cultural heritage objects. The last of these devices enables wireless data transmission. In order to save our cultural heritage we have performed long-term monitoring of a number of monuments in Slovakia using our monitoring technique, among these is a recently restored tower of St. Martin Cathedral in Bratislava where we have placed a number of sensors below

belfry windows. Our contribution in monitoring historic buildings helped to identify the critical condition of the building when it is necessary to make adjustments to prevent its further deterioration.

Department of Multilayers and Nanostructures

Head: Eva Majková

Katarína Gmucová, Yuriy Halahovets, Ján Ivančo, Matej Jergel, Teodóra Kocsisová, Štefan Lányi, Štefan Luby, Vojtech Nádaždy, Peter Šiffalovic, Martin Weis

Self-assembled nanoparticle templates for future spintronic devices

Novel electronic, magnetic, optical and structural properties of metallic colloidal nanoparticles are increasingly attractive for the contemporary applied materials research. New hybrid spintronic structures can be based on magnetic nanoparticles. The important property of nanoparticles is the spontaneous self-assembly. In our work we studied the self-assembly of colloidal Fe-O nanoparticles (diameter 7 nm) applied on Si substrate. The GISAXS (Grazing Incidence Small Angle X-ray Scattering) at synchrotron in HASYLAB was employed within the framework of the EU project EC - DESY IA SFS:EU, II 05 083 EC, 2006-2009. We have found that self-assembled nanoparticle clusters are located neither in the volume of colloidal drop nor on the drop surface down to 80 micrometers above the substrate. The results reveal the vicinity of three-phase drop boundary as the region of nanoparticles self-assembly. Using the cyclic voltammetry we observed a quantized charging of nanoparticle layer deposited via Langmuir-Blodgett technique on a-Si:H substrates. This result shows the possibility of fabrication of the voltage-controlled capacitor for future nanoelectronics.

Controlled azimuthal re-ordering of nanoparticle arrays

Studies of nanoparticle assemblies provide the information necessary for the understanding of basic phenomena and technologically important processes at nanoscale. We have observed a reversible azimuthal re-ordering of bimetallic nanoparticles as a result of the laser irradiation under proper biasing. The experiments were performed on the sandwich structure (Pt / photovoltaic hydrogenated amorphous silicon / Langmuir-Blodgett film of Ag-Co nanoparticles). The metallic nanoparticle core was covered by a surfactant to prevent agglomeration. The result provides a novel type of the manipulation of the nanoparticles arrays.

Further we developed an experimental technique for the real-time monitoring of self-assembly processes based on rapidly scanning grazing-incidence small-angle X-ray scattering. The measurements show that the three-phase boundary of colloidal drop is the origin of the self-assembly process.

Nanoparticle arrays for smart sensors

We have elaborated a modified Langmuir-Blodgett method of preparation of ordered nanoparticle monolayers and multilayers over large areas, that provides nanoparticle assemblies suitable for practical applications. The nanoparticle monolayer formed at the water-air interface is deposited on the substrate by a controlled removal of the sub-phase. The multilayer is prepared by a repeated deposition of monolayer. The nanoparticle monolayers composed of the Fe-O nanoparticles of 7 nm diameter were functionalized by UV photolysis. We have showed that nanoparticle clusters of 30 nm characteristic size were formed by photolysis via diffusion type kinetics.

We have analyzed mechanical behaviour of the nanoparticle monolayer in the form of a supported nanoparticle membrane. We have described behaviour of these membranes which are convenient for fast mechanical sensors. We have prepared and investigated electrical properties of a functionalized nanoparticle monolayer and multilayer (7 monolayers) on the basis of Fe-O and Co-Fe-O semiconductor oxides. The structures were prepared on sapphire substrates equipped with electrodes for measurements of the temperature dependence of conductivity and with an integrated meander-shaped heating element. The experimental sensors were tested in the reduction (CO) and oxidizing (NO₂) atmosphere with gas concentration of 5 and 100 ppm in dry air. We have analyzed the temperature response of the corresponding

current signal and determined an optimum temperature for the current response. The temporal sensor dynamics, non-hysteresis response and conductivity change of one order of magnitude of the output signal are very good operation sensor parameters for environmental protection as well as for civil security (explosives detection).

Pentacene - organic semiconductor for applications in photovoltaics, organic electronics, and hydrogen storage

Pentacene is known as an organic crystalline semiconductor. We have reported preparation of an amorphous pentacene Langmuir-Blodgett film. The amorphous character of pentacene was detected by X-ray diffraction. The energy band diagram of the pentacene film prepared on a metallic surface was reconstructed from the electrochemical data. The films were further characterized by the C-V and Q-DLTS methods. An original setup developed by us was used for the latter method. The dynamics of both the hydrogen- and hydroxyl-related defects formation in wet environments was described. We have found that Langmuir-Blodgett film is able to bond hydrogen more effectively than the thermally evaporated one. This seems to be a promising electrode coverage for hydrogen-storage applications. Contrary, thermally evaporated film provides a better matching of defectless properties necessary for the application in organic electronics and photovoltaics.

Pilot laboratory X-ray set-up for studies of the nanoparticle self-assembly at the air/liquid interface

Nanotechnology is based on the control of materials at nanoscale. Research performed at the Department of Multilayers and Nanostructures is focused on the preparation and studies of colloidal metallic nanoparticles and self-assembled nanoparticle arrays. The ordered nanoparticle arrays exhibit new collective properties attractive for novel functional devices, such as e.g. sensors, actuators, plasmonic nanodevices.

To recognize the details of the deposition process, it is necessary to study formation of the nanoparticle arrays at the air/water interface still before transfer onto a solid substrate (process called Langmuir Blodgett deposition). The most suitable technique is the grazing incidence small-angle X-ray scattering (GISAXS) that has usually been measured at synchrotron sources due to very weak scattering interface effects. To enable such measurements in laboratory a unique laboratory X-ray set-up with an innovative microfocus source was designed and built at the Department of Multilayers and Nanostructures. By means of this device it is possible to analyze principle stages of the formation of the ordered nanoparticle arrays. This study is inevitable to master a targeted nanoparticle deposition to tailor functional properties of the final assembly. The first studies of the behaviour of the compressed silver nanoparticle arrays revealed for the first time the bilayer formation that has serious implications for plasmonic applications

Department of Nuclear Physics

Head: Martin Veselský

Emil Běták, Štefan Gmuca, Stanislav Hlaváč, Ján Kliman, Jozef Krištiak, Luboš Krupa, Viktor Majerník, Vladislav Matoušek, Ondrej Šauša, Ivan Turzo, Martin Venhart

Study of the few-nucleon systems

We have studied the spin structure of two and three-nucleon forces at intermediate energies in deuteron induced reactions. A new polarimeter based on d and p elastic scattering has been installed. Experiments with polarized and unpolarized deuteron beam have been performed at 140, 200, 270, 800 MeV and 2 GeV energy for (d,p) and (d,d) reactions. The experimental data on the vector A_y and tensor A_{xx} analyzing power for d,p elastic scattering were obtained. The results are discussed in framework of the multiple-scattering model and other theoretical calculations

Nuclear symmetry energy

Understanding of density dependence of the symmetry energy is important to bridge the properties of finite nuclei, common or exotic ones, and properties of massive objects such as the neutron stars. With researchers from Texas A&M University, we described the trend of symmetry energy as a function of excitation energy, based on model analysis of isotopic compositions of heavy projectile residues experimentally observed in nuclear reactions. In collaboration with researchers from SINAP Shanghai, we used model analysis of the decay of hot nuclei to verify the use of isoscaling for quantitative estimate of symmetry energy. Based on such estimation, relative importance of the volume and surface components of the symmetry energy was deduced, what is important for description of the neutron stars, where, due to their size, volume component is dominant.

We used equation of state of nuclear matter to construct macroscopic properties of compact objects (neutron stars) in collaboration with Silesian University. We succeeded to obtain radii and masses in accord with recent experimental constrains.

Nuclear shape coexistence

The experiments have been performed at CERN-ISOLDE facility in close collaboration with research groups located at University of Leuven and University of West of Scotland (Paisley, UK). The phenomenon of the shape coexistence in odd-Au isotopes has been investigated in details. Strongly deformed intruder structures have been unambiguously identified at low excitation energy in ^{179}Au .

Crucial part of nuclear structure studies is detailed by Monte Carlo the simulation of detector response functions. During the above studies we gained unique experience with simulations of detector response and experimental setup optimization using the GEANT4 package, especially in low energy region, relevant for nuclear physics.

For data acquisition and analysis we have improved the algorithms of efficient data acquisition, sorting and storage of multi-parameter γ -ray coincidence spectra. To eliminate the background in experimental spectra, we have developed new methods which enable us to estimate the complex non-linear shapes of the background. We have designed and implemented new algorithms of non-oscillating deconvolution based on iterative algorithms and "boosted" deconvolution.

Assymmetric nuclear fission

New fission mode was observed in the process of beta-delayed fission of the isotope ^{180}Tl in experiments at ISOLDE at CERN. Using the radioactive beam ^{180}Tl , asymmetric fission was observed experimentally in the region of nuclei encompassing daughter isotope ^{180}Hg for the first time. Asymmetric fission of the isotope ^{180}Hg cannot be explained by favorable energetic balance due to the stabilizing effect of the shell structure in the fragments. On contrary, symmetric fission into two equal fragments ^{90}Zr with closed neutron shell $N=50$ is strongly suppressed. The asymmetric fission of ^{180}Hg thus proceeds via so far unobserved mechanism.

Positron annihilation studies of confined molecular systems

Positron annihilation was used for studies of properties and dynamics of confined molecular systems within nanoscale pores in temperature range 14-300 K $^{\circ}$. The confined molecules create the structure with greater free volume in comparison with molecules in bulk state. From expansion of the free volume the microviscosity of confined molecules was determined, which is greater than in bulk state. This property will influence the relaxation and dynamic behaviour of the confined molecular system with limited number of molecules. Experiment for investigation of properties of confined water in nanopores has been started. The reference experiment in bulk water in temperature region of 50-300 K $^{\circ}$ was performed.

The positron and ortho-positronium lifetime and Doppler broadening of annihilation line for confined system CPG-hexadecane was measured. We have found a correlation between the annihilation parameters and the characteristics of DSC measurements

The samples of montmorillonite, hectorite and kaolinite with different content of water were measured. The results showed the decrease of o-Ps lifetime with water content in hectorite and will be correlated with RTG diffraction measurements.

The characteristic temperatures in salol sample from point of view of local free volume dynamics were studied by two independent methods (broadband dielectric spectroscopy and positron annihilation lifetime spectroscopy). The comparison shows, that o-Ps is sensitive to the dynamics of undercooled liquid.

Department of Theoretical Physics

Head: Stanislav Dubnička

Cyril Adamuščin, Erik Bartoš, Juraj Boháčik, Peter Filip, Dalibor Krupa, Andrej Liptaj, Miroslav Nagy

π meson electromagnetic form factor in space-like region

For the pion electromagnetic (EM) form factor (FF) $F_\pi(Q^2)$ with the squared four-momentum transfer $Q^2 = -t$ the pQCD gives only asymptotic behavior and all known attempts to extend it to the experimentally measurable region give non uniform results. We have demonstrated how pion EM FF can be reconstructed in the space-like region in a model independent way with the help of the accurate data on the total cross-section in the elastic region, which plays a dominant role in our prediction.

On the basis of Phragmen-Lindelof theorem an assumption was made, that asymptotical pion EM FF in the Minkowski region has an analogous form to that in the Euclidean one. As a result, the asymptotic form of the imaginary part of pion EM FF in the time-like region is found to be useful to specify correct parameterization of corrections from the interval $(m_{\pi^0} + m_\omega)^2 \leq t \leq +\infty$. All these ingredients are linked up together via dispersion integrals and as a result, a model independent prediction for the pion EM FF in the space-like region was achieved.

Parameters of charged and neutral members of ρ meson families

New very precise KLOE data on $e^+e^- \rightarrow \pi^+\pi^-$, obtained by radiative return method in Frascati, are unified with corrected CMD-2 and SND Novosibirsk $e^+e^- \rightarrow \pi^+\pi^-$ data and supplemented below and beyond by older data in order to be described by the Unitary and Analytic pion EM FF model. As a result the most precise neutral members of the rho-meson families parameters are found. On the other hand the recently appeared accurate BELLE (in KEK) data on the weak pion FF are described by the same Unitary and Analytic model, as it follows from the CVC hypothesis. They provide the charged members of the rho-meson families parameters. Comparing both descriptions the most reliable parameter differences of the rho-meson families are determined.

Electromagnetic form-factors of deuteron

It was theoretically demonstrated, that by elastic scattering of unpolarized electrons on a polarized deuteron target in the direction of the three-momenta of the outgoing deuteron and by measuring the vector polarization of the final deuteron in the same direction and at the same value of squared transferred momenta t as the unpolarized elastic electron-deuteron cross-section is measured, all three deuteron EM FFs in the space-like region can be determined by a completely new, till now not practically realized experimental method.

Strange quark content in the nucleon

Evidences are reviewed, which indicate the naive quark model of hadrons not to be complete and a real existence of nonzero admixture of sea quark $\bar{c}ss$ pairs to the nucleon structure is justified. Then nonaccidental compatibility of the pure theoretical predictions for nucleon strange FFs with parity violation experimental results, obtained in G0 collaboration, is demonstrated.

Initial eccentricity in deformed HI collisions at RHIC

It has been shown, that ground-state deformation of heavy nuclei (Au, U) in relativistic heavy ion collisions have a significant influence on the initial state geometry of the expanding QCD (partonic) matter created in these experiments. In central collisions of deformed Au nuclei, the initial eccentricity is increased by 20%, compared to models assuming spherical shape of Au nucleus. The calculations were performed using the optical Glauber model and Monte Carlo Glauber simulations. Initial state eccentricity of compressed QCD matter is crucial for the physical interpretation of the elliptic flow strength observed in relativistic collisions of nuclei, with direct implications on the Equation of state and viscosity of dense QCD matter created in these experiments.

Research center for quantum Information

Head: Mário Ziman

Vladimír Bužek, Andrej Gendiar, Miroslav Grajciar, Daniel Nagaj, Peter Rapčan, Daniel Reitzner, Michal Sedlák, Peter Staňo

The paradigm of quantum computation forced us to reconsider the basics of information processing and pay more attention to physical layer of information processing technologies. Our research interests range from abstract mathematics and simulations to proposals for experimental verification of quantum systems and physical implementation of ideas of quantum information processing. Over the last five years our research group published 65 original research papers, approximately half of them in collaboration with recognized researchers from Europe and North America. The achieved results were presented at international conferences, at leading research universities and institutions. The topics covered by RCQI can be split into five categories: quantum measurements and estimations, quantum communication and dynamics, quantum algorithms and simulations, spin-based solid-state quantum computation and foundations of quantum theory. In each of these subjects we have achieved several interesting results and observations. Let us describe in more details the following four (collections of) results.

Quantum walks

Random walks represent a popular, extremely important and relatively simple algorithmic tool. We were working on understanding of properties and complexity of implementation of its quantum counterpart. In particular, we explored the possibility of using quantum walks on graphs to find structural anomalies, such as extra edges or loops, on a graph. We focused our attention on star graphs, whose edges are like spokes coming out of a central hub. If there are N spokes, we show that a quantum walk can find an extra edge connecting two of the spokes or a spoke with a loop on it in $O(N)$ steps in accordance with the limitations of the famous Grover search algorithm exhibiting quadratic speedup in comparison with best classical algorithms.

Further we presented an efficient general method for realizing a quantum walk operator corresponding to an arbitrary sparse classical random walk. This method is intended for use in quantum walk algorithms with polynomial speedups, whose complexity is usually measured in terms of how many times we have to apply a step of a quantum walk, compared to the number of necessary classical Markov chain steps. We considered a finer notion of complexity including the number of elementary gates it takes to implement each step of the quantum walk with some desired accuracy. The difference in complexity for various implementation approaches is that our method scales linearly in the sparsity parameter and poly-logarithmically with the inverse of the desired precision. The best previously known general methods scale either quadratically in the sparsity parameter, or polynomially in the inverse precision. Our approach is especially relevant for implementing quantum walks corresponding to classical random walks like those used in the classical algorithms for approximating permanents and sampling from binary contingency tables. In those algorithms, the sparsity parameter grows with the problem size, while maintaining high precision is required.

Unambiguous quantum discrimination

Quantum theory enables us to perform predictions that are intrinsically statistical. It follows that also our conclusions based on observed events are statistical. However, in special situations deterministic predictions and error-free unambiguous conclusions are possible. We analyzed the potential of deterministic predictions and unambiguous conclusions for all types of quantum objects, i.e. for quantum states, quantum measurements and quantum processes. We addressed the problem of unambiguous comparison, in which we are given two (unknown) quantum apparatuses of the same type (either preparator, measurement apparatus, or quantum channel). Our goal is to unambiguously decide whether the devices are different, or not. Moreover, we are interested in solutions employing the devices number of times as small as possible. We designed experiments implementing optimal unambiguous state discrimination and unambiguous comparison. Originally, we developed mathematical formalism for description of measurements of quantum processes and of quantum measurements. One of our proposals was successfully implemented by the quantum optics group in Olomouc.

Quantum dots and spintronics

Using analytic and numerical methods we investigated the implementation of qubits in quantum dots. In particular, we studied the spin relaxation induced by acoustic phonons in the presence of spin-orbit interactions in single electron Si/SiGe lateral coupled quantum dots. The relaxation rates are computed numerically in single and double quantum dots, in in-plane and perpendicular magnetic fields. The deformation potential of acoustic phonons is taken into account for both transverse and longitudinal polarizations, and their contributions to the total relaxation rate are discussed with respect to the dilatation and shear potential constants. We find that in single dots the spin relaxation rate scales approximately with the seventh power of the magnetic field, in line with a recent experiment. In double dots the relaxation rate is much more sensitive to the dot spectrum structure, as it is often dominated by a spin hot spot. The anisotropy of the spin-orbit interactions gives rise to easy passages, special directions of the magnetic field for which the relaxation is strongly suppressed. Quantitatively, the spin relaxation rates in Si are typically two orders of magnitude smaller than in GaAs due to the absence of the piezoelectric phonon potential and generally weaker spin-orbit interactions. We also demonstrated that in the absence of magnetic field, the exchange interaction is practically unaffected by spin-orbit coupling, for any interdot coupling, boosting prospects for spin-based quantum computing. The anisotropic exchange appears at finite magnetic fields. A numerically accurate effective spin Hamiltonian for modeling spin-orbit-induced two-electron spin dynamics in the presence of magnetic field is proposed.

3. Concept of R&D activity of the Organisation for the next four years (max. 5 pages)

i. Present state of knowledge and status of ongoing research related to the subject of the Concept, from both international and national perspective

For the following period we develop our focused science and technology driven activities in accord with the Horizon 2020 concept of the EU. Since the research scope of the Institute is rather broad, individual research groups developed specific plans for the next period.

Department of Complex Physical Systems

We do not foresee considerable changes in research directions of the department. We will continue solving challenging problems in the fields of our expertise, where we already achieved international reputation. The topics include (in the form of headlines):

1. Computer modelling of condensed-matter systems: Non-contact atomic force microscopy – Mechanochemistry – Quantum Monte Carlo. (Collaboration: Basel Univ., Osaka Univ., King's College London, NCSU.)

2. Statistical mechanics of Coulomb systems: Strong-coupling phenomena of counter-ions near charged plates in the presence of a dielectric discontinuity. This discontinuity can cause that, at zero and low temperatures, counter-ions form a stable Wigner crystal at some distance from the plate. The creation of thermodynamically stable structures plays an important role in chemical and biological systems. (Collaboration: Univ. Paris Sud.)

3. Transport processes in quasi one-dimensional structures: Generalization of the mapping method for the Fokker-Planck equation, including inertial dynamics, reduction of the phase space onto the real space for massive particles. – Including time dependent forces in the mapped equations, active boundaries, extending the theory for the processes far from the stationary state. – Application of the mapped equations in description of the Brownian pumps, stochastic resonance, models studying rectification of a random walker, Brownian motors. (Collaboration: N.Y. University)

4. Colour confinement and the ground state of QCD: Numerical investigation of the QCD vacuum wave-functional in (3+1) dimensions. – Identification of local vacuum domains in gauge theories and study of their percolation properties, both at low and high temperatures. – Investigation of the changes of properties of dominant gauge-field configurations above the deconfinement phase transition. – Study of exactly solvable models on the light cone and their physical vacuum states. (Collaboration: SFSU, Univ. Montpellier.)

5. Physics of quantum information: Investigation of the influence of weak randomness and entanglement on security of quantum information processing. – Coarse grained measurements and operations. – Study of information and entropy flow in quantum systems. (Collaboration: Masaryk Univ. Brno, Vienna Univ., and Oxford Univ.)

We will also continue to be involved in **popularization and outreach activities** such as organization of the Young Physicists' Tournament, International Junior Science Olympiad, lectures in high schools, performances on science festivals such as Researchers' Night, etc.

Department of Metal physics

Determination and investigation of new phenomena related to the specific bulk and surface properties of metallic systems and their functionalization by knowledge-based processing algorithms. Particular attention will be paid to material properties to be exploited in various sensors.

Assessment of new structures and phases in alloy systems, selective experimental formation of phases with unusual properties as predicted by ab-initio calculations and molecular dynamics simulations, assessment of their application potential. We intend to investigate the structure and catalytic properties of surfaces of complex intermetallic compounds, including quasicrystalline approximants.

Design, development and investigation of new amorphous alloy systems in bulk and pseudobulk shapes, their application in physical research as unique specimen for studying of mass transport and interface properties in disordered or nanocrystalline states. Development of technology of preparation of rapidly quenched bilayer and multilayered ribbons and bulks, development of metal composites with rapidly quenched metallic matrix containing fine-scale powders.

Research, understanding and development of lightweight high-strength alloys with high ratio of elastic modulus to specific mass. Investigation of principles of formation and properties of rapidly quenched nanocrystalline systems based on Fe-B with high saturation magnetization. Investigation of deterioration of historic monumental buildings, experimental analysis of pore structures, water diffusion, and advance of freezing/thawing fronts, monitoring of temperature-moisture regimes of historic buildings, investigation of life cycle of concrete structures - monitoring of concrete setting, hardening and deterioration processes.

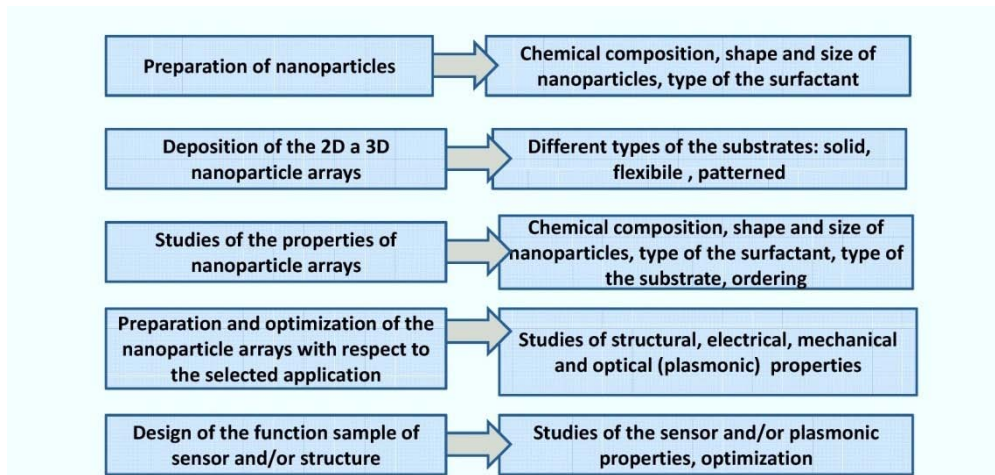
Investigation of crystalline semiconductor surfaces after RCA cleaning and passivation, interaction of surface metal contaminants with HCN solutions, investigation of defect structure of

amorphous-based and porous structures of semiconductors and metals before and after strong passivation-interaction. Investigation of formation and properties of ultra-thin and very-thin dielectrical layers on flat atomically clean semiconductor and metal surfaces. Application of results and development of advanced devices from these materials.

Focused project activities related to transfer of latest solid state physics and materials science expertise towards university students and towards industrial partners into technological processes and production.

Department of Multilayers and Nanostructures

During the period 2012-2016 we plan to continue our research in the field of nanoparticles and nanoparticle assemblies for different applications. Simultaneously, new diagnostic tools and procedures necessary for new nanostructures will be developed. The scheme of our research is the following:



We will continue in the research of the nanoparticle gas sensors for CO_x and NO_x gases. Another type of sensor to be developed is the strain sensor based on the tunneling current between the nanoparticles in a nanoparticle monolayer. Plasmonic properties of Ag, Au nanoparticles and nanoparticle assemblies will be studied aiming at selected plasmonic applications, such as photovoltaic structures and SERS structures. In particular, the organic thin film photovoltaic structures with enhanced efficiency due to embedded plasmonic nanoparticles will be addressed. A directed assembling of nanoparticles on pre-patterned substrates will be employed in addition to the self-assembled templates. For successful preparation of the self-assembled ordered nanoparticle arrays, we will continue the studies of the formation and properties of the nanoparticle assemblies at the water-air interface. The development of new instruments and protocols necessary for the nanoscience research as described above is planned, too. We will continue our research of ultrathin films and multilayers. We will employ our new custom designed equipment based on ion beam sputtering technique which will be delivered in September 2012.

Department of Nuclear Physics

In the next four years we would like to continue our successful experimental activities in world class laboratories abroad and under positive circumstances we would like to develop new nuclear physics laboratory at our Institute.

The Letter of Intent for HIE-ISOLDE upgrade, aiming on studies of transfer reaction induced fission has been submitted to INTC committee. LOI was approved and we will present a full proposal of the experiment at INTC meeting in September 2012.

As a continuation of spectroscopy program, another proposal aiming on experimental study of the excited states in ^{179,181,183,185}Au, using the unique radioactive ion beams produced by the CERN-ISOLDE facility has been presented to INTC committee. The proposal has been fully approved by the CERN Scientific Board and officially include into CERN experimental program.

Parallel to the experiment at CERN, another proposal on the in-beam gamma ray study of light gold isotopes has been approved by PAC committee at University of Jyväskylä. It is expected to take place in year 2012.

We seek to become again a member in HADES collaboration in GSI. We already became informal member of the collaboration and took part in the recent experiments. Our aim is to contribute to the development of electromagnetic calorimeter for HADES. Studies will be devoted to properties of dense nuclear matter and in collaboration with Department of theoretical physics to the study of pion/hadron electromagnetic form factors.

Theoretical studies of pre-equilibrium reactions and of the compact objects will continue along with the current path, with adding new ingredients, like rotating neutron stars and the cooling processes

The goals of the positron annihilation group is to understand the solidification and melting processes in finite systems confined in nanopores and the role of different degrees of freedom for these processes. The PALS results will be correlated with another techniques, e.g. DSC, X-ray scattering, EPRDSC measurements.

A proposal to build a new laboratory around a small singletron accelerator with terminal voltage up to 1.8 MeV was made. Such accelerator will enable low energy nuclear reaction studies, interesting for nuclear astrophysics. We intend to devote part of the available time to the nuclear structure studies using $(n, n'\gamma)$ reactions with $D(d, n)T$ reaction as a neutron source. Using this machine, we plan to develop important applications like ion beam analysis and material studies in strong radiation fields, crucial for nuclear power reactor technology.

In accord with recent trends in digital electronics, we intend to transfer the knowledge gained in data acquisition and analysis to the new digital technology.

Department of Theoretical Physics

By application of the Unitary and Analytic model we would like to achieve more precise evaluation of the anomalous magnetic moment of the muon and the running QED coupling constant (MZ). To evaluate the so-called light-by-light diagrams to muon $g-2$ anomaly by the elaborated Unitary and Analytic model for pseudoscalar meson transition FFs. Our aim is to determine parameters of the lightest scalar meson by the inverse scalar FF of the pion and the experimental information on the S-wave of $\pi\pi$ scattering and continue investigations at the STAR in BNL with heavy ion collisions.

Research Center for Quantum Information

In the future we plan to work on area of numerical (tensor product states approximation) and quantum simulations of many-body quantum systems, also investigating the computational complexity of many-body Hamiltonians. Especially, we plan to study the critical phenomena of non-Euclidean geometries and quantum chemistry using DMRG methods. This work will be conducted in collaboration with research groups from Austria, USA, Japan and Poland. Another research line will be devoted to current problems of coherent semiconductor systems and their potential for quantum information technology and semiconductor spintronics. In collaboration with groups hosted at the universities of Regensburg, Geneva, Basel and Arizona, we will focus on extension of coherence times of electronic quantum dots and measurement of spin currents in gated mesoscopic conductors. Further, we will work on foundations of quantum theory and thermodynamics in collaboration with research teams from Pavia, Turku and Wien. Especially, we will focus on assumption-free tomography methods, theories with non-causal global structure and complexity-based axiomatization of quantum theory, or its complete restrictions. We plan to develop our understanding of the emergence of temperature in physical systems, in particular, its relation with entanglement and statistical typicality. We will also continue in developing quantum models for information processing such as quantum walks and quantum cellular automata. The quantum-based privacy and randomness will be employed in various communication protocols hopefully enhancing the classical ones. We will also start a closer collaboration with a newly open laboratory of low temperatures which aims to prepare stable superconducting qubits. For all our activities we plan to apply for both European and Slovak funding.

ii. Organisation's role or significance in the overall research effort within the field of the Concept on both the national and international scales

The research areas of IoP SAS are manifold, covering different areas of theoretical as well as experimental physics. Approximately half of the researchers are experimentally oriented, the most important research activities are focused on materials science. In this field we improved significantly the quality of instrumentation in the past period, mainly with the help of Structural funds of EU. Efficient use of the new experimental equipment will provide basis for excellent research in materials science in the next period. In experimental nuclear physics we successfully benefit from user facilities in CERN, GSI and other European laboratories. Both theoretical as well as experimental groups are very active in international collaborations and there is no single group without strong international collaboration.

The position of individual research groups is well documented in publication and citation output and gives confidence that proposed research plans will be fulfilled.

iii. Objectives of the Concept

Main objective of the concept is to improve quality of conducted research and focus on promising research topics within European Research Area. We would like to improve collaboration with Universities and via close collaboration with Universities to increase the possibility to hire young promising scientist.

iv. Proposed strategies and methods to be applied, and time schedule

We propose to reach our goals via several activities

1. Continue to develop research infrastructure, mainly with the help of Structural Funds of EU
2. Use available infrastructure in collaboration with Universities and when possible and suitable by creation of common research laboratories with Universities.
3. Hire more diploma, PhD students and postdocs
4. Take part in competitive research funding schemes from Slovak as well as from European funding agencies, with ultimate goal to be successful in funding by ERC.
5. Publish in top ranking journals

III. Partial indicators of the main activities:

1. Research output

- i. List of the selected publications documenting the most important results of basic research. Total number of publications in the whole assessed period should not exceed the average number of the research employees**

Department of Complex Physical Systems

- [1] J. Greensite, K. Langfeld, K. Š. Olejník, H. Reinhardt, T. Tok, Color screening, casimir scalling and domain structure in $G(2)$ and $SU(N)$ gauge theories. In Physical Review D 75, 2007, 034501
- [2] P. Kalinay, Calculation of the mean first passage time tested on simple twodimensional models. In Journal of Chemical Physics 126, 2007, 194708
- [3] P. Markoš, L. Schweitzer, Critical conductance of two, dimensional chiral systems with random magnetic flux. In Physical Review B 76, 2007, 115318

- [4] J. Greensite, Š. Olejník, Dimensional reduction and the Yang-Mills vacuum state in 2+1 dimensions. In *Physical Review D* 77, 2008, 065003
- [5] M. Konôpka, R. Turanský, J. Reichert, H. Fuchs, D. Marx, I. Štich, Mechanochemistry and thermochemistry are different: stress, induced strengthening of chemical bonds. In *Physical Review Letters* 100, 2008, 115503
- [6] A. Maas, Š. Olejník, A first look at Landau, gauge propagators in G2 Yang, Mills theory. In *Journal of High Energy Physics*. 2008, 02, 070
- [7] L. Martinovič, Spontaneous symmetry breaking in light front field theory. In *Physical Review D* 78, 2008, 105009
- [8] L. Šamaj, B. Jancovici, Equilibrium long, ranged charge correlations at the surface of a conductor coupled to electromagnetic radiation. In *Physical Review E* 78, 2008, 051119
- [9] B. Jancovici, L. Šamaj, Equilibrium longranged charge correlations at the interface between media coupled to the electromagnetic radiation. In *Physical Review E* 80, 2009, 031139
- [10] M. Dubecký, R. Derian, L. Mitáš, I. Štich, Ground and excited electronic states of azobenzene: A quantum Monte Carlo study., *Journal of Chemical Physics* 133, 2010, 244301
- [11] M. Dubecký, R. Derian, L. Horváthová, M. Allan, I. Štich, Disentanglement of triplet and singlet states of azobenzene: direct EELS detection and QMC modeling. In *Physica Chemistry Chemical Physics* 13, 2011, 20939,
- [12] L. Šamaj, E. Trizac, Counterions at highly charged interfaces: From one plate to like, charge attraction, *Physical Review Letters* 106, 2011, 078301

Department of Metal Physics

- [13] M. Jahneke, J. Hafner, M. Krajčí, Shear deformation, ideal strength, and stacking fault formation of fcc metals: A density, functional study of Al and Cu, *Physical Review B* 79, 2009, 224103
- [14] M. Widom, M. Mihalkovič, Symmetry, broken crystal structure of elemental boron at low temperature, *Physical Review B* 77, 2008, 064113
- [15] E. Illeková, J. C. Gachon, A. Rogachev, H. Grigoryan, J.C. Schuster, A. Nosyrev, P. Tsygankov, Kinetics of intermetallic phase formation in the Ti/Al multilayers, *Thermochimica Acta* 469, 2008, 77
- [16] S. Stankov, Y. Z. Yue, M. Miglierini, B. Sepiol, I. Sergueev, A. I. Chumakov, L. Hu, P. Švec, R. Ruffer, Vibrational Properties of Nanograins and Interfaces in Nanocrystalline Materials, *Physical Review Letters* 100, 2008, 235503
- [17] V. Franco, C. F. Conde, J. S. Blazquez, A. Conde, P. Švec, D. Janičkovič, L. F. Kiss, A constant magnetocaloric response in FeMoCuB amorphous alloys with different Fe/B ratios, *Journal of Applied Physics* 101, 2007, 093903
- [18] P. Butvin, B. Butvinová, J. Sitek, J. Degmová, G. Vlasák, P. Švec, D. Janičkovič, Magnetic properties and macroscopic heterogeneity of FeCoNbB Hitperms, *Journal of Magnetism and Magnetic Materials* 320 2008, 1133-1140
- [19] S. Stankov, M. Miglierini, A. I. Chumakov, I. Sergueev, Y. Z. Yue, B. Sepiol, P. Švec, L. Hu, R. Ruffer, Vibrational thermodynamics of Fe₉₀Zr₇B₃ nanocrystalline alloy from nuclear inelastic scattering, *Physical Review B* 82, 2010, 144301
- [20] M. Krajčí, J. Hafner, J. Ledieu, V. Fournée, R. McGrath, Quasiperiodic Pb monolayer on the fivefold i,Al,Pd,Mn surface: Structure and electronic properties. In *Physical Review B* 82, 2010, 085417
- [21] I. Černíková, P. Priputen, T. Y. Liu, A. Zemanová, E. Illeková, D. Janičkovič, P. Švec, A. Kusý, L. Čaplovič, J. Janovec, Evolution of phases in Al, Pd, Co alloys. In *Intermetallics*, 19, 2011 no. 10, 1586,1593
- [22] H. Euchner, M. Mihalkovič, F. Gahler, M. R. Johnson, H. Schober, S. Rols, E. Suard, A. Bosak, S. Ohhashi, A. P. Tsai, S. Lidin, C. P. Gomez, J. Custers, S. Paschen, M. De

Boissieu, M. Anomalous vibrational dynamics in the Mg(2)Zn(11) phase. In *Physical Review B* 83, 2011, 144202

- [23] E. Illeková, I. Maňko, P. Švec, P. Švec, Jr., D. Janičkovič, The crystallization behavior of amorphous Fe, Sn, B ribbons. In *Journal of Alloys and Compounds*, 509S, 2011, 46,51

Department of Multilayers and Nanostructures

- [24] V. Nádaždy, R. Durny, J. Puigdollers, C. Voz, S. Cheylan, K. Gmucová, Experimental observation of oxygen-related defect state in pentacene thin films. In *Applied Physics Letters* 90, 2007, 092112
- [25] P. Šiffalovič, E. Majková, L. Chitu, M. Jergel, Š. Luby, A. Šatka, S. V. Roth, Self-assembly of iron oxide nanoparticles studied by timeresolved grazing, incidence small angle x, ray scattering. In *Physical Review B* 76, 2007, 195432
- [26] K. Gmucová, M. Weis, V. Nádaždy, E. Majková, Orientation ordering of nanoparticle Ag/Co cores controlled by electric and magnetic fields. In *ChemPhysChem* 9, 2008, 1036,1039
- [27] P. Šiffalovič, E. Majková, L. Chitu, M. Jergel, Š. Luby, I. Capek, A. Šatka, A. Timmann, S.V. Roth, Real, time tracking of superparamagnetic nanoparticle self, assembly. In *Small* 4, 2008, 2222, 2228
- [28] J. Ivančo, T. Toader, A. Firsov, M. Brzhezinskaya, M. Sperling, W. Braun, D.R.T. Zahn, Indium on copper phthalocyanine thin film: not a reactive system. In *Physical Review B* 81, 2010, 115325
- [29] P. Šiffalovič, L. Chitu, K. Végso, E. Majková, M. Jergel, M. Weis Jr., Š. Luby, I. Capek, J. Keckes, G. A. Maier, A. Šatka, J. Perlich, S. V. S. V. Roth, Towards strain gauges based on a self, assembled nanoparticle monolayer, SAXS study. In *Nanotechnology* 21, 2010, 385702
- [30] P. Šiffalovič, L. Chitu, E. Majková, K. Végso, M. Jergel, Š. Luby, I. Capek, A. Šatka, G. A. Maier, J. Keckes, A. Timmann, S. V. Roth, Kinetics of nanoparticle reassembly mediated by UV, photolysis of surfactant. In *Langmuir* 26, 2010, vol. 26, 5455
- [31] P. Šiffalovič, M. Jergel, L. Chitu, E. Majková, I. Maňko, Š. Luby, A. Timmann, R. S. Volker, J. Keckes, G. A. Maier, A. Hembd, F. Hertlein, J. Weismann, Interface study of a high, performance W/B4C X,ray mirror. In *Journal of Applied Crystallography* 43 2010,1439
- [32] H. Dachraoui, M. Michelswirth, P. Šiffalovič, P. Bartz, C. Schaefer, B. Schnatwinkel, J. Mattay, W. Pfeiffer, M. Drescher, U. Heinzmann, Photoinduced reconfiguration cycle in a molecular adsorbate layer studied by femtosecond inner, shell photoelectron spectroscopy. In *Physical Review Letters* 106, 2011,107401
- [33] L. Chitu, Y. Chushkin, Š. Luby, E. Majková, A. Šatka, J. Ivan, IVAN, L. Smrčok, A. Buchal, M. Giersig, M. Hilgendorf, Structure and self, assembling of Co nanoparticle. In *Materials Science and Engineering C* 27, 2007, 23,28
- [34] L. Chitu, M. Jewrgel, E. Majková, Š. Luby, LUBY, I. Capek, A. Šatka, J. Ivan, J. Kováč, M. Timko, Structure and magnetic properties of CoFe₂O₄ and Fe₃O₄ nanoparticles. In *Materials Science and Engineering C* 27, 2007, 1415,1417

Department of Nuclear Physics

- [35] M. Veselský, G. A. Souliotis, Production of cold fragments in nucleus nucleus collisions in the Fermi,energy domain. In *Nuclear Physics A* 781, 2007, 521, 530
- [36] HADES Coll., S. Hlaváč, Dielectron production in ¹²C+¹²C collisions at 2A GeV with the HADES spectrometer. In *Physical Review Letters* 98, 2007, 052302
- [37] M. MORHÁČ, V. Matoušek, Library of sophisticated functions for analysis of nuclear spectra. In *Computer Physics Communications* 180, 2009, 1913,1940
- [38] A. N. Andreyev, J. Elseviers, M. Huyse, P. Van Duppen, S. Antalic, A. Barzakh, N. Bree, T. E. Cocolios, V. F. Comas, J. Diriken, D. Fedorov, V. Fedosseev, S. Franchoo, J.

- A. Heredia, O. Ivanov, U. Koster, B. A. Marsh, K. Nishio, R. D. Page, N. Patronis, M. Seliverstov, I. Tsekhanovich, P. Van Den Bergh, J. Van De Walle, M. Venhart, S. Vermote, M. Veselský, C. Wagemans, T. Ichikawa, A. Iwamoto, P. Mollerr, A. J. Sierk, New type of asymmetric Fission in proton, rich nuclei. In *Physical Review Letters* 105, 2010, 252502
- [39] A. L. Keksis, L. W. May, G. A. Souliotis, M. Veselský, S. Galanopoulos, Z. Kohley, D.V. Shetty, S. N. Soisson, B. C. Stein, R. Tripathi, S. Wuenschel, S. J. Yennello, B. A. Li, Experimental studies of N/Z equilibration in peripheral collisions using fragment yield ratios. In *Physical Review C* 81, 2010, 054602
- [40] J. Bartoš, O. Šauša, G. A. Schwartz, A. Alegría, J. M. Alberdi, A. Arbe, J. Krištiak, J. Colmenero, Positron annihilation and relaxation dynamics from dielectric spectroscopy and nuclear magnetic resonance: Cis,trans,1,4,poly(butadiene). In *Journal of Chemical Physics* 134, 2011, 164507
- [41] T. E. Cocolios, W. Dexters, M. D. Seliverstov, A. N. Andreyev, S. Antalic, A. E. Barzakh, B. Bastin, J. Buescher, I. G. Darby, D. V. Fedorov, V. N. Fedosseyev, K. T. Flanagan, S. Franchoo, S. Fritzsche, G. Huber, M. Huyse, M. Kekupers, U. Koester, Yu. Kudryavtsev, E. Mane, B. A. Marsh, P. L. Molkanov, R. D. Page, A. M. Sjoedin, I. Stefan, J. Van De Walle, P. Van Duppen, M. Vehart, S. G. Zemlyanoy, M. Bender, P. H. Heenen, Early onset of ground state deformation in neutron deficient polonium isotopes. In *Physical Review Letters* 106, 2011, 052503
- [42] I. G. Darby, R. D. Page, D.T. Joss, J. Simpson, L. Bianco, R. J. Cooper, S. Eeckhoudt, S. Erturk, B. Gall, T. Grahn, P. T. Greenless, B. Hadinia, P. M. Jones, D. S. Judson, R. Julin, S. Juutinen, S. Ketelhut, M. Leino, A. P. Leppanen, M. Nyman, P. Rahkila, J. Saren, C. Scholey, A. N. Steer, J. Uusitalo, M. Venhart, Decay of the high,spin isomer in ^{160}Re : changing, particle structure beyond the proton drip line. In *Physics Letters B* 695, 2011, 78
- [43] I. G. Darby, R. D. Page, D. T. Joss, L. Bianco, T. Grahn, D. S. Judson, J. Simpson, S. Eeckhoudt, P. T. Greenlees, P. M. Jones, R. Julin, S. Juutinen, S. Ketelhut, M. Leino, A. P. Leppanen, M. Nyman, P. Rahkila, J. Saren, C. Scholey, A. N. Steer, J. Uusitalo, M. Venhart, S. Erturk, B. Gall, B. Hadinia, Precision measurements of proton emission from the ground states of ^{158}Ta and ^{160}Re . In *Physical Review C* 83, 2011, 064320
- [44] M. Venhart, A. N. Andreyev, J. L. Wood, S. Antalic, L. Bianco, P. T. Greenlees, U. Jakobsson, P. Jones, R. Julin, S. Juutinen, S. Ketelhut, M. Leino, M. Nyman, R. D. Page, P. Peura, P. Rahkila, J. Saren, C. Scholey, J. Sorri, J. Thomson, J. Uusitalo, Shape coexistence in odd, mass Au isotopes: Determination of the excitation energy of the lowest intruder state in ^{179}Au . In *Physics Letters B* 695, 2011, 82,87.

Department of Theoretical Physics

- [45] E. Bartoš, S. Dubnička, A. Z. Dubničková, E. A. Kuraev, Sum rule for photon target. In *Physical Review D*. 76, 2007, 057901
- [46] M. Belička, S. Dubnička, A. Z. Dubničková, A. Liptaj, Rigorous pion electromagnetic form factor behavior in the space, like region, *Physical Review C* 83, 2011, 1,4
- [47] E. Bartoš, S. Dubnička, A. Z. Dubničková, M. Fujikawa, H. Hayashii, Parameter differences of the charged and neutral rho meson family, *Nucl. Phys. B* 198, 2010, 186,189
- [48] C. Adamuščin, S. Dubnička, A. Z. Dubničková, New method of experimental determination of all three deuteron EM FFs, *Phys. Rev. C* 80, 2009, 018202
- [49] S. Dubnička, A. Z. Dubničková, Strange quark content in the nucleon, *Prog. Part. Nucl. Phys.* 61, 2008, 198,204
- [50] P. Filip, R. Lednicky, H. Masui, Nu Xu: Initial eccentricity in deformed $^{197}\text{Au} + ^{197}\text{Au}$ and $^{238}\text{U} + ^{238}\text{U}$ collisions at $\sqrt{s\text{-NN}} = 200\text{GeV}$ at the BNL relativistic heavy ion collider, *Phys. Rev. C* 80, 2009, 054903

- [51] S. Dubnička, A. Z. Dubničková, M. A. Ivanov, J. G. Korner, P. Santorelli, G. G. Saidullaeva, One photon decay of the tetraquark state $X(3872)$, , $\gamma + J/\psi$ in a relativistic constituent quark model with infrared confinement. In *Physical Review D* 84, 2011, 014006
- [52] Star Coll., P. Filip, Transverse momentum and centrality dependence of High, $p(T)$ nonphotonic electron suppression in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. In *Physical Review Letters* 98, 2007, 192301
- [53] Star Coll., incl. , P. Filip, Observation of the antimatter helium, 4 nucleus. In *Nature*, 473, 2011, 353

Research Center for Quantum Information

- [54] P. Staňo, P. Jacquoud, Spin to charge conversion of mesoscopic currents, *Physical Review Letters* 106, 2011, 206602
- [55] M. Bonanome, V. Bužek, M. Hillery, M. Ziman, Toward protocols for quantum, ensured privacy and secure voting, *Physical Review A* 84, 2011, 022331
- [56] M. Hillery, D. Reitzner, V. Bužek, Searching via walking: How to find a marked subgraph of a a marked clique of a complete graph using quantum walks, *Physical Review A* 81, 2010, 062324
- [57] F. Baruffa, P. Staňo, J. Fabian, Theory of Anisotropic Exchange in Laterally Coupled Quantum Dots, *Physical Review Letters* 104, 2010, 126401
- [58] E. Farhi, D. Gosset, A. Hassidim, A. Lutomirski, D. Nagaj, P. Shor, Quantum State Restoration and Single Copy Tomography for Ground States of Hamiltonians, *Physical Review Letters* 105, 2010, 190503
- [59] P. Wocjan, Ch. Fu Chiang, A. Abeyesinghe, D. Nagaj, Quantum algorithm for approximating partition functions, *Physical Review A* 80, 2009, 022340
- [60] D. Nagaj, P. Wocjan, Y. Zhang, Fast Amplification of QMA, *Quantum Information and Computation* 9, 2009, 1053,1068
- [61] P. Staňo, D. Reitzner, T. Heinosaari, Coexistence of qubit effects, *Physical Review A* 78, 2008, 012315
- [62] M. Ziman, Process POVM: A mathematical framework for the description of process tomography experiments, *Physical Review A* 77, 2008, 062112
- [63] M. Sedlák, M. Ziman, V. Bužek, M. Hillery: Unambiguous comparison of ensembles of quantum states, *Physical Review A* 77, 2008, 042304
- [64] J. Fabian, A. M. Abiague, Ch. Ertler, P. Staňo, I. Zutic, Semiconductor Spintronics, *Acta Physica Slovaca* 57, No.4,5, 2007, 565,907
- [65] M. Sedlák, M. Ziman, O. Pribyla, V. Bužek, M. Hillery, Unambiguous coherent state identification: Searching quantum database, *Physical Review A* 76, 2007, 022326

ii. List of the selected publications documenting the most important results of applied research

- [1] Ľ. Kubičár, V. Vretenár, V. Boháč, Study of phase transitions by transient methods. In *Solid State Phenomena*, 2008, vol. 138, p. 3-28
- [2] M. Balog, V. Vretenár, I. Vávra, J. Zhang, M. A. Crimp, Ľ. Kubičár, Zoltán Lenčeš, Thermophysical properties of electrically conductive SiC-(Nb,Ti-C)ss-based cermets. In *International Journal of Thermophysics*, 2009, vol. 30, no. 6, p. 1918-1930

- [3] Ľ. Kubičár, V. Vretenár, V. Štofánk, V. Boháč, Hot-ball method for measuring thermal conductivity. In *International Journal of Thermophysics*, 2010, vol. 31, no. 10, p. 1904-1918.
- [4] S. Holotescu, F. D. Stoian, O. Marinica, Ľ. Kubičár, P. Kopčanský, M. Timko, Utilization of the magnetogrulometric analysis to estimate the thermal conductivity of magnetic fluids. In *Journal of Magnetism and Magnetic Materials*, 2011, vol. 323, no. 10, p. 1343-1347.
- [5] M. Nosko, F. Simančík, K. Iždinský, P. Švec, R. Florek, Stabilizing intermetallic phases within aluminum foam. In *Materials Letters*, 2011, vol.65, p.1378-1380
- [6] P. Butvin, B. Butvinová, J. M. Silveyra, M. Chromčíková, D. Janičkovič, J. Sitek, P. Švec, G. Vlasák, Effects of substitution of Mo for Nb on less-common properties of Finemet alloys. In *Journal of Magnetism and Magnetic Materials*, 2010, vol. 322, p. 3035-3040.

iii. List of monographs/books published abroad

- [1] P. Markoš, C. M. Soukoulis, *Wave Propagation: From Electrons to Photonic Crystals and Left-Handed Materials*, Princeton, Princeton University Press, 2008, 352 p., ISBN 978-0-691-13003-3.

[2] List of Chapters in monographs/books published abroad

- J. Bartoš, D. Račko, O. Šauša, J. Krištiak, Positron annihilation lifetime spectroscopy and atomistic modelling - effective tools for the disordered condensed system characterization. In *Soft matter under exogenic impacts*. - Dordrecht : Springer, 2007, p. 113 – 131, ISBN 978-1-4020-5871-4
- M. Jergel, E. Majková, Ch. Borel, Ch. Morawe, I. Matko, Multilayers with Ultra-short Periods. In *Modern Developments in X-Ray and Neutron Optics*. – Berlin, Springer Verlag, 2008, p. 389-406, ISBN 978-3-540-74560-0
- M. Krajčí, J. Hafner, Ab- Initio of Quasicrystalline Surfaces. In *Quasicrystals. Handbook of Metal Physics 6*. – Amsterdam, Elsevier B.V., 2008, p. 313-355, ISBN 978-0-444-51418-9
- Š. Lányi, Application of scanning capacitance microscopy to analysis at the nanoscale. In *Applied Scanning Probe Methods VIII. Scanning Probe Microscopy Techniques*. – Berlin, Springer-Verlag, 2008, p. 377-420, ISBN 978-3-540-74080-3
- E. Majková, Š. Luby, M. Jergel, Interface properties and thermal stability of multilayers for X-EUV optics. In *Leading-Edge Materials Science Research*. - New York, Nova Science Publ. Inc., 2008, p. 5-39, ISBN 1-60021-798-2
- M. Ziman, V. Bužek, M. Plesch, Optimal approximation of non-physical maps via likelihood estimation. In *Advances in Information Optics and Photonics*. – Bellingham, SPIE, 2008, p. 513-532, ISBN 078-0-81947-234-2
- E. Illeková, J. Šesták, Crystallization of metallic micro- and nano-crystalline glasses. In *Some Thermodynamic, Structural and Behavioral Aspects of Materials Accentuating Non-crystalline States*. – Plzeň, University of Bohemia, 2009, p. 308-326, ISBN 978-80-87269-06-0
- E. Illeková, J. Šesták, Crystallization of metallic micro- and nano-crystalline glasses. In *Thermodynamic, structural and behavioral aspects of materials accentuating non-crystalline states*. – Plzeň, Západočeská Univerzita v Plzni, 2011, p. 308-326, ISBN 978-80-87269-20-6.

- J. Ivančo, Certain problems in the practical characterization of molecular films and associated interfaces by direct photoemission : Chapter 2. In Organic Semiconductors: Properties, Fabrication and Applications. - Hauppauge, NY, Nova Science Publishers, Inc., 2011, p. 65-105, ISBN 978-1-61209-391-8
- M. Morháč, E. Morháčová, Monte Carlo simulations of grain growth in polycrystalline materials using potts model. In Applications of Monte Carlo Method in Science and Engineering. Chapter 22. – Rijeka, InTech, 2011, p. 563-580, ISBN 978-953-307-691-1.
- P. Šiffalovič, M. Jergel, E. Majková, GISAXS- probe of buried interfaces in multilayered thin films. In X-Ray Scattering, Chapter 1. - Hauppauge NY, Nova Science Publishers Inc., 2011, ISBN 978-1-61324-326-8
- M. Weis, Jr., M. Iwamoto, Dielectric physics approach for improvement of organic-field effect transistors performance. In Energy Efficiency and Renewable Energy Through Nanotechnology. Part V. Energy Efficiency and Saving. – London, Springer-Verlag, 2011, p. 843-871, ISBN 978-0-85729-637-5, ISSN 1865-3529.

iv. List of monographs/books published in Slovakia

v. List of other scientific outputs specifically important for the Organisation (normalization, standardization, maps, etc.)

vi. Table of research outputs

*Table **Research outputs** shows research outputs in number of specified entries; these entries are then divided by FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).*

(and the name of research organisations appears in the list of author)

Research outputs	2007			2008			2009			2010			2011			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
chapters in monographs, books published abroad	1	0.020	1.26	6	0.112	6.92	1	0.019	1.13		0.000	0.00	5	0.086	5.51	13	3.3	0.059	3.71
chapters in monographs, books published in Slovakia		0.000	0.00		0.000	0.00		0.000	0.00		0.000	0.00		0.000	0.00	0	#####	#####	#####
CC publications	78	1.542	98.33	89	1.667	102.70	72	1.366	81.63	108	1.748	116.51	116	1.991	127.80	463	92.6	1.673	105.79
scientific publications indexed by other databases (specify)	24	0.474	30.26	23	0.431	26.54	26	0.493	29.48	49	0.793	52.86	19	0.326	20.93	141	28.2	0.510	32.22
scientific publications in other journals	8	0.158	10.09	16	0.300	18.46	7	0.133	7.94	4	0.065	4.32	10	0.172	11.02	45	9.0	0.163	10.28
publications in proc. of international scientific conferences	22	0.435	27.73	45	0.843	51.93	45	0.854	51.02	79	1.279	85.22	59	1.013	65.00	250	50.0	0.903	57.12
publications in proc. of nat. scientific conferences	5	0.099	6.30	8	0.150	9.23	13	0.247	14.74	19	0.307	20.50	6	0.103	6.61	51	10.2	0.184	11.65
active participations at international conferences	158	3.123	199.18	107	2.004	123.47	63	1.195	71.43	118	1.910	127.30	89	1.528	98.05	535	107.0	1.933	122.24
active participations at national conferences	2	0.040	2.52		0.000	0.00	1	0.019	1.13	4	0.065	4.32	1	0.017	1.10	8	2.0	0.036	2.28

vii. List of registered patents

[1] Measurement of material properties by impulse transient method and apparatus for measurement (measuring instrument) using this method

Patent No. 2858354, 2007

Authors: Ľ. Kubičár, V. Boháč, M. Markovič

[2] Sensor of relative deformations (strain)

Patent No. 286132, 2008

Authors: P. Baláž (EMCON, Ltd.), J. Bydžovský (STU Bratislava), L. Kraus (IoP AS CR), M. Pasquae (IENGF Torino), P. Švec (IoP SAS)

[3] Method and sensor for thermal conductivity measurement

Patent No. 287386, 2010

Authors: Ľ. Kubičár, V. Vretenár, V. Štofánik

We continue to develop products, which may find practical application. We continue to protect our intellectual property by additional patent applications, which are listed in Chapter 6.iv.

viii. Supplementary information and/or comments on the scientific output of the Organisation

2. Responses to the scientific output

Table **Citations** shows specified responses to the scientific outputs; these entries are then divided by the FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

Citations	2006			2007			2008			2009			2010			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Web of Science	1522	30.1	1918.7	1598	29.9	1844.0	1616	30.7	1832.2	1845	29.9	1990.4	1625	27.9	1790.3	8206	1641.2	29.7	1875.0
SCOPUS	0	0.0	0.0	0	0.0	0.0	27	0.5	30.6	37	0.6	39.9	241	4.1	265.5	305	61.0	1.1	69.7
Not registered in DB	0	0.0	0.0	107	2.0	123.5	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	107	21.4	0.4	24.4
in monographs, conf. proceedings and other publications abroad	161	3.2	203.0	475	8.9	548.1	59	1.1	66.9	50	0.8	53.9	66	1.1	72.7	811	162.2	2.9	185.3
in monographs, conf. proceedings and other publications in Slovakia	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0.0

i. List of 10 top-cited publications from staff members since the establishment of the Organisation up to 2010 and number of their citations in the period 2006 – 2010

List excluding papers by Large Collaborations

- [1] D. R. Smith, S. Schultz, P. Markoš, SOUKOULIS, C.M. Determination of effective permittivity and permeability from reflection and transmission coefficients. *Physical Review B*, vol. 65, 2002, 195104. WOK: 427
- [2] M. Hillery, V. Bužek, A. Berthiaume, Quantum secret sharing. *Physical Review A*, vol. 59, 1999, p. 1829-1834. WOK: 344
- [3] V. Bužek, M. Hillery, Quantum copying : Beyond the no-cloning theorem. *Physical Review A*, vol. 54, 1996, p. 1844-1852. WOK: 229
- [4] P. Rungta, V. Bužek, C.M. Caves, M. Hillery, G.J. Millburn, Universal state inversion and concurrence in arbitrary dimensions. *Physical Review A*, vol. 64, 2001, 042315. WOK: 173
- [5] M.S Kim, V. Bužek, P.L. Knight, Entanglement by a beam splitter: Nonclassicality as a prerequisite for entanglement. *Physical Review A*, vol. 65, 2002, 032323. WOK: 119
- [6] J. Fabian, A. Matos-Abiague, Ch. Ertler, P. Staňo, I. Zutic, Semiconductor spintronics, *Acta Physica Slovaca*, vol. 57, 2007, p. 565-907. WOK: 117
- [7] T. Koschny, P. Markoš, D.R. Smith, C.M. Soukoulis, Resonant and antiresonant frequency dependence of the effective parameters of metamaterials. *Physical Review E*, vol. 68, 2003, 065602. WOK: 82
- [8] V. Bužek, SU(1,1) squeezing of SU(1,1) generalized coherent states. *Journal of Modern Optics*, vol. 37, 1990, p. 303-316. WOK: 42
- [9] P. Kalinay, J.K. Percus, Corrections to the Fick-Jacobs equation. *Physical Review E*, vol. 74, 2006, 041203. WOK: 38
- [10] P.E. Hodgson, E. Běták, Cluster emission, transfer and capture in nuclear reactions. *Physics Reports*, vol. 374, 2003, p. 1-89. WOK: 33

Top cited publication of Large Collaborations

- [1] Star. Coll. incl. P. Filip, Experimental and theoretical challenges in the quark-gluon plasma. *Nuclear Physics A*, vol. 757, 2005, p. 102-183. WOK: 489

ii. List of 10 top-cited publications from staff members published 2000 - 2010 and number of their citations in the period 2006 - 2010

List excluding papers by Large Collaborations

- [1] D.R. Smith, S. Schultz, P. Markoš, C.M. Soukoulis, Determination of effective permittivity and permeability from reflection and transmission coefficients. *Physical Review B*, vol. 65, 2002, 195104. WOK: 427

- [2] P. Rungta, V. Bužek, C.M. Caves, M. Hillery, G.J. Milburn, Universal state inversion and concurrence in arbitrary dimensions. *Physical Review A*, vol. 64, 2001, 042315. WOK: 173
- [3] M.S. Kim, V. Bužek, P.L. Knight, Entanglement by a beam splitter: Nonclassicality as a prerequisite for entanglement. *Physical Review A*, vol. 65, 2002, 032323. WOK: 119
- [4] J. Fabian, A. Matos-Abiague, Ch. Ertler, P. Staňo, I. Zutic, Semiconductor spintronics, *ACTA PHYSICA SLOVACA*, vol. 57, 2007, p. 565-907. WOK: 117
- [5] T. Koschny, P. Markoš, D.R. Smith, C.M. Soukoulis, Resonant and antiresonant frequency dependence of the effective parameters of metamaterials. *Physical Review E*, vol. 68, 2003, 065602. WOK: 82
- [6] P. Kalinay, J.K. Percus, Corrections to the Fick-Jacobs equation. *Physical Review E*, vol. 74, 2006, 041203. WOK: 38
- [7] P.E. Hodgson, E. Běťák, Cluster emission, transfer and capture in nuclear reactions. *Physics Reports*, vol. 374, 2003, p. 1-89. WOK: 33
- [8] M. Ziman, V. Bužek, Concurrence versus purity: Influence of local channels on Bell states of two qubits. *Physical Review A*, vol. 72, 2005, 052325. WOK: 22
- [9] B. Janovici, L. Šamaj, Casimir force between two ideal-conductor walls revisited. *Europhysics Letters*, vol. 72, 2005, p. 35-41. WOK: 20
- [10] M. Widom, M. Mihalkovič, Symmetry-broken crystal structure of elemental boron at low temperature. *Physical Review B*, vol. 78, 2008, 064113. WOK: 18

Top cited publications of Large Collaborations

- [11] Star. Coll. incl. P. Filip, Experimental and theoretical challenges in the quark-gluon plasma. *Nuclear Physics A*, vol. 757, 2005, p. 102-183. WOK: 489
- [12] Star Coll. incl. P. Filip, Transverse momentum and centrality dependence of high-p(T) nonphotonic electron suppression in Au plus Au collisions at root (NN)-N-S=200 GeV. *Physical Review Letters*, vol. 98, 2007, 192301. WOK: 67
- [13] Star Coll. incl. P. Filip, Rho(0) production and possible modification. *Physical Review Letters*, vol. 92, 2004, 092301. WOK: 43

iii. List of top-cited authors from the Organisation (at most 10 % of the research employees) and their number of citations in the period 2006 – 2010

List of top cited authors excluding Large collaborations

- | | |
|--------------------|----------------------------------|
| [1] Bužek Vladimír | 2459 |
| [2] Markoš Peter | 825 (left the Institute in 2008) |
| [3] Olejník Štefan | 263 |
| [4] Švec Peter | 256 |
| [5] Krajčí Marián | 200 |
| [6] Ziman Mário | 172 |

List of top cited authors in Large Collaborations

[1] Filip Peter 2415

iv. Supplementary information and/or comments on responses to the scientific output of the Organisation

Participation of our researchers in large collaborations leads often to problems with explicit affiliation of Institute in scientific publications, which is caused mainly by internal rules of given collaboration, usually connected with financial contribution to it.

3. Research status of the Organisation in the international and national context

- **International/European position of the Organisation**

- i. **List of the most important research activities documenting international importance of the research performed by the Organisation, incl. major projects (details of projects should be supplied under Indicator 4). Provide the arguments why the selected projects are particularly important and represent the international position of the Organisation).**

Project title	Methods of Integrable Systems, Geometry, Applied Mathematics
Principal investigator	Ladislav Šamaj, RNDr. D.Sc.
Chief coordinator	Prof. Boris Dubrovin, ICTP Trieste
No. of contract	CBP.EAPCLG 981471
Period:	2004-2009

Project title	(Nanoparticle manipulation with atomic force microscopy
Principal investigator	Štich Ivan, Prof. Ing. D.Sc
No. of contract	ESF-EC-0007-07
Period:	2008-2011

Both projects were organized within activities of European Science Foundation. First aimed to establish and explore the bridge between geometry and applications of integrable systems to physics, applied mathematics and statistics. It investigated the relationships, discovered recently by mathematicians and physicists, between integrable differential equations, discrete and continuous differential geometry, the topology of moduli spaces, singularity theory and random matrices. European researchers are actively involved in the study of these problems. The main scope of the Programme was to unify the European efforts on this exciting interdisciplinary project.

The second project was cooperative research project focused on atomic force microscopy at the nanoscale, addressing nanoparticles with different sizes, shapes and functional groups on their surfaces, as well as substrates with different roughness, structure and chemical composition in different environments, from liquids to ultrahigh vacuum. The experimental studies are harmonized with theoretical investigations concerning the manipulation process itself, as well as the interfacial atomic processes during particle translation.

Project title	Advanced Solder Materials for High-Temperature Application – their nature, design, process and control in a multiscale domain
Principal investigator	Janičkovič Dušan, Ing.
Chief coordinator	Dr. Aleš Kroupa, IPM CAS, Brno
No. of contract	COST MP0602
Period:	2007-2011

Project title Electromagnetic processing of metastable materials
 Principal investigator Švec Peter, Ing. D.Sc
 Chief coordinator Švec Peter, Ing. D.Sc
 No. of contract APVV-COST-0031-06
 Period: 2007-2009

Project title Bulk nanostructured Al profiles for applications at elevated temperatures
 Principal investigator Švec Peter, Ing. D.Sc
 Chief coordinator Dr. F. Simančík, UMMS
 No. of contract MNT ERA-Net Project
 Period: 01/2008-12/2010

The projects, besides obtaining new fundamental information which has been extensively published and which has already received international response in form of citations, invitations for lectures, etc., have created an important theoretical, experimental, instrumental and technological basis for solving even the most advanced research problems in physics and materials science. The knowledge and material background thus created enables the research teams to continue their participation competitively in the research schemes foreseen by the EC Programmes (Horizon 2020, ERA-Net, etc.)

Project title X-ray Reflectivity Measurements for Evaluation of Thin Films and Multilayers
 Principal investigator Jergel Matej , Ing. D.Sc.
 Chief coordinator Prof. Laura E. Depero, Chemistry and Structural Chemistry Laboratory, University of Brescia, Taliansko
 No. of contract VAMAS A10
 Period: 2005-2008

Project title Nanostructures for spintronics and other applications
 Principal investigator Jergel Matej , Ing. D.Sc
 Chief coordinator Jergel Matej , Ing. D.Sc
 No. of contract MNT-ERA NET 2007-009-SK
 Period: 2008-2010

Project title Oxide Sensors for Chemicals Detection
 Principal investigator Luby Štefan, Prof. Ing. D.Sc
 Chief coordinator Prof. Armando Luches, University Salento, Lecce
 No. of contract NATO CLG 982748
 Period: 2008-2010

Project title Ordered arrays of nanoparticles for spintronic devices
 Principal investigator Majková Eva, RNDr. D.Sc.
 Chief coordinator IA SFS:EU DESY, Hamburg, Germany
 No. of contract II 05 083 EC
 Period: 2006-2008

Project title Arrays of magnetic nanoparticles and nanoparticle membranes for sensor applications
 Principal investigator Majková Eva, RNDr. D.Sc
 Chief coordinator Majková Eva, RNDr. D.Sc

No. of contract	SAV-FM-EHP-2008-01-01
Period:	2009 - 2010
Project title	Development of new components for X-ray diffraction and a novel (GI)SAXS instrument
Principal investigator	Šiffalovič Peter, Dr.Rer.Nat.,PhD.
Chief coordinator	Materials Center Leoben Forschung GmbH
No. of contract	COMET K2 project A2.12 Competence Center for Excellence Technologies
Period:	2009-2011

This project list gives an overview of the main research topics solved at the Department of Multilayers and Nanostructures (DMN). The projects were of vital importance for development of the Department in terms of generation of new research lines as well as the relevant experimental basis.

The DMN has focused on the research and development of multilayer nanostructures for applications in X-ray optics, spintronics and sensors since 90-ies. Basic technological, diagnostics and analytical infrastructure with corresponding software relevant for this research was built. The research team of the DMN is internationally well established in the field of multilayer structures and interface analysis utilizing the techniques of X-ray diffraction, X-ray reflectivity and reciprocal space mapping of the diffusely scattered X-rays. In the last 10 years, the team has been established also in the domain of the colloidal nanoparticle research and studies of the self-assembling processes on surfaces and interfaces (e.g. liquid/air) utilizing the grazing-incidence small-angle X-ray scattering (GISAXS) technique. The self-assembled nanoparticle arrays and/or hybride structures (multilayers with embedded nanoparticles) can be applied in sensors, plasmonics or photovoltaics. In situ time-resolved GISAXS measurements were introduced and a new spatial tracking GISAXS scheme was developed. To perform this research in laboratory, the DMN team has built an original laboratory set-up for SAXS and GISAXS measurements which were confined solely to synchrotron before. This set-up allows studies of the liquid/air interfaces and the dynamical probing of the nanoparticle monolayer formation on the water surface. Development of other unique devices with the parameters not accessible on the market is performed as well, e.g. scanning magneto-optical Kerr microscope (resolution 1.5 μm), electrochemical analyzer and tracking null ellipsometer with temporal resolution of 5 ms.

The results were published as chapters in 3 world monographies. The DMN team publishes regularly in top journals of the physics and materials research which found response in several invited lectures at world conferences. The DMN team also participated at a world-wide Round Robin test for determination of parameters of mono- and multilayer structures by the X-ray reflectivity whose results were summarized in a report for ISO-TC 201 Committee as a basis for a new ISO standard for industrial standardization of X-ray reflectometry. This participation proved competitiveness of the research performed at DMN

Another expertise of the DMN team is in electrochemistry, in particular research and development of processes in electrochemical sensors based on electrodes modified by thin film organic semiconductors. We elaborated methods enabling to modify response kinetics in such a way that a specific reduction-oxidation reaction can be detected. We have shown a possibility to prepare a selective sensor for neurosciences based on the modification of a carbon fiber microelectrode with polythiophene utilizing kinetics-sensitive volt-coulometry developed at DMN. One of our recent works concerned to electrochemical characterization of novel materials has appeared as Editor's Choice article in *physica status solidi (a)*, moreover, that paper has also been selected to be featured as Article in Wiley's Material Science portal, Materials Views.

In collaboration with the team of the Polymer Institute of SAS, Department of Polymerization Reactions, the DMN team developed an original technology for the preparation of metallic and oxide nanoparticles with small size dispersion. At present, IPo SAS has basic technological equipments acquired within common projects with IPo SAS for preparation of different types of metallic and composite nanoparticles. Nanoparticles of 5-15 nm size are

prepared with a small size dispersion (below 10%) within one technological cycle. These parameters correspond to a world standard.

Project title	European Isotope Separation On-Line Radioactive Ion Beam Facility (EURISOL DS)
Principal investigator	Běták Emil, Assoc. Prof. RNDr. D.Sc
Chief coordinator	Dr. Yorick Blumenfeld, GANIL, Caen, France
No. of contract	515768
Period:	2005-2009
Project title	EUROpean Nuclear Structure Integrated Infrastructure Initiative (EURONS)
Principal investigator	Běták Emil, Assoc. Prof. RNDr. D.Sc
Chief coordinator	Dr. A. Mueller, GSI, Darmstadt, Germany
No. of contract	506065
Period:	2005-2008
Project title	Relativistic nuclear physics in 4pi-geometry
Principal investigator	Kliman Ján, Ing. D.Sc.
Chief coordinator	Prof. A. I. Malachov, VBLHE, Project SPHERA-HEL JINR Dubna
No. of contract	03-1-0983-92
Period:	1997-2009
Project title	Synthesis of New Nuclei and Study of Nuclear Properties and Heavy-Ion Reaction Mechanisms
Principal investigator	Kliman Ján, Ing. D.Sc.
Chief coordinator	Dr. M. G. Itkis, JINR, Dubna, RF
No. of contract	04-05-1004-94
Period:	
Project title	Theoretical investigation of heavy and exotic hadrons properties in the framework of the relativistic quark model
Principal investigator	Stanislav Dubnička, RNDr., D.Sc.
Chief coordinator	Stanislav Dubnička, RNDr., D.Sc.
No. of contract	JINR-01-3-1070
Period:	2010

Contemporary nuclear and subnuclear physics requires access to international experimental facilities. Such facilities, built in international collaboration, typically provide unique opportunities for performing experiment, which are not available at smaller laboratories. Many activities were therefore concentrated on international projects, either future (EURISOL, EURONS) as well as on running projects in CERN, Dubna and JYFL.

The collaboration with the Laboratory of Nuclear Reactions of the Joint Institute of Nuclear Research in Dubna is focused on synthesis of new nuclei and study of nuclear properties and heavy-ion reaction mechanisms. The researchers from the Institute of Physics of Slovak Academy of Sciences were a part of the collaboration, which obtained many unique results of properties of the heaviest nuclei and possibility of their synthesis in reactions, induced by heavy-ion beams.

The collaboration with the Laboratory of Theoretical Physics of the Joint Institute of Nuclear Research in Dubna is focused on theoretical investigation of heavy and exotic hadrons properties in the framework of the relativistic quark model. These studies, performed by the researchers from the Institute of Physics of Slovak Academy of Sciences in collaboration with the colleagues from Dubna, provide a detailed insight into structure of heavy and exotic hadrons, with the implications for the fundamental physics such as the QCD.

One of the major research facilities in nuclear physics in the world is the CERN, of which Slovakia is a member country. Besides the high energy particle physics, being performed at the LHC, it provides also an infrastructure for experimental nuclear physics, most prominently at the radioactive beam facility ISOLDE. Recently, the researchers from the Institute of Physics of

Slovak Academy of Sciences started several activities, aimed at formulating a future physical programme at ISOLDE, performed under their leadership.

Project title Simultaneous spectroscopy of γ rays and conversion electrons:
Systematic study of E0 transitions and intruder states in close vicinity of
mid-shell point in odd-Au isotopes
Laboratory CERN-ISOLDE
Speaker Venhart Martin, Mgr., PhD.
No. of contract IS521
Period: 2011-

Project title Shape co-existence in odd-A isotopes: In-beam spectroscopy of $^{177,179}\text{Au}$
Laboratory JYFL
Speaker D. T. Joss (Liverpool) and Venhart Martin, Mgr., PhD.
No. of contract JR115
Period: 2012-

Project title Transfer induced fission of heavy radioactive beams
Laboratory CERN-ISOLDE
Speaker Veselský Martin, Mgr., PhD.
No. of contract Approved LOI
Period:

Recently, the researchers from Department of Nuclear Physics started several activities, aimed at formulating a future physical programme at ISOLDE, performed under their leadership. As a first part of the future physics programme, an experiment was proposed and accepted under acronym IS521 at ISOLDE (as a first ever experiment at CERN under leadership of Slovak organization), which focuses on detailed systematic studies of the β^+/EC decays of $^{179,181,183,185}\text{Hg}$ leading to excited states in the neutron-deficient Au isotopes in the vicinity of the $N=104$ midshell.

These studies will address important structural questions such as the excitation energies of coexisting states, properties of multiple intruder states (i.e. intruder particles coupled to intruder cores) and mixing of coexisting structures.

Project title Controlled Quantum Coherence and Entanglement in Sets of
Trapped Particles (CONQUEST)
Principal investigator Bužek Vladimír, Prof. RNDr. D.Sc.
Chief coordinator Bužek Vladimír, Prof. RNDr. D.Sc.
No. of contract MRTN-CT-2003-505089
Period: 2004-2008

Project title Quantum Applications (QAP)
Principal investigator Bužek Vladimír, Prof. RNDr. D.Sc.
Chief coordinator Martin Plenio, Prof., Imperial College, London
No. of contract 2004-IST-FETPI-15848
Period: 2005-2009

Project title Quantum Information Entanglement-Enabled Technologies
Principal investigator Bužek Vladimír, Prof. RNDr. D.Sc.
Chief coordinator Bužek Vladimír, Prof. RNDr. D.Sc.
No. of contract EU Grant Agreement No: 247597

Period:	2010-2013
Project title	Quantum Interfaces, Sensors and Communication based on Entanglement
Principal investigator	Bužek Vladimír, Prof. RNDr. D.Sc
Chief coordinator	
No. of contract	EU Grant Agreement No: 248095
Period:	2010-2013
Project title	Hybrid Information Processing
Principal investigator	Mário Ziman, Assoc. Prof. PhD.
Chief coordinator	Fabrizio Illuminati, Prof., Università Degli Studi Di Salerno
No. of contract	DO7RP-0008-08
Period:	2008-2012
Project title	Quantum Interfaces, Sensors and Communication based on Entanglement
Principal investigator	Mário Ziman, Assoc. Prof. PhD.
Chief coordinator	Konrad Banaszek, Prof., University of Warsaw, Poland
No. of contract	MVTS-248095
Period:	2010-2013
Project title	Quantum Information Entanglement-Enabled Technologies
Principal investigator	Mário Ziman, Assoc. Prof. PhD.
Chief coordinator	
No. of contract	MVTS-247597
Period:	2010-2013

Quantum (information) technologies were born of basic science and have always been motivated by the quest to understand the physical world and how the Universe “works”. Basic science is a long-term undertaking, but has the potential to result in transformative changes in technology. These very changes are what define modern society. Vivian Reading in her opening speech at the FET “Science Beyond Fiction” conference said: *“Quantum Information Technologies hold the promise of revolutionizing computing and communication. FET invested early in these mind-boggling technologies and rallied a group of Member States to match its efforts. Thanks to this support, Europe now produces half of the scientific knowledge worldwide in this area and leads the commercial exploitation of this technology in the area of network security. What was considered fiction less than a decade ago, has become a reality today.”*²

The research carried out at the RCQI is mostly curiosity driven though with a large potential to provide basis for future disruptive quantum technologies. The quality of the research performed in the RCQI explains and justifies number of research grants that have been awarded to the group.

ii. List of international conferences (co-) organised by the Organisation

- [1] Identifying quantum states and operations: theory and applications, Budmerice, Slovakia ,20.-24.6.2007
- [2] Central European Quantum Information Processing 2007, Valtice, Czech Republic, 24.-27.6.2007

² V. Reading, former Commissioner DG-INFSO, from the opening address of the FET “Science Beyond Fiction” conference (Prague, 2009).

- [3] Autumn student school on mathematical physics, Stara Lesna, Slovakia, 22.-27.9.2007
- [4] Hadron structure 07, Modra – Harmonia, Slovakia, 3.-7.9.2007
- [5] NANOVED 2007, 4th Intl. Conference on Nanosciences and Nanotechnologies, Bratislava, Slovakia, 12.-15. 11. 2007
- [6] Central European Quantum Information Processing 2008, Telč, Czech Republic, 5.-8.6.2008
- [7] Hadron Structure and QCD 2008, Gatchina, Russian Federation, 30.6.-4.7.2008
- [8] European Conference on Thermophysical properties, Pau, France, 31.8.-9.4, 2008
- [9] Workshop on Synchrotron Radiation and its Application, Liptovský Ján, 25. -31.10.2008
- [10] 6th Int. Conference on Solid State Surfaces and Interfaces, Smolenice, Slovakia, 24.-27. 11. 2008
- [11] Relativistic Nuclear Physics: From Hundreds MeV to TeV, Stará Lesná, Slovakia, 05.06.-11.06.2009
- [12] Hadron Structure 2009, Tatranská Štrba, Slovakia, 30.08.-03.09.2009
- [13] Progress in Applied Surface, Interface and Thin Film Science 2009 (SURFINT – SREN II) , Florence, Italy, 15.11.- 20.11.2009
- [14] Central European Quantum Information Processing 2009, Jindřichův Hradec, Czech Republic, 1.6.-4.6. 2009
- [15] V4 summer schol in quantum information, Budmerice, Slovakia, 21-27.9. 2009
- [16] Advanced Solder Materials for High Temperature Application, COST Action, Bratislava, Slovakia, 07.04.-09.04.2010
- [17] Nanoved, Nanotech, Techtransfer 2010, 5th International Conference on Nanosciences, Nanotechnologies, Nanomaterials, Nanomedicine and Technology Transfer, Bratislava, Slovakia, 16.05.-19.05.2010
- [18] Solid State Surfaces and Interfaces, SSSI 2010, Smolenice Castle, Slovakia, 22.11.-25.11.2010
- [19] Hadron Structure 2011, Tatranská Štrba, Slovakia, 27.6.-1.7.2011
- [20] Central European Quantum Information Processing 2011, Znojmo, Czech Republic, 02.06.-06.06.2011
- [21] Quantum Information Processing and Communication 2011, Zurich, Switzerland, 5.-9. 9.2011
- [22] 10th International Workshop on Positron and Positronium Chemistry, Smolenice, Slovakia, 5.-9. 9.2011
- [23] SAV-ISOLDE autumn seminar on GEANT4, Častá Papiernička, Slovakia, 9.-12.10.2011
- [24] Int. Conference on dynamic aspects of nuclear fission, Smolenice, Slovakia, 17. -21. 10. 2011

iii. List of international journals edited/published by the Organisation

- [1] ACTA PHYSICA SLOVACA . Journal for experimental and theoretical physics. Bratislava: Institute of Physics, Slovak Academy of Sciences . ISSN 0323-0465

iv. List of edited proceedings from international scientific conferences and other proceedings

- [1] HADRON STRUCTURE '07.1st Joint International Conference, September 3-7, 2007, Modra-Harmónia, Slovakia. In Sp. Iss. Fizika B (Zagreb), vol. 17, 2008. Eds. E. Bartoš, S. Dubnička, A.Z.Dubničková. Zagreb: Croatian Physical Society, 2008. 368 p. ISSN 1330-0016
- [2] 6th SOLID STATE SURFACES AND INTERFACES. November 24-27, 2008, Smolenice Castle . Extended Abstract Book. Edited by R. Brunner . Bratislava: Comenius University, 2008. 103 p. ISBN 978-80-223-2566-0

- [3] DYNAMICAL ASPECTS OF NUCLEAR FISSION . Proceedings of the 6th International Conference, October 2-6, 2006, Smolenice Castle. Eds. J. Kliman, M.G.Itkis, Š. Gmuca . New Jersey: World Scientific, 2008. 362 p. ISBN 13-978-981-283-752-3
- [4] NUCLEAR PHYSICS METHODS AND ACCELERATORS IN BIOLOGY AND MEDICINE, FIFTH INTERNATIONAL SUMMER SCHOOL ON NUCLEAR PHYSICS METHODS and ACCELERATORS in BIOLOGY and MEDICINE, July 6-15, 2009, Bratislava, Slovak Republic. AIP Conference Proceedings, 1204. Eds. A.Z.Dubničková, S. Dubnička, C. Granja, C. Leroy, I. Štekl. Melville, New York: American Institute of Physics, 2009. 267 p. ISBN 978-0-7354-0741-1
- [5] RELATIVISTIC NUCLEAR PHYSICS: From Hundreds of MeV to TeV, Proceedings of the 10th International Workshop, Stará Lesná, Slovak Republic, June 5-11,2009, 192 p, ISBN 978-5-9530-0241-7
- [6] HADRON STRUCTURE '09. The Proceedings of the 3rd Joint International Hadron Structure '09 Conference, August 29-September 3, 2009, Tatranská Štrba, Slovak Republic. In Nuclear Physics B (Proc. Suppl.), vol. 198, 2010. Eds. S. Dubnička, A.Z.Dubničková, E. Bartoš . Amsterdam: Elsevier, 2010. 259 s. ISSN 0920-5632
- [7] PROGRESS IN APPLIED SURFACE, INTERFACE AND THIN FILM SCIENCE-SURFINT SREN II. Quest Editor E. Pinčík . In Sp. Iss. Applied Surface Science, vol. 256, Iss. 18, 2010. ISSN 0169-4332.
- [8] HADRON STRUCTURE '11. The Proceedings of the 5th Joint International Hadron Structure '11 Conference, June 27- July 1st, 2011, Tatranská Štrba, Slovak Republic. In Nuclear Physics B (Proc. Suppl.), vol. 219-220, 2011. Eds. S. Dubnička, A.Z.Dubničková, E. Bartoš. Amsterdam: Elsevier, 2011. 320 s. ISSN 0920-5632.

- **National position of the Organisation**

- i. **List of selected most important national projects (provide the arguments why the selected projects are particularly important and represent the international position of the Organisation)**

Project title	Self-assembled nanoparticle templates for future spintronic devices
Principal investigator	Eva Majková
No. of contract	APVV-0173-06
Period:	2006-2009

Project title	Description of the transition anomalous - normal diffusion in nanochannels
Principal investigator	P. Markoš
No. of contract	APVV 51-003505
Period:	2006-2008

Project title	Quantum-information Aspects of Quantum Measurements
Principal investigator	Vladimír Bužek
No. of contract	APVV-0673-07
Period	2008-2010

Project title	System for Direct Pyrolysis of Selected Municipal Waste with Simultaneous Exhaust Gas Cleaning, Possibility to produce of Liquid Fuel and Gaseous Hydrogen
Principal investigator	Katarína Gmucová
No. of contract	APVV-0267-06
Period	2007-2009

Project title	Complex Metallic Alloys
Principal investigator	Marian Krajčí
No. of contract	APVV-0413-06

Period:	2006-2009
Project title	Thermophysical sensors
Principal investigator	Ľudovít Kubičár
No. of contract	APVV-0497-07
Period:	2008-2011
Project title	Nanostructures for development of biosensors
Principal investigator	Štefan Lányi
No. of contract	APVV-0362-07
Period:	2008-2010
Project title	Hybrid Spintronic Nanostructures Controlled by Spin-Polarized Current
Principal investigator	Eva Majková
No. of contract	APVV-0173-06
Period:	2007-2009
Project title	Research and optimization of parameters of c-Si and poly-Si MIS solar cells
Principal investigator	Emil Pinčík
No. of contract	APVV-0577-07
Period:	2008-2011
Project title	Quantum Monte-Carlo: Maximum Accuracy Simulation of Matter
Principal investigator	Ivan Štich
No. of contract	APVV-0091-07
Period:	2008-2010
Project title	Interactions in metal-liquid metal interfaces
Principal investigator	Peter Švec
No. of contract	APVV-0102-07
Period:	2008-2010
Project title	Study of rocks properties and investigation of structural and textural characteristic in correlation with thermophysical and physico-mechanical properties
Principal investigator	Vlastimil Boháč
No. of contract	APVV-641-10
Period:	2011-2014
Project title	Application of advanced metallic materials for stiffness enhancement of lightweight structural components
Principal investigator	Peter Švec
No. of contract	APVV-0647-10
Period	2011-2014
Project title	Complexity of quantum information
Principal investigator	Mário Ziman
No. of contract	APVV-0646-10
Period	2011-2014

Projects aimed at improvement of research Infrastructure, supported from Structural Funds of EU

Project title	Center of excellence for new technologies in electrical engineering, Stage I
Principal investigator	Eva Majková
Coordinator	Karol Fröhlich, Institute of Electrotechnics SAS
No. of contract	ITMS 26240120011

Period	2009-2011
Project title	Assemblies of magnetic nanoparticles and nanoparticle membranes for sensor application
Principal investigator	Eva Majková
Coordinator	Karol Fröhlich, Institute of Electrotechnics SAS
No. of contract	SAV-FM-EHP-2008-01-01
Period	2009-2010
Project title	Center of excellence for new technologies in electrical engineering, Stage II
Principal investigator	Eva Majková
Coordinator	Karol Fröhlich, Institute of Electrotechnics SAS
No. of contract	ITMS 26240120019
Period	2010-2011
Project title	Effective control of production and consumption of energy from renewable sources
Principal investigator	Eva Majková
Coordinator	M. Janek, Institute of Technology SAS
No. of contract	ITMS 26240220039
Period	2010-2013
Project title	Competence Centre for New Materials, Advanced Technologies and Energetics
Principal investigator	Eva Majková
Coordinator	Karol Fröhlich, Institute of Electrotechnics SAS
No. of contract	ITMS 26240220073
Period	2011-2014
Project title	Industrial Safety Research Center of Loss of Coolant Accidents in Nuclear Power Plants
Principal investigator	Štefan Gmuca
Coordinator	VÚEZ a.s. Levice
No. of contract	ITMS 26220220147
Period	2011-2015
Project title	Research Center of Light and Light Technique
Principal investigator	Eva Majková
Coordinator	OMS Ltd.
No. of contract	ITMS 26220220150
Period	2010-2014
Project title	QUTE - Centre of excellence for quantum technologies
Principal investigator	Ivan Štich
Coordinator	Ivan Štich
No. of contract	ITMS 26240120009
Period	2009-2012
Project title	meta-QUTE: Centre of excellence for quantum technologies
Principal investigator	Ivan Štich
Coordinator	Ivan Štich
No. of contract	ITMS 26240120022
Period	2010-2012
Project title	Technology center for research and development of composite materials for engineering, civil engineering and medical applications
Principal investigator	Peter Švec
Coordinator	František Šimančík
No. of contract	ITMS 26240120006
Period	2009-2011

Project title	Technology center for research and development of composite materials for engineering, civil engineering and medical applications II
Principal investigator	Peter Švec
Coordinator	František Šimančík
No. of contract	ITMS 26240120020
Period	2009-2012
Project title	Applied research of advanced photovoltaic cells
Principal investigator	Peter Šiffalovič
Coordinator	Peter Šiffalovič
No. of contract	ITMS 26240220047
Period	2010-2013
Project title	Center for applied research of nanoparticles
Principal investigator	Eva Majková
Coordinator	
No. of contract	ITMS 26240220011
Period	2009-2012

These projects are of great importance for the Institute, because on one hand they prove the quality of our proposals, which are able to win support in an open competition at national level, on the other hand they provide experimental basis for our future experimental work. The improved infrastructure will strengthen our competitive position in European Research Area.

ii. List of national scientific conferences (co)-organised by the Organisation

- [1] 17th conference of Slovak Physicists, Bratislava, 16. 9. - 19. 9. 2009
- [2] 18th conference of Slovak Physicists, Banská Bystrica, 6. 9. - 9. 9. 2010

iii. List of national journals published by the Organisation

iv. List of edited proceedings of national scientific conferences/events

- **International/European position of the individual researchers**

- i. **List of invited/keynote presentations at international conferences, documented by an invitation letter or programme**

2007

- [1] V. Bužek : Quantum observations, Summer school „International Summer School in Quantum Information Processing and Control“, Maynooth, Ireland (29.8.2007)
- [2] V. Bužek : Quantum observations: Recycling of quantum information. Konferencia „Information and Complexity on Quantum Scale“, Erice, Italy (7.11.2007)
- [3] V. Bužek : Three-qubit quantum information processing. Conference NII, Tokyo, Japan (14.3.2007)
- [4] E. Bartoš, S. Dubnička, A. Z. Dubničková, E. A. Kuraev: Sum rules for total cross sections

- of hadron photo-production on pseudoscalar mesons and octet baryons. Conference „XLI PNPI Winter School“, Repino, Russia (19.-25.2.2007)
- [5] S. Dubnička, A. Z. Dubničková: Implications of the proton electric form factor spacelike behavior puzzle, Conference „Exclusive reactions at high momentum transfer“, Jefferson Lab. Newport News, USA (21.-24.5.2007)
- [6] P. Filip : Elliptic flow in central collisions of deformed nuclei, Conference „Relativistic Nuclear Physics 2007“, Kiev, Ukraine (18.-22.6.2007)
- [7] M. Jergel, Utilization of Synchrotron Radiation at the Institute of Physics SAS and Synchrotron Community in Slovakia, Conference „Synchrotron Facilities for the Development of Science and Technology in the Central and Eastern Europe“, Brno, Czech Republic (20.-21.11.2007)
- [8] M. Krajčí, Quasiperiodic monolayers on the i-AIPdMn surface. Workshop „EU Network of Excellence Complex Metallic Alloys“, Nancy, France (13.-15.4. 2007)
- [9] J. Krištiak, O. Šauša, M. Iskrová, V. Majerník, J. Bartoš: Is positronium a passive probe of δ , Conference „37th Polish Seminar on Positron Annihilation“, Ladek Zdroj, Poland, (3.-7.9.2007)
- [10] D. Krupa, I. Tunyi: A novel conceptualization of gravitation, Conference „Science on Stage“, Grenoble, Francúzsko (2.-6.4.2007)
- [11] Š. Luby, E. Majková, L. Chitu, P. Šiffalovič: Magnetic nanoparticles preparation, properties, applications, 34th International Conference of Slovak Soc. Chem. Eng., Tatr. Matliare, Slovakia (Maj 2007), Proc. SSChE, ISBN 978-80-227- 2640-5, p. 123 – 1-10.
- [12] E. Majková , P. Šiffalovič, Š. Luby, S. V. Roth, Self-assembling of magnetic nanoparticles: Time-resolved study, Conference „11th International Conference on Magnetic Ferrofluids“, Košice, Slovakia (23.-27.7.2008)
- [13] Ľ. Martinovič: Exactly solvable models in space-like and light front quantizations. Workshop „Light cone workshop“, Sete, France (15.-18.10.2007)
- [14] D. Muller, J. Turčanová, D. M. Kepaptsoglou, D. Janičkovič, I. Škorvanek, P. Švec, Complex metastable phases formed in amorphous Fe-Ni-Nb-B system, Conference „International Conference on Metastable Amorphous and Nanocrystalline Materials“- ISMANAM 2007, Korfu, Greece (26.8.–30.9.2007)
- [15] Š. Olejník, Confinement and screening in SU(N) and G(2) gauge theories. Workshop „The Many Faces of Quantum Fields“, Leiden, Netherland (10.-13.4.2007)
- [16] E. Pinčík , H. Kobayashi, R. Brunner, M. Takahashi, Y.-L. Liu, K. Imamura, J. Rusnák: On formation and passivation of defect states in Si- and GaAs-based semiconductor Structures, Workshop „V. International Workshop on Semiconductor Surface Passivation“, SSP'2007, Zakopane, Poland (16.-19.9.2007)
- [17] P. Švec , D. Janičkovič, M. Miglierini, D.M. Kepaptsoglou: Metastability of phases in melt-quenched systems, Conference „13th Intl. Conf. on Liquid and Amorphous Metals” LAM 13, Ekaterinburg, Russia (7.-11.7. 2007)
- [18] M. Veselský, Phase transitions in isolated systems, Workshop „International Workshop on Nuclear Dynamics in Heavy-Ion Reactions and Neutron Stars”, Beijing, China, (10.-14.7.2007)
- [19] M. Ziman, Short introduction to quantum entanglement. School „Autumn Student School on Mathematical Physics“, Stará Lesná, Slovakia (25.9.2007)
- [20] M. Ziman, Quantum programmable processors, Summer School „International Summer School in Quantum Information Processing and Control“, Maynooth, Ireland (30.8.2007)
- [21] M. Ziman, Quantum Entanglement, Conference „Finite projective geometries in quantum theory“, Tatranská Lomnica, Slovakia (1.8.2007)
- [22] M. Ziman, Quantum-based privacy, Conference „Quantum Algorithms and Applications“, Blue mountains, Australia (30.5.2007)
- [23] M. Ziman, Lecture on Quantum Estimation, Conference IQING 5, Innsbruck, Austria (11.4.2007)

- [24] Vlastimil Boháč, The Progress in Development of New Models for Pulse Transient Method, THERMOPHYSICS 2007, 11.- 12. 10. 2007, Kočovce chateau, Slovakia
- [25] D. Muller, J. Turčanová, D. M. Kepaptsoglou, D. Janičkovič, I. Škorvánek, P. Švec, Complex metastable phases formed in amorphous Fe-Ni-Nb-B system. 14th International Symposium on Metastable and Nano Materials, Corfu, Greece, 25. 8. - 1. 9. 2007.

2008

- [1] C. Adamuščin: Hadron Structure and QCD: from LOW to HIGH energies, Conference HSQCD'2008, Gatchina, Russia, (30.7 – 4.8 2008)
- [2] C. Adamuščin, S. Dubnička and A.Z. Dubničková, "Electromagnetic structure of the deuteron in the framework of the Unitary and Analytic approach, Conference HSQCD'2008, Gatchina, Russia, (30.7 – 4.8 2008)
- [3] E. Bartoš, S. Dubnička, A.-Z. Dubničková and A. Liptaj, "Evaluation of $e+e- \rightarrow \pi+\pi-$ contribution to muon anomaly by unitary and analytic model of pion electromagnetic structure, Conference HSQCD'2008, Gatchina, Russia, (30.7 – 4.8 2008)
- [4] V. Boháč, Ľ. Kubičár, V. Vretenár, P. Dieška, V. Štofanič, M. Vrabec: Series of invited lectures Measurement of Thermophysical Properties by Transient Methods:
- a. Review of transient techniques,
 - b. Model Development and Analysis of the Pulse Transient Technique,
 - c. RT-Lab - Equipment for Transient Methods Measurements
 - d. Applications of Transient Methods in Praxes (Pulse and Hot Ball),
 - e. Investigation of building materials by transient methods
 - f. Thermophysical and Sound Velocity Analysis of Gioia Marble
- Workshop on Thermo-acoustics tools 2008, University of Sharjah – UAE, (May, 2008)
- [5] V. Bužek, Quantum observation: Quantum Estimation: Theory and Practice Workshop, Waterloo, Kanada, (27. 8. 2008)
- [6] V. Bužek, Quantum observation: Recycling & compression of quantum information and process estimation, IV Quantum Optics conference, Florianopolis, Brazilia, (16. 10. 2008)
- [7] V. Bužek, Accreditation process of Academic Institutions in Slovakia, The National Authority for Quality Assurance & Accreditation In Education, Káhira, Egypt, (5.9.2008)
- [8] P. Filip, Nuclear geometry and Elliptic Flow in Collisions of Deformed Nuclei, 6-th Conference of Czech and Slovak Physicists, Hradec Kralové, Czech Republic, (8.- 11.9.2008)
- [9] P. Filip, Elliptic flow Fluctuations in Collisions of Deformed Nuclei, STAR Collaboration meeting, Brookhaven National Laboratory, Upton, N.Y. USA, (24.-28.9.2008)
- [10] D. Janičkovič, F. Simančík, I. Škorvánek, P. Švec, Rapidly Quenched Metastable Alloys and Physical Processing autorov, CSIR Theme Meeting on "Nanostructured Advanced Materials", NML Jamshedpur, India, (25. – 31. 3. 2008)
- [11] D. Janičkovič, I. Škorvánek, P. Švec, Physical Processing of Rapidly Quenched Alloys, Conference ISMANAM 2008, Buenos Aires, Argentina (6. – 10. 7. 2008),
- [12] Š. Luby, E. Majková, M. Jergel, P. Šiffalovič, Role of interfaces in GMR layered structures, Conference 6th Solid State Surfaces and Interfaces, Smolenice, (Nov. 2008)
- [13] M. Plesch, Young Physicists' Tournament from the view of a (former) participant, International Academic Conference on Physics Education, Tianjin, China, (November 2008)
- [14] E. Pinčík, H. Kobayashi, M. Jergel, M. Takahashi, J. Rusnák, and R. Brunner: On common electrical, optical and structural properties of MOS structures prepared on a-Si:H/cSi, porous silicon/cSi and cSi, International Conference on Thin Films and Porous Materials (ICTFPM 08) v Algiers, Alžír, (Máj 19-22, 2008).
- [15] H. Kobayashi, K. Imamura, M. Urago, Asuha, T. Matsumoto, and E. Pinčík: Nitric acid oxidation of Si at 120 °C to fabricate MOS structure with excellent electrical characteristics, Algiers, Alžír, (Máj 19-22, 2008)

- [16] E. Pinčík, H. Kobayashi, R. Brunner, M. Takahashi, M. Kučera, J. Rusnák, M. Jergel: Electrical, optical and structural properties of different Si-based structures prepared on a-Si:H/cSi, Porous silicon/cSi, and c-Si, International Conference and Exhibition on Analysis and Testing Materials, Beijing, Čína, (November 04, November 07, 2008)
- [17] H. Kobayashi, K. Imamura, Woo-Byoung Kim, M. Madani, T. Matsumoto, S. Imai, and E. Pinčík: One step and two step NAOS methods for fabrication of SiO₂/Si structure with excellent electrical characteristics, Conference 6th Solid State Surfaces and Interfaces, Smolenice, (24-27 November 2008)
- [18] D. Reitzner, M. Hillery, E. Feldman, V. Bužek: Quantum-scattering-walk Searches on Highly Symmetric Graph Structures Quantum Prague '08, Prague, (4.5.2008)
- [19] P. Staňo: Relaxation, dephasing, and decoherence in quantum dot spin qubit, 413. WE-Heraeus seminar, Bad Honnef, Germany, (1.10. 2008)
- [20] P. Šiffalovič, E. Majková, M. Jergel, Š. Luby: Novel diagnostics of buried interfaces by X-ray scattering, 12th Joint Vacuum Conference, 10th European Vacuum Conference, 7th Annual Meeting of the German Vacuum Society – DVG, Balatonalmadi, Hungary, (22.-26.09.2008)
- [21] P. Švec (Sr.), P. Švec, Microstructure analysis of rapidly quenched nanocrystalline alloys by X-ray and electron microscopy methods, EBSD Workshop (JEOL, Oxford Instruments), Dobruška, ČR, (3. - 4. 11. 2008)
- [22] M. Ziman, T. Heinosaari: Discrimination of quantum observables CEWQO, Belgrad, Serbia, (1.6.2008)

2009

- [1] J. Bartoš, O. Šauša, M. Köhler, H. Švajdlenková, P. Lunkenheimer, J. Krištiak and A. Loidl. Positron annihilation and broadband dielectric spectroscopy: A series of propylene glycols, Conference 6-th IDMRCS, Roma, 30.8.-5.9.2009.
- [2] J. Bartoš, O. Šauša, G. A. Schwartz, A. Alegría, J. M. Alberdi, J. Krištiak and J. Colmenero. Positron annihilation response and the relaxation dynamics from broadband dielectric spectroscopy and nuclear magnetic resonance: 1,4-poly(butadiene) The Glass Transition in Binary Mixtures, Conference 6-th IDMRCS, Roma, 30.8.-5.9.2009.
- [3] V. Boháč, L. Kubičár, L. Némethy, P. Dieška, Investigation of moisture influence on thermophysical parameters of PORFIX aerated concrete, Conference THERMOPHYSICS 2009, 29 - 30 October 2009, Hotel Hubertus, Valtice Chateau, Czech Republic
- [4] H. Kobayashi, E. Pinčík, Nitric Acid Oxidation of Si-method for Fabrication of Si/SiO₂ Structure at 120°C and its Application to Thin Film Transistors, VI International Workshop on Semiconductor Surface Passivation (SSP 2009), September 13-18, 2009, Zakopane, Poľsko
- [5] H. Kobayashi, E. Pinčík, „Nitric Acid Oxidation of Si(NAOS) Method for the Formation of Gate Oxides in TFT“, Conference Progress in Applied Surface, Interface, and Thin Film Science 2009 (SURFINT-SREN II), Florencia, Taliansko, November 16-19, 2009
- [6] Š. Luby, E. Majková, P. Šiffalovič, M. Jergel, Semiconductors, Electronics, Information Technology – History and Perspectives, Conference "15th Int. Conf. on Applied Physics of Condensed Matter - APCOM 2009", Liptovský Ján, June 24-26, 2009
- [7] Š. Olejník, Vacuum structure and Casimir scaling in Yang-Mills theories. Pozvaná prednáška, International Workshop on QCD Green's Functions, Confinement and Phenomenology, 7-11.9.2009, ECT Trento, Taliansko.
- [8] Š. Olejník, Ground-state solution of the Yang-Mills Schroedinger equation in 2+1 dimensions. Erwin Schroedinger Symposium 2009, 20.-21.11.2009, Praha, Česká republika.
- [9] E. Pinčík, „On Ultra-Thin Oxide/Si and Very-Thin Oxide/Si structures Prepared by Wet Chemical Process“, VI International Workshop on Semiconductor Surface Passivation (SSP 2009), September 13-18, 2009, Zakopane, Poľsko

- [10] P. Šiffalovič, K. Végső, L.Chitu, M. Jergel, E. Majková, Š.Luby, "The novel applications of tabletop GISAXS systems", PRORA 2009 Prozessnahe Röntgenanalytik 26.-27.11 2009 Berlin, Germany (invited)
- [11] P. Šiffalovič, E. Majková, L.Chitu, M. Jergel, Š.Luby, A.Šatka, S.V.Roth, "Self-assembled nanoparticle templates for future spintronic devices", HASYLAB User Meeting, January 30, 2009, Hamburg, Germany (invited)
- [12] P. Švec (Sr.), P. Švec, R. Portier, Microstructure analysis of nanomaterials by electron microscopy and diffraction methods, Microstructure and Fracture -Mechanical Properties of Nanostructured Materials, First Training School of DEMATEN, 7FP Network Programme Project, Kosice, March 18, 2009.
- [13] P. Švec, I. Škorvanek, D. Janičkovič, P. Švec Sr., Physical processing of rapidly quenched alloys – the case of nanocrystalline Fe-B. New perspectives of materials prepared by rapid quenching, Conference ICAM 2009, 11th Intl. Conference on Advanced Materials, Rio de Janeiro, September 20-25, 2009.
- [14] P. Švec (Sr.), P. Švec, R. Portier, Využitie metód transmisnej elektrónovej mikroskopie a difrakčných metód pre štruktúrnu analýzu nanomateriálov, Seminar „Nanotechnologické aplikácie prístrojů částicové optiky“, TESCAN, Brno, August 19, 2009.
- [15] I. Štich, Optical, Mechanical and Opto-Mechanical Cycles of Anchored Photochromic Molecules, MSL Workshop "Accessing large length and time scales with accurate quantum methods", Jan. 2009, London, U.K.
- [16] I. Štich, Azobenzene: From electronic structure to molecular switching, The 3rd Japan-Czech-Slovak Symposium on Theoretical and Computational Chemistry, Sept. 2009, Bratislava, Slovakia.
- [17] I. Štich, Motion of Sb Nanoparticles on HOPG: Simulation study of frictionless behaviour, Energy Dissipation in Nanocontacts and Molecular Bonds, Sept. 2009, Dresden, Nemecko
- [18] M. Veselský and G.A. Souliotis, Isospin dynamics and production of exotic nuclei in nucleus-nucleus collisions at beam energies up to 50 A MeV, Conference 10th International Conference on Nucleus-Nucleus Collisions NN2009, Beijing (China), August 16-21, 2009.
- [19] M. Veselský, G.A. Souliotis, A. Keksis, S.J. Yennello, Kun Wang and Yu-Gang Ma, Dynamical emission of neutrons at Fermi energies, "The International Workshop on Nuclear Dynamics in Heavy-Ion Reactions and the Symmetry Energy (IWND2009)

2010

- [1] M.Hartmanová: Effect of crystallographic structure on electrical and mechanical characteristics of Sm₂O₃ -doped CeO₂ thin films, 10th International Meeting on Fundamental Problems of Solid State Ionics, Chernogolovka, June 14-16, 2010, Russia
- [2] P. Kalinay: Mapping of diffusion in confined systems (beyond the concept of entropic potential), 4-th Mexican Meeting on Math. and Exp. Physics, Mexiko.
- [2] L. Martinovič: Hamiltonians and physical vacua of exactly solvable models, Conference Hadron Structure and QCD 2010, Gatchina, RF.
- [3] Š. Olejník: In quest of the Yang-Mills vacuum wave functional, Workshop "The Many Faces of QCD", Ghent, Belgium, November 1-5, 2010.
- [4] M.Plesch: Democon 2010, Taiwan, <http://democon.phy.tw/2010>.
- [5] I.Štich: Quantum Monte Carlo meets Quantum Chemistry: new approaches for electron correlation, Electronic structure of lowest singlet states of azobenzene, Lugano, Switzerland, June 2010
- [6] I.Štich: 62. sjezd asociací českých a slovenských chemických společností, Electronic structure of molecular systems: a bridge between Quantum Monte-Carlo and quantum chemistry, Pardubice, CZECH REPUBLIC, June 2010
- [7] E. Majková: Self-assembly and UV mediated re-assembly of colloidal nanoparticles, Conference "Int. Conf. On Nanomaterials – ICN 2010", Kottayam, Kerala, April 2010

- [8] E.Majková, P.Šiffalovič, M. Jergel, Š.Luby: Nanometer Sized Layered Structures – GISAXS Studies, Abstracts “4th International SAXS / GISAXS Workshop“, MCL, Leoben, Austria, September 2010
- [9] P.Šiffalovič, K.Vegso, M.Weis, L. Chitu, E.Majková, M.Jergel, Š.Luby: Two and Three - Dimensional Nanoparticle Assemblies – GISAXS From Liquid to Solid Surfaces, Abstracts “4th International SAXS / GISAXS Workshop“, MCL, Leoben, Austria, September 2010
- [10] D.Nagaj: Local Hamiltonians in quantum computation, January 2010, QIP 2010 - 13th workshop on Quantum Information Processing, Zurich, Switzerland
- [11] D.Nagaj: Local Hamiltonians and quantum complexity, June 2010, 7th Central European Quantum Information Processing Workshop, Valtice, Czech Republic
- [12] M.Ziman: Collision models aka quantum infodynamics, 46th Karpacz, Winter School on Theoretical Physics, Ladek Zdroj, Poland, February 2010
- [13] V.Bužek: Recycling Quantum Information , Seminar Quantum Optics, Obergurgl, 25.02.2010 Austria
- [14] V.Bužek: FET FLAGSHIPS: New paradigms for computing and engineering, January 2010 FET flagship meeting, Brussels, Belgium
- [15] V.Bužek: QUIE2T - Information about coordination action, Seminar Quantum Optics, Obergurgl, Austria, February 2010
- [16] V.Bužek: The QUIE2T, QIPC general meeting (FET information day), Oxford, UK , July 2010
- [17] V.Bužek: Quantum information technologies (Slovak effort and European dimension), Istanbul Chamber of Commerce, Istanbul, Turkey, November 2010
- [18] V.Bužek: Challenges for Europe, workshop From Quantum Foundations to Quantum Technologies, Technical University Viena, Austria, December 2010
- [19] M. Krajčí, J. Hafner: Catalytic properties of Al₁₃Co₄ studied by ab-initio methods, Conference Surfaces of Quasicrystals, Tsukuba, Japan, June 2010
- [20] M. Mihalkovič, Phase diagram, stability and energetics of complex metallic phases. Structural and physical properties of metal hydrides, superconductors and magnetic compounds , 5th European School in Materials Science, Lublana, Slovenia, June 2010
- [21] M. Mihalkovič, Landau theory of phase transitions, Conference Aperiodic 2010, La Valérane, Carqueiranne, France, September 2010.
- [22] Ľ. Kubičár, Thermophysical Analysis of Technological Processes by Pulse Transient and Hot Ball Methods, Conference Thermophysics 2010, Valtice, 3 – 5 November 2010, Czech Republic
- [23] H. Kobayashi, Woo-Byoung Kim, E. Pinčík, Improvement of Si Solar Cell Performance by New Chemical Methods: Surface Passivation, Defect Elimination, Metal Removal, and Surface Structure Transfer Technologies, SSSI 7, Smolenice, Slovakia, November 2010
- [24] S. Jurečka, Woo-Byoung Kim, M. Takahashi, H. Kobayashi, E. Pinčík: Study of density of interface states in MOS structure with ultrathin NAOS oxide, SSSI 7, Smolenice, Slovakia, November 2010.
- [25] E. Pinčík: On electrical and optical properties of very thin oxide/6H-SiC structures, 15th CSM Conference and Exhibition on Analysis and Testing of Metallurgy and Materials 2010 (CCATM 2010) Beijing, China, September 2010
- [26] M. Iskrová, O. Šauša, V. Majerník, D. Berek, E. Illeková, J. Krištiak, B. Sláviková: Confined molecular systems studied by positron annihilation . In: 39th Polish Seminar on Positron Annihilation (PSPA), Kazimierz Dolny, Poland, June 2010.
- [27] J. Bartoš, H. Švajdlenková, O. Šauša, J. Krištiak, P. Lunkenheimer, A. Loidl: On the mutual relationships between atomistic and molecular probe dynamics and broadband dielectric spectroscopy, Madrid, Spain, September 2010

- [28] Š. Gmuca, J. Kliman, L. Krupa et al.: Neutron emission from proton induced fission of actinides, Seminar on Fission VII, May 16-20, 2010, Gent, Belgium
- [29] Š. Gmuca, J. Kliman, L. Krupa et al.: Pre-scission neutron emission from proton induced fission THEORY-1 Scientific Workshop on Nuclear Fission Dynamics and the Emission of prompt Neutrons and Gamma Rays, Sinaia, Romania, September 2010
- [30] Š. Gmuca, K. Petřík: Density dependent couplings in the RMF approach, International Baldin Seminar on High Energy Physics Problems, Conference Relativistic Nuclear Physics and Quantum Chromodynamics, Dubna, Russia, October 2010

2011

- [1] P. Šiffalovič, Tracking the nanoparticle self-assembly, GISAXS-2011, Hamburg, Germany, October 2011.
- [2] M. Mihalkovič, Prediction of phase transition in Al(11)Ir(4), XII Congress of IUC, Madrid, Spain, August 2011 .
- [3] E. Pinčík: „On Structures with Device Quality Ultra-thin and Very thin Films Prepared on Si, a-Si:H and GaAs with Reduced Interface State Densities”, 14th SANKEN International Symposium and 9th SANKEN Nanotechnology Symposium, Osaka University, Japan, January 2011
- [4] E. Pinčík: „Passivation of surfaces of Si-based semiconductors“, VII International Workshop on Semiconductor Surface Passivation, Kraków, Poland, September 2011
- [5] E. Pinčík: “On plasma surface treatment of GaAs and Si-based semiconductors”, 1st International Conference on Plasma Processing of Organic Materials and Polymers, Mahatma Gandhi University, Kottayam, India, November 2011
- [6] E. Majková, Self-assembly of nanoparticles at solid and liquid interfaces, 2nd Annual World Congress of NanoMedicine - NanoMedicine 2011, Shenzhen, China, November 2011.
- [7] L. Šamaj, Long-range correlations of the surface charge between two electrical media, Strongly Coupled Coulomb Systems, Budapest, Hungary, July 2011.

i. List of employees who served as members of the organising and/or programme committees for international conferences

- [1] Adamuščín C., Mgr., PhD.
Member of Organization Committee
- Hadron Structure 2007, Modra-Harmónia, Slovakia, 3.9. - 7.9.2007
 - Hadron Structure 2009 Tatranská Štrba, Slovakia, 30.08.-03.09.2009
 - Hadron Structure 2011, Tatranská Štrba, Slovakia, 27.6.-1.7.2011
- [2] Bartoš E., Mgr., PhD.
Member of Organization Committee
- Hadron Structure 2007, Modra-Harmónia, Slovakia, 3.9. - 7.9.2007
 - Hadron Structure 2009 Tatranská Štrba, Slovakia, 30.08.-03.09.2009
 - Hadron Structure 2011, Tatranská Štrba, Slovakia, 27.6.-1.7.2011
- [3] Běták E., Assoc. Prof., RNDr., D.Sc.
Member of Organization Committee
- 5th International Summer School on Nuclear Physics Methods in Biology and Medicine, Bratislava, 6.-15. 7. 2009
 - 8th International Conference on Nuclear Physics and Radiation Physics, Almaty Kazakhstan, 20-23 Sept. 2011

- [4] Bužek V., Prof., RNDr., D.Sc.
Member of Programme Committee
- ICONO-2007, Minsk, Belarus, 28.5.-1.6.2007
 - 14th Central European Workshop on Quantum Optics, Palermo, Italy, 1.- 5.6.2007
 - QIPIRC conference and workshop, Oxford, Great Britain, 25.-29.6.2007
 - QUIC 2007, International Summer School on Quantum Information Processing and Control, Maynooth, Ireland, 26.–31.8.2007
 - Photons, Atoms and Quanta 07, Royal Society, London , Great Britain, 2.-5.9.2007
 - International Symposium "Quantum informatics - 2007", Moscow, Russia, 1.-5.10.2007
 - CEQIP 2011 - Central European Quantum Information Processing, Znojmo, Czech Republic, 02.06.-06.06.2011
- Member of Organization Committee
- Identifying quantum states and operations: theory and applications, Budmerice, Slovakia, 20.-24.6.2007
 - CEQIP2007, Valtice, Czech Republic, 24.-27.6.2007
- [5] Boháč V., Ing., CSc.
Member of Scientific committee
- European Conference on Thermophysical properties 2008, Pau, France
 - MEASUREMENT 2009
- [6] Brunner R., RNDr., CSc.
Member of Organization Committee
- 6th Conf. Solid State Surfaces and Interfaces I, Smolenice, Slovakia, 24.-27.11.2008
- [7] Dubnička S., RNDr., D.Sc.
Member of Organizing and Programme Committee
- Hadron Structure 2007, Modra-Harmónia, Slovakia, 3.9. - 7.9.2007
 - Hadron Structure 2008, Gatchina, Russia, 20. 8. – 3. 9. 2008
 - Hadron Structure 2009 Tatranská Štrba, Slovakia, 30.08.-03.09.2009
 - Hadron Structure 2010, Gatchina, Russia, 5.7. – 9.7. 2010
 - Hadron Structure 2011, Tatranská Štrba, Slovakia, 27.6.-1.7.2011
- [8] Gmuca Š., Ing., CSc.
Member of Organizing Committee
- Relativistic Nuclear Physics: From Hundreds MeV to TeV, Stará Lesná, Slovakia, 05.06.-11.06.2009
- [9] Hartmanová M., RNDr., D.Sc.
Member of Organizing Committee
- 9th Internat. Meeting on Fundamental Problems of Solid State Ionics, Chernogolovka, Russia, 24.-27.6.2008
- [10] Janičkovič D., RNDr.
Member of Organizing and Programme Committee
- COST Action MP0602, Advanced Solder Materials for High Temperature Application, 2010 Annual Meeting, Bratislava, 7.4.-9.4.2010
- [11] Jergel M., RNDr., D.Sc.
Member of Advisory Committee

- 9th Biennial Conference on High-Resolution X-ray Diffraction and Imaging - X-TOP 2008“, Linz, 15.-19.9.2008
- [12]Kliman J., Ing., D.Sc.
Member of Programme Committee
- 4th Int. Conf. On Fission an Properties of Neutron-Rich Nuclei, Sanibel Island, USA, 11.-17.11.2007
- Member of Organizing Committee
- XXI. Int. Symp. on Nuclear Electronic and Computing (NEC 07), Varna, Bulgaria, 10.-17.9.2007
 - Relativistic Nuclear Physics: From Hundreds MeV to TeV Stará Lesná, Slovakia 05.06.-11.06.2009
- [13]Krištiak J., Ing., CSc.
Member of Organizing and Programme Committee
- 10th International Workshop on Positron and Positronium Chemistry, Smolenice, Slovakia, 5.-9. 9.2011
- [14]Krupa D., RNDr., CSc.
Member of Organizing Committee
- Hadron structure 2007, Harmonia, 3.-9.9.2007
 - 16. Conference of Czech and Slovak Physicists, Hradec Králové, 8.-11.9.2008
 - Hadron Structure 2009 Tatranská Štrba, Slovakia, 30.08.-03.09.2009
 - Hadron Structure 2011, Tatranská Štrba, Slovakia,27.6.-1.7.2011
- [15]Kubičár Ľ., Ing., D.Sc.
Member of Programme Committee
- 8th Asian Thermophysical Properties Conference, 21.-24.8.2007
- Co-chair and Member of Organizing and Scientific Committee
- European Conference on Thermophysical properties 2008, Pau, France
- [16]Liptaj A., Mgr., PhD.,
Member of Organization Committee
- Hadron Structure 2007, Modra-Harmónia, Slovakia, 3.9. - 7.9.2007
 - Hadron Structure 2009 Tatranská Štrba, Slovakia, 30.08.-03.09.2009
 - Hadron Structure 2011, Tatranská Štrba, Slovakia,27.6.-1.7.2011
- [17]Luby Š., Prof., Ing., D.Sc.
Member of Organizing and Programme Committee
- Symposium for PhD Students of University Bielefeld and DMN IoP SAS, Stara Lesná, Slovakia
- [18]Majková E., RNDr., D.Sc.
Member of International Programme Committee,
- 12th Joint Vacuum Conference, 10th European Vacuum Conference, 7th Annual Meeting of the German Vacuum Society – DVG, Balatonalmadi, Hungary, 22.-26.9. 2008
 - Workshop on Synchrotron Radiation and its Application , Liptovský Ján, 2008
- [19]Markoš P., RNDr., D.Sc.
Co-chair
- Materials II (Part of the SPIE), Prague, 16.-18.4. 2007

- [20] Pinčík E., RNDr., CSc.
Member of Organizing Committee
- Progress in Applied Surface, Interface and Thin Film Science 2009 (SURFINT – SREN II) Florence, Italy 15.11.-20.11.2009
 - Solid State Surfaces and Interfaces, SSSI 2010 Smolenice Castle, Slovakia 22.11.-25.11.2010
- [21] Plesch M., Mgr., PhD.
Member of Organizing Committee
- Identifying quantum states and operations: theory and applications, Budmerice, Slovakia, 20-24.6.2007
 - CEQIP2007, Valtice, Czech Republic , 24.-27.6.2007
 - Autumn student school on mathematical physics, Stará Lesna, Slovakia, 22.-27.9.2007
- [22] Šauša O., RNDr., CSc.
Member of Organizing Committee
- 10th International Workshop on Positron and Positronium Chemistry, Smolenice, 5.-9. 9.2011
- [23] Šurda A., RNDr., CSc.
Member of Organizing Committee
- MECO 32, Ladek, Poland, 16.-18.4.2007
 - 33rd Conference of the Middle European Cooperation in Statistical Physics, Puchberg Austria, 1.-16.4. 2008
- [24] Švec P. Ing., D.Sc.
Member of International Advisory Committee
- CSMAG2007
 - International Conference on Condensed Matter Physics, Jaipur, 25.-28.11.2007
 - The 13th International Conference on Rapidly Quenched & Metastable Materials, Dresden, Germany, 24. – 29.8. 2008
 - NANOVED; NANOTECH; TECHTRANSFER 2010, Bratislava, Slovakia 16.05.-19.05.2010
- [25] Venhart M., Mgr., PhD.
Member of Organizing Committee
- SAV-ISOLDE Autumn Seminar on GEANT, Častá Papiernička, Slovakia, 9.-12.10.2011
- [26] Veselský M., Mgr., PhD.
Member of Organizing Committee
- SAV-ISOLDE Autumn seminar on GEANT, Častá Papiernička, 9.-12.10.2011
 - International Conference on dynamic Aspects of Nuclear Fission, Okt. 2011
- [27] Ziman M., Mgr., PhD.
Member of Organizing Committee
- Identifying quantum states and operations: theory and applications, Budmerice, 20-24.6.2007

- CEQIP2007, Valtice, Czech Republic , 24.-27.6.2007
- Autumn student school on mathematical physics, Stará Lesná, 22.-27.9.2007
- CEQIP 2011 - Central European Quantum Information Processing, Znojmo, ČR, 02.06.-06.06.2011
- QIPC 2011 - Quantum Information Processing and Communication, Zurich, CH, 5.-9. 9.2011

ii. List of employees who served as members of important international scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

- [1] Bužek V., Prof., RNDr., D.Sc.
- Editor, European Physical Journal D
 - Editor, Acta Physica Slovaca
 - Honorary Editor, Acta Physica Hungarica B
 - Member of Editorial Board, Physical Review A
 - Member of Editorial Board, Journal of Modern Optics
 - Member of Editorial Board, Journal of Physics B
- [2] Dubnička S., RNDr., D.Sc.
- Member of Editorial Board, Medicus
- [3] Krištiak J., Ing., CSc.
- Member of Editorial Board, Materials Science Foundations
- [4] Lányi, Š. Ing., D.Sc.
- Member of Editorial Board, Czechoslovak Journal of Physics
- [5] Luby Š., Prof., Ing., D.Sc.
- President of ALEA, All European Academies
 - Senator, Vicepresident, Academia Europea Sctietiarum et Artium
 - Member of Editorial Board, Contemporary Materials
 - Member of Editorial Board, Mediteranae Review
- [6] Majková E., RNDr., D.Sc.
- National representative at International Union of Vacuum Science, Technology and Applicationa
 - National representative ESUO Integrated Infrastructure Initiative (I3) ELISA
- [7] Švec P., Ing., D.Sc.
- Member, Intl. Advisory Committe on Rapid Quenching
 - Assoc. Member of IUPAP Commision C10- Solid State Physics
 - Member of Editorial Board, Metallic Materials
- [8] Šamaj L., RNDr., D.Sc.
- Editor, Journal of Statistical Mechanics
 - Member of Editorial Board, Journal of Statistical Physics
 - Member of Editorial Board, Journal of Statistical Mechanics

iii. List of international scientific awards and distinctions

- [1] Bužek V., Prof. RNDr. D.Sc., Finalist of Rene Descartes Price of EU – as a member of QGATES consortium, 2007
- [2] Morháč M., Ing. D.Sc., Kliman J., Ing. CSc., Gmuca Š., Ing. CSc., Matoušek V., Ing. CSc., Turzo I., Ing. CSc., 2. price of JINR Dubna for “Laser-based calibration system of

electromagnetic calorimeters for the experiments on relativistic nuclear physics at the JINR Nuclotron”, Dubna, 2007

[3] Ziman M., RNDr. PhD., The Visegrad Group Academies Young Researcher Award, 2007

[4] Lipták, Ľ., Mgr., PhD., 2009 Václav Votruba Prize for the best thesis in theoretical physics, awarded by The Doppler Institute for Mathematical Physics and Applied Mathematics, Prague, Czech Republic

- **National position of the individual researchers**

- i. **List of invited/keynote presentations at national conferences documented by an invitation letter or programme**

[1] Adamuščín C., Mgr., PhD., Electromagnetic Structure of Hadrons, 16. Conference of Slovak Physicists, 10.-13. september 2007, Žilina

[2] Švec P., Ing., D.Sc., FeCo-based soft magnetic nanocrystalline alloys, Scientific Conference Physics of Materials '09, 14-16 October 2009, Košice, Slovakia

[3] Štich I. Prof., Ing., D.Sc., Modeling of Photoswitchable molecules: from electron structure to molecular switches, 18. Conference of Slovak Physicists, Banská Bystrica, Slovakia, 6. – 9. September 2010

[4] Liptaj A., Mgr., PhD., Remarkable suppression of the $e+e- \rightarrow \pi+\pi-$ contribution error into muon $g-2$, 17th Conference of Czech and Slovak physicists, 5.– 8. September, 2011, Žilina

- ii. **List of employees who served as members of organising and programme committees of national conferences**

[1] Krupa D., RNDr., CSc,
Member of the Organizing Committee
– 16. Conference of Slovak Physicists, Žilina, 9.-13.9.2007
– Physics and Ethics, Nitra, 27.-28.6.2007

- iii. **List of employees serving in important national scientific bodies (e.g. boards, committees, editorial boards of scientific journals)**

[1] Běťák E., RNDr., D.Sc.,
Member of the working group for Physics and Geosciences and Space Sciences of the Accreditation Commission (Advisory Committee of the Slovak Government)
Member of the Scientific Board of the Faculty of Philosophy and Natural Sciences of the Silesian University, Opava, Czech Republic

[2] Bužek V., Prof., RNDr., D.Sc
Chairman of Slovak Learned Society
Editor, Acta Physica Slovaca
Member of Scientific Board of Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava

[3] Dubnička S., RNDr., D.Sc.
Plenipotentiary of the Government of Slovak Republic in JINR Dubna

[4] Hlaváč S., RNDr., CSc.

- Member of the Board of the Nuclear Regulatory Authority of the Slovak Republic
- [5] Krupa D., RNDr., CSc.
Member of Editorial Board, *Obzory matematiky, fyziky a informatiky*
- [6] Luby Š., Prof., Ing., D.Sc
Member of Editorial Board, *J. Electrical Engineering*
Chairman of the Slovak Vacuum Society
Member of the Slovak Learned Society
Honorary member of the Slovak Academy of Agricultural Sciences
Member of the Government Board for Science and Technology
Member of the Government Committee for the Knowledge Society
Member of the Committee for Science and Education of Ministry of Education
Member of the Scientific Board of
Faculty of Mathematics, Physics & Informatics, Comenius University
Matej Bel University, Banská Bystrica
Trnavian University, Trnava
Slovak Technical University, Bratislava
Comenius University, Bratislava
Slovak Medical University, Bratislava
Trenčín University of A. Dubček, Trenčín
Catholic University in Ružomberok
- [7] Majková E., RNDr., D.Sc.
Member of the Committee for XFEL, CENI and ESFR of the Ministry of Education
Representative of the Slovak Republic at ELISA, ESUO Integrated Infrastructure Initiative
Representative of the Slovak Republic at International Union of Vacuum Science, Technology and Applications
Member of the Monitoring Board for Learned Economy
Member of the Scientific Board
Comenius University, Bratislava
Faculty of Mathematics, Physics & Informatics, Comenius University,
Faculty of Engineering Technologies, Trenčín University of A. Dubček,
- [8] Nádaždy V., Ing., CSc.
Member of the Board of Slovak Metrological Institute
- [9] Štich I. Prof., Ing., D.Sc.
Member of the Slovak Learned Society
Member of Editorial Board, *Acta Physica Slovaca*
- [10] Švec P., Ing., D.Sc.,
Member of the Slovak Learned Society
Vice-chair, National Liaison Committee of IUPAP
Member of the Editorial Board, *Metallic Materials*
- [11] Veselský M. Mgr. PhD.
Member of the Slovak CERN Committee

iv. List of national awards and distinctions

2007

- [1] Adamuščín C., Mgr., PhD. - 2nd place in Competition of young physicists, Slovak Physical Society
- [2] Bužek V., Prof., RNDr., D.Sc - Ludovít Štúr's Order of Merit of the 1st Class,
- [3] Bužek V., Prof., RNDr., D.Sc - Award of Literary Fond for most frequently cited Scientist of Slovakia in 2004-2008
- [4] Šamaj L., RNDr., D.Sc. - SAS Award for Research and Development
- [5] Ziman M., Mgr. PhD. - SAS Award for Popularization of Science
- [6] Běták E. Assoc. Prof. RNDr., D.Sc, Award of Slovak Physical Society

2008

- [1] Staňo P., Ing., Mgr. PhD. – Competition of Young Physicists, Slovak Physical Society, 1-2 place
- [2] Illeková E., RNDr. D.Sc. - Medal of Slovak Physical Society
- [3] Lányi Š. Ing., D.Sc - Honorary member of Slovak Physical Society for significant contribution to progress of Physics in Slovakia
- [4] Luby Š., Prof., RNDr., D.Sc - Gold Medal of Archeological Institute of SAS
- [5] Luby Š., Prof., RNDr., D.Sc - Medal of Jesenius Faculty of Medicine in Martin
- [6] Majerníková E., Prof., RNDr., D.Sc - Award of Slovak Physical Society

2010

- [1] Luby Š., Prof., Ing., D.Sc - Honorary member of M.R. Štefánik's Society
- [2] Luby Š., Prof., Ing., D.Sc - Award for Science of Slovak Literary Fonds
- [3] Majková E., RNDr., D.Sc Award of Slovak Physical Society

2011

- [1] Majková E., RNDr., D.Sc and her Team from Department of Multilayers and Nanostructuresm, Benkovičová M., Gmucová K., Halahovets Y., Ivančo J., Jergel M., Luby Š., Nádaždy V., Senderák R., Šiffalovič P., Végsö K.- SAS Award for development for scientific infrastructure
- [2] Luby Š., Prof., Ing., D.Sc - SAS Award for popularization of science
- [3] Duhaj P., Ing., D.Sc - Scientist of the year 2010 (in memoriam), award by Learned Society of SAS and Journalist Studio
- [4] Gmuca Š., Ing., CsC. - Medal of the Slovak Physical Society
- [5] Gmuca Š., Ing., CsC. - Memorial Medal of Faculty of Mathematics, Physics and Informatics, Comenius University
- [6] Liptaj A., Mgr., PhD. - Award SAS for Young scientists by President of Slovak Republic
- [7] Luby Š., Prof., Ing., D.Sc - Acknowledgement for life-work by Learned Society of SAS and Journalist Studio
- [8] Dubnička S., RNDr., D.Sc - Scientist of the year 2010, award by Learned Society of SAS and Journalist Studio
- [9] Nagaj D., Mgr., PhD. - 1st place in Competition of Young Physiscists by Slovak Physical Society
- [10] Venhart M., Mgr., PhD. - 1st place in Competition of Young Physiscists by Slovak Physical Society

v. Supplementary information and/or comments documenting international and national status of the Organisation

4. Project structure, research grants and other funding resources

• International projects and funding

- i. **List of major projects within the European Research Area – 6th and 7th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, ESA etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the Organisation, responsible person in the Organisation and his/her status in the project, e.g. coordinator, work package leader, investigator)**

[1] *EURISOL DS - EUROpean Isotope On-Line Radioactive Ion Beam Facility Design Study*

Principal investigator Běták Emil,
Period: 2/2005-7/2009
Project number 515768 - 6th FP
Main Coordinator GANIL, Caen, France
Financial support (€) 39 306.00

[2] *EUROpean Nuclear Structure Integrated Infrastructure Initiative*

Principal investigator Běták Emil,
Period: 1/2005-12/2008
Project number 506065- 6th FP
Main Coordinator
Financial support (€) 12000.00

[3] *Controlled Quantum Coherence and Entanglement in Sets of Trapped Particles*

Principal investigator Bužek Vladimír
Period: 03/2004 – 02/2008
Project number MRTN-CT-2003-505089(6 RP)
Main Coordinator Institute of Physics
Financial support (€) 4703.00

[4] *Quantum Information Processing and Communication in Europe*

Principal investigator Bužek Vladimír
Period: 09/2006-08/2009
Project number 6RP (CA 033622
Main Coordinator Institute of Physics
Financial support (€) 4990.00

[5] *Quantum Applications*

Principal investigator Bužek Vladimír
Period: 11/2005-10/2009
Project number 2004-IST-FETPI-15848(6th FP)
Main Coordinator Institute of Physics
Financial support (€) 166120.00

[6] *Hybrid Information Processing*

Principal investigator Bužek Vladimír
Period: 11/2008 – 10/2011
Project number HIP 221889 (7th FP)
Main Coordinator Institute of Physics
Financial support (€) 179254.00

[7] *Nanostructures for spintronics and other applications*

Principal investigator Matej Jergel
Period: 2008-2010
Project number MNT-ERA NET 2007-009-SK
Main Coordinator Institute of Physics
Financial support (€) 33194.00

[8] *Nanostructured oxide sensors for chemicals detection*

Principal investigator Luby Štefan
Period: 2008-2010
Project number NATO CLG 982748
Main Coordinator Armando Luches, University Salento
Financial support (€) 6904.00

[9] *Advanced Solder Materials for High- Temperature Application – their nature, design, process and control in a multiscale domain*

Principal investigator Dušan Janičkovič
Period: 5/2007–5/2011
Project number COST MP0602
Main Coordinator Institute of Physics
Financial support (€) 3319.00

[10] *Electromagnetic processing of Materials*

Principal investigator Švec Peter
Period: 1/2006-12/2009
Project number COST P17
Main Coordinator Institute of Physics
Financial support (€) 6638.00

[11] *Bulk nanostructured Al profiles for applications at elevated temperatures*

Principal investigator Švec Peter
Period: 01/2008-12/2010
Project number COST-HIGHTEMAL
Main Coordinator F. Simančík, IMMS SAS
Financial support (€) 13277.00

[12] *Nanostructures for spintronics and other applications*

Principal investigator Matej Jergel
Period: 2008-2010
Project number MNT-ERA NET 2007-009-SK(6th FP)
Main Coordinator Institute of Physics
Financial support (€) 33190.00

[13] *Gasless combustion and structure formation in multilayer thin films*

Principal investigator	Illeková Emília
Period:	2004-2008
Project number	INTAS 03-51-4103
Main Coordinator	Prof.J.C.Gachon, Université Henri Poincaré, Vandoeuvre les Nancy
Financial support (€)	2120.00

ii. List of other international projects incl. total funding and funding for the Organisation

[1] *Mechanism of defect passivation and low temperature oxidation and their application to Si solar cells*

Principal investigator	Pinčík Emil
Period:	4/2007–3/2009
Project number	JSPS/RCI-2/06248
Main Coordinator	Institute of Physics
Financial support (€)	93493,00 (10 mil. YEN)

[2] *Theoretical interpretation of experimental results obtained on COMPASS and HERMES*

Principal investigator	Stanislav Dubnička
Period:	2005-2008
Project number	01-3-1028-99/2008
Main Coordinator	E.A.Kuraev, JINR Dubna
Financial support (€)	5444.00

[3] *Synthesis of New Nuclei and Study of Nuclear Properties and Heavy-Ion Reaction Mechanisms*

Principal investigator	Ján Kliman
Period:	1/1997-12/2009
Project number	04-05-1004-94/2009
Main Coordinator	G. Itkis, JINR, Dubna
Financial support (€)	6108.00

[4] *Relativistic nuclear physics in 4 π -geometry*

Principal investigator	Ján Kliman
Period:	1/1997–12/2009
Project number	JINR 03-1-0983-92/2007
Main Coordinator	D. Malachov, JINR Dubna
Financial support (€)	3817.00

[5] *Novel structures with 2D nanoparticle arrays*

Principal investigator Majková Eva
Period:
Project number 2008-2011II-20080036 EC
Main Coordinator DESY, Hamburg
Financial support (€) 664.00

[6] Quantum Technologies in V4

Principal investigator Plesch Martin
Period: 12/2008 - 11/2009
Project number
Main Coordinator Institute of Physics SAS
Financial support (€) 12000.00

iii. List of other important projects and collaborations without direct funding

- **National projects and funding**
- i. **List of projects supported by the European Social Funds (ESF) and Structural Funds of EU and the role of the Organisation**

Start	Project title	Project number	Duration month/year-month/year	Funding for Organisation within 2007-11 (EUR)	Role of the Organisation
2007 and earlier	Cluster of advanced studies	13120200055	1/2005-12/2007	42986.00	main partner
2009	Center for research and development of constructional composite materials for engineering, civil engineering and medical applications	26240120006	6/2009-5/2011	247906.20	partner
	Center of excellence for new technologies in electrotechnics	26240120011	6/2009-5/2011	161995.00	partner
	QUTE - Centre of excellence for quantum technolgis	26240120009	5/2009-3/2011	379345.00	main partner
	Center of excellence for new technologies in electrotechnics II	26240120019	11/2009-11/2011	231391.00	partner
	Center of Excellence for Research and Development of Constructive Composite Materials II	26240120020	9/2009-12/2012	5028.00	partner
	Center of applied research of nanoparticles	26240220011	10/2009-3/2012	370773	main partner
	Center for commercialiazion of know-how	26240220006	10/2009-8/2012		partner
2010	Applied research of advanced photovoltaic cells	26240220047	9/2010-8/2013	99850.00	main partner
	metaQUTE	26240120022	3/2010-2/2012	1763220.00	main partner
	Research center of light	26220220150	12/2010-12/2014		partner
	Center of excellence for new technologies in electrotechnics II	26240120011	2/2010-1/2012		partner
	Center for PhD students development - education based on science methods	26110230006	4/2010 - 3/2013	113676.00	main partner
	Effective control of production and consumption of energy from obnovitelne sources	26240220028	6/2010-5/2013	9000.00	partner
2011	Industrial research center for loss of coolant accidents in nuclear power plants	26220220147	2/2011-1/2015		partner
	Competence Centre for New Materials, Advanced Technologies and Energetics	26240220073	5/2011-9/2014	11286.00	partner

i. List of projects supported by APVV and the role of the Organisation

Start	Project title	Project number	Duration month/year-month/year	Funding for Organisation within 2007-2011 (EUR)	Role of the Organisation
2007 and earlier	Functional supramolecule surfac	APVT-20-02-029804	1/2005-12/2007	2456.35	Partner
	The theory of strong interactions	APVT-51-005704	1/2005-12/2007	14505.74	Coordinator
	Novel Scanning Probe Microscop	APVT-51-013904	1/2005-12/2007	32264.49	Coordinator
	Thin oxide films for advanced M	APVT-51-017004	1/2005- 12/2007	1659.70	Partner
	Research and development of s	APVT-99-017904	1/2005-12/2007	4979.09	Coordinator
	Investigation of nuclei under ext	APVV SK-CN-00706	1/2006-12/2007	3983.27	Coordinator
	Magnetic multilayers and effects	APVV SK-FR-00706	1/2006-12/2007	2655.51	Coordinator
	Quantum Mechanics of Nucleon	APVV SK-SI-02006	1/2006-12/2007	2157.60	Coordinator
	Diffusion and interface stability i	APVV SK-UA-01606	1/2006-12/2007	2655.51	Coordinator
	Scanning magneto-optical Kerr	APVV LPP-0080-06	11/2006-11/2009	38329.36	Coordinator
	Quantum applications	APVV RPEU-0014-06	1/2007-12/2009	49790.92	Coordinator
	Hybrid Spintronic Nanostructure	APVV-0173-06	3/2007 -12/2009	114187.27	Coordinator
	System for Direct Pyrolysis of S	APVV-0267-06	2/2007 – 12/2009	18920.34	Partner
	Complex metallic alloys	APVV-0413-06	1/2006-12/2008	94402.74	Coordinator
	Electromagnetic processing of n	APVV-COST-0031-06	3/2007-6/2009	38172.59	Coordinator
2008	Thermophysical sensors	APVV 0497-07	09/2008-12/2010	102866.85	Coordinator
	Quantum Monte-Carlo: Simulatio	APVV-0091-07	1.9.2008 / 31.12.20	118899.66	Coordinator
	Interactions in metal-liquid meta	APVV-0102-07	1.9.2008 / 31.12.20	68146.42	Partner
	Nanostructures for development	APVV-0362-07	09/2008-12/2010	30969.63	Partner
	Ultra high-accuracy quantum Me	APVV-LPP-0252-07	1.6.2008 / 31.5.20	38482.47	Coordinator
	Catalysis controlled by mechano	APVV-SK-CN-0027-0	3/2008-12/2009	7966.27	Coordinator
	Research and optimization of pa	APVV-0577-07	09/2008 – 12/2010	201642.56	Coordinator
	Nanoparticle manipulation with a	ESF-EC-0007-07	06/2008-12/2011	132774.92	Coordinator
2009	Quantum-information Aspects o	APVV-0673-07	1.6.2008 / 31.12.20	109480.00	Coordinator
	Quantum Walks, Operations an	APVV-LPP-0264-07	1.7.2008 / 30.6.20	67726.00	Coordinator
	nanoQMC: Quantum Monte-car	LPP-0392-09	1.9.2009 / 21.8.20	49071.00	Coordinator
	Role of water in porous structur	LPP-0422-09	1.9.2009 / 31.8.20	55500.00	Coordinator
	Quantum Walks and Complexity	APVV-LPP-0430-09	1.9.2009 / 31.8.20	22130.00	Coordinator
2011	Complexity of quantum informat	APVV-0646-10	1.5.2011 / 30.4.20	19699.00	Coordinator
	Application of advanced metallic	APVV-0647-10	1.5.2011 / 31.10.20	19308.00	Coordinator
	Study of rocks properties and in	APVV-641-10	1.5.2011 / 31.10.20	25437.00	Coordinator
	Advanced Scanning Probe Micro	SK-IT-0020-08		403.50	Coordinator
	Physics of quantum walks	SK-PT-0008-10	1.4.2011 / 31.12.20	775.00	Coordinator
	Coarse grained measurements	SK-AT-015-10	1.1.2011 / 31.12.20	2000.00	Coordinator

- ii. **Number of projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding**

VEGA	2007	2008	2009	2010	2011
number	23	29	33	33	25
funding in the year (EUR)	87366	95113	103079	130886	148735

- **Summary of funding from external resources (based on annual financial report of the Organisation)**

External resources	2007	2008	2009	2010	2011	total	average
external resources (millions of EUR)	0.547	0.546	0.864	2.155	3.421	7.534	1.507
external resources transferred to cooperating research organisations (millions of EUR)	0.006	0.097	0.078	0.266	0.409	0.855	0.171
ratio between external resources and total salary budget	0.690	0.630	0.980	2.325	3.769	–	1.679
overall expenditures from external as well as institutional resources (millions of EUR)	2.444	2.796	2.973	4.257	5.043	17.513	3.503

- iii. **Supplementary information and/or comments on research projects and funding resources**

5. Organisation of PhD studies, other pedagogical activities

- i. **List of accredited programmes of doctoral studies (as stipulated in the previously effective legislation as well as in the recently amended Act on the Universities)**

- [1] 4.1.3 Condensed matter physics and acoustics
- [2] 4.1.2 General physics and mathematical physics
- [3] 4.1.5 Nuclear and subnuclear physics
- [4] 5.2.13 Microelectronics
- [5] 5.2.48 Physical engineering
- [6] 4.1.4 Quantum electronics and optics

- ii. Summary table on doctoral studies (number of internal/external PhD students; number of students who completed their study by a successful thesis defence; number of PhD students who quitted the programme)

PhD study	31-12-2007			31-12-2008			31-12-2009			31-12-2010			31-12-2011		
number of potential PhD supervisors	42			41			43			51			49		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
internal	11	5		15	2		17	3		18	5		14	1	
external	1			1						1			1		2
supervised at external institution by the research employees of the assessed organisation															

- iii. Postdoctoral positions supported by

a) *external funding (specify the source)*

b) *internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz*

c) In the period 2007-2011 we won funding for 12 posdocs from Supporting Fund of Stefan Schwarz

- iv. Summary table on pedagogical activities in undergraduate programmes for each year

Teaching	2007	2008	2009	2010	2011
lectures (hours/year)	255	294	191	272	446
practicum courses (hours/year)	0	7	96	152	186
supervised diploma works (in total)	11	2	15	16	12
members in PhD committees (in total)	17	18	3	10	6
members in DrSc. committees (in total)	4	6	1	3	2
members in university/faculty councils (in total)	4	6	3	3	5
members in habilitation/inauguration committees (in total)	6	2	5	6	0

v. List of published university textbooks

vi. Number of published academic course books

vii. List of joint research laboratories/facilities with the universities

[1] **Laboratory of Ultrafast Laser Photonics**- joint research laboratory with International Laser Center of Comenius University and Slovak Technical University

viii. Supplementary information and/or comments on doctoral studies and pedagogical activities

6. Applied research

i. List of the most important results of applied research projects and their socio-economic impact

[1] Applications of results from research and R&D projects

Development of Al-based construction elements with enhanced stiffness and strength (exhibiting high modulus of elasticity and low density) – preliminary results from APVV project Application of advanced metallic materials for stiffness enhancement of lightweight structural components) – (Simančík, Švec)

Enhancement of conversion efficiency of solar cells via ultrathin oxide layers and passivation of surfaces and interfaces of cell elements – results from APVV project Research and optimization of parameters of c-Si and poly-Si MIS solar cells- Pinčík

Monitoring of thermal and humidity regimes in archeological and historical objects in relationship with the climatic and meteorological conditions – Spis Castle massif, St. Jakub Church in Levoca and Bratislava Cathedral of St. Martin – results from APVV project Role of water in porous structures (Kubičár). Application of newly developed methods and original sensors and measuring devices in diverse instances for e.g. monitoring of setting of concrete mixtures, control of thermophysical properties of produced steel sheets, etc.

Development and testing of lead-free Sn-Ag-based solders as potential replacement of currently used SAC solders for elevated temperatures, in cooperation with SEMIKRON, s.r.o. and IMMM SAS, results from COST MP0602 Action and APVV project High-temperature lead-free solders for joining of composite materials – (Janičkovič, Švec).

Preparation of functional gas sensors for detection of CO and NO based on Co-Fe-O nanoparticle sensor operating at 325°C, result of NATO CLG project Oxide Sensors for Chemicals Detection - (Luby)

Development of lightweight high-strength Al-based composites with enhanced mechanical and structural stability at elevated temperatures applied in diverse automobile parts, result of joint IMMM SAS and IP SAS APVV project Bulk nanostructured Al profiles for applications at elevated temperatures - (Simančík, Švec)

Development and application of new rapidly quenched amorphous and nanocrystalline materials in diverse conditions as high-performance brazing materials and low-cost materials for power electronics cores due to chemical modifications focused on low-cost admixture atoms, results of bilateral Slovak-Argentinian project Amorphous and nanostructured alloys for engineering applications - (Švec)

Cooperation on design and development of magnetic field gauges, FEL ČVUT Prague - (P. Butvin). Orders in 2009, 2010, 2011; total revenue € 1192.0. Partially funded project follows in 2012, 2013.

[2] Creation of joint laboratories with industrial partners

TRANSIENT MS: Application of Hot Ball Method in technologies of concrete for monitoring of ripening of concrete and of moisture of mortar walls - (L. Kubičár)

General Motors: Offer for participation in R&D project for development of hydrogen container vessels for automobiles - (Ľ. Kubičár)

US Steel Košice: Consultations about possibilities of permanent cooperation in measuring of thermal conductivity of metal sheets - (Ľ. Kubičár)

Schüco International KG and Malibu GmbH & Co. KG.: Cooperation in development of prototype of device for measurement of angular dependence of scattering of light from solar panels - (Cooperation contract, E. Majková, P. Šiffalovič)

Incoatec GmbH Geesthacht and Materials Center Leoben GmbH : Cooperation in application of microfocuss X-ray sources to small-angle X-ray scattering measurements (P. Šiffalovič)

Research center of light and light technology, partners: OMS Ltd. Dojč, STU Ba. Application project for development of advanced lighting systems, founded in 2010, start of activities in 2001, funding 939 990,- EUR in 2011 - (E. Majková).

[3] Creation of Joint Research Centers and Competence Centers with industrial partners and Universities based on Structural Funds of the EU and focused on applied research

Applied research center of advanced photovoltaic cells - (SF project, Majková, IP SAS coordinator)

Competence center for new materials, advanced technologies and power (SF project, IP SAS partner)

Research and Development Center for Advanced X-ray Technologies (SF projekt, Integra TDS s.r.o. coordinator, IP SAS partner)

Center of Excellence of SAS for functionalized multiphase materials FUN-MAT (Krajčí, IP SAS coordinator). – consortium of 4 institutes of SAS and 2 university partners focused on scientific, educational and technological advancement and progress in diverse multiphase materials (nanoparticles, nanostructures, polymers, metals, ceramics, etc.).

Joint Research Laboratory of Institute of Physics and Polymer Institute SAS for preparation of colloidal nanoparticles. Laboratory is supported by SF project Center for applied research of nanoparticles

ii. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign organisations

- [1] Composite authors, incl. Eva Majková, Strategy of development of Slovak Society, Institute of Economy SAS, 2010, 695 p.
Study prepared within Governmental Project “Vision and Strategy of Slovak Society Development”, approved by Slovak Government Decree No 906 from 25. October 2006. ISBN 978-80-7144-179-3.

M. Šikula, P. Staněk, O. Krejčí, P. Berčík, E. Bárány, D. Nikodým, M. Pekník, J. Baxa, M. Benža, Ľ. Blaha, Ľ. Gajdošíková, M. Hronský, E. Jaššová, N. Kmeť, L. Lapšanský, Z. Magurová, J. Marušiak, Z. Poláčková, D. Šmihula, J. Vozár, J. Okáli, I. Domonkos, T. Frank, H. Gabrielová, J. Iša, M. Lábaj, K. Morvay, V. Páleník, L. Pániková, J. Renčko, I.

Šikulová, J. Vokoun, A. Klas, V. Baláž, E. Majková, V. Juríčková J. Košta, I. Tirpák, J. Urbánek, M. Buček,... [et al.]. *Stratégia rozvoja slovenskej spoločnosti*. Bratislava : Ekonomický ústav SAV, 2010. 695 s. Monografia bola vypracovaná v rámci projektu Vízia a stratégia rozvoja slovenskej spoločnosti schváleného vládou SR uz. č. 906 z 25. októbra 2006. ISBN 978-80-7144-179-3.

iii. List of patents issued abroad, incl. revenues

- [1] Patent application no. 285834: Method of measurement of materials parameters by transient pulse method and the apparatus for measuring thereof. Authors: L. Kubičár, V. Boháč, M. Markovič, V. Vretenár, Hrkút, Matay, patent owners: L. Kubičár, V. Boháč, M. Markovič and Transient MS, s. r. o.. Realised by: Transient MS, s.r.o., 2008, revenue 0.0 €
- [2] Patent application PP 0160-2006: Method of measurement of thermal conductivity of materials and sensor thereof. Authors L. Kubičár, V. Vretenár, V. Štofanič. Realized by: Transient MS, s.r.o., 2008, revenue 0.0 €

iv. List of the patents issued in Slovakia, incl. revenues

- [1] Patent 2858354: Method of measurement of materials parameters by transient pulse method and the apparatus for measuring thereof. Authors: L. Kubičár, V. Boháč, M. Markovič. Awarded in 2007, revenue 0.0 €
- [2] Patent 286132: Magnetoelastic strain sensor. Authors: P. Baláž (EMCON, sro.), J. Bydžovský(FEI STU), L. Kraus (FzÚ AVČR), M. Pasquae (IENGF Torino), P. Švec (FÚ SAV). Awarded in Banská Bystrica, 2008, revenue 0.0 €
- [3] Patent application 2009: Preparation of polystyrene latex, Application number PP 5073-2009. Authors I. Capek, E. Majková, revenue 0.0 €
- [4] Patent application 2010: Method of measurement of thermal conductivity of materials and sensor thereof. Application number PV: 287386. Authors L. Kubičár, V. Vretenár, V. Štofanič, revenue 0.0 €
- [5] Patent application 2010: Preparation of networks of polymer nanoparticles based on butylacrylate. Application number: PV: 5001-2010. Authors: I. Capek, E. Majková, K. Gmucová, P. Šiffalovič, revenue 0.0 €
- [6] Patent application 2010: Preparation of nanoparticle mono and multilayers by modified Langmuir-Blodgett method. Application number: PP 5006 2010. Authors: L. Chitu, P. Šiffalovič, E. Majková, M. Jergel, Š. Luby, revenue 0.0 €
- [7] Patent application 2010: Device for formation of relief on semiconducting silicon substrates. Application number PV: 5054-2010. Author: R. Brunner, revenue 0.0 €
- [8] Patent application 2011: Multilayer Ribbons based on Metal Alloys and the Method of preparation thereof. Application number PCT/SK2011/000025. Authors: P. Švec, D. Janičkovič, M. Halász, P. Švec ml., J. Hoško, revenue 0.0 €
- [9] Preparation of polystyrene latex, Application number PP 5073-2009. Authors I. Capek, E. Majková, revenue 0.0 €

v. List of licences sold abroad, incl. revenues

vi. List of licences sold in Slovakia, incl. revenues

- [1] Patent 2858354: Method of measurement of materials parameters by transient pulse method and the apparatus for measuring thereof. Authors: L. Kubičár, V. Boháč, M. Markovič. Awarded in 2007. Realized by Transient MS, s.r.o. , revenue 0.0 €

vii. List of contracts with industrial partners, incl. revenues

- [1] Measurement of thermophysical properties of slag, ordered by SAFINA Jablonec, ČR.(L. Kubičár, revenue 200EUR)
- [2] Monitoring of setting of concrete mixtures, partner Betón Racio s.r.o. Trnava , start of contract 2011 (L. Kubičár, revenue to be realized in 2012).
- [3] Thermophysical properties of foamed aluminium, partner Institute of Construction and Architecture, 2010 (L. Kubičár revenue 2.785,- EUR)
- [4] Thermophysical analysis of aerated concrete, 2008, partner PORFIX, a.s. Zemianske Kostolany (L. Kubičár, revenue 7800,00 EUR)
- [5] Monitoring of setting of concrete mixtures, partner Považská cementáreň a.s. Ladce, start of contract 2011 (L. Kubičár, revenue 1000EUR, contract continued in 2012)
- [6] Monitoring of thermal and moisture regime of the St. Martin Cathedral in Bratislava, requested by Archbishop Office, Bratislava (contact FÚ: Ľ.Kubičár). Devices for long-term monitoring were installed and are operated after approval of Monuments Board. Monitoring will provide information about the degradation of walls and mortar due to environmental load, revenue 0.0 Euro.
- [7] Monitoring of setting of concrete mixtures, partner Technický a skúšobný ústav stavebný, n.o. Bratislava, 2010 (contact FÚ: Ľ.Kubičár), revenue 0.0 Euro.

viii. List of research projects with industrial partners, incl. revenues

- [1] Magnetic fluid - new insulated and cooling medium for power transformers, MNT ERA-Net Project, duration 01/2009-12/2011, project coordinator M. Timko (IEP SAS), project responsible for (IP SAS) Ľ. Kubičár, revenue 39 000.00 Euro
- [2] HIGTEMAL, Bulk nanostructured Al profiles for applications at elevated temperatures, MNT ERA-Net Project, duration 01/2008-12/2010, Project Coordinator F. Simančík (IMMM SAS), project responsible for IP SAS – Peter Švec. Cooperation with SAPA profily, a.s., Vienna Univ. of Technology and New Materials Development GmbH, St. Pantaleon, Austria, revenue 0.0 Euro
- [3] Development of new components for X-ray diffraction and a novel (GI)SAXS instrument, COMET K2 Project A2.12, duration 04/2009-04/2011, project coordinator Materials Center Leoben Forschung GmbH, project responsible for IP SAS – P. Šiffalovič. Cooperating partners – Austria (5 partners), Germany (3 partners), revenue 0.0 Euro

ix.

Outreach activities	2007	2008	2009	2010	2011	total
studies for the decision sphere, government and NGOs, international and foreign organisations				1		1

7. Popularisation of Science

i. List of the most important popularisation activities

- [1] Publication of popularising articles in press media
- [2] Appearance in telecommunication media in discussion popularising science, with special emphasis on occasion of opening of new research labs like NANOLAB and Laboratory of Ultrafast Laser Photonics.

[3] Public popularisation lectures

[4] Organization of “Night of the researcher” presenting results of the Institute to the public in popular shopping center in Bratislava

[5] Organization of “Day of opened door” presenting the existing research infrastructure to interested public, connected with popularising lectures for students of secondary schools

[6] Organization of “Tournament of young physicists” for students of secondary schools

[7] Production of movies popularising science and own research results

ii. Summary of outreach activities

Popularisation of science	2007	2008	2009	2010	2011	total
articles in press media/internet popularising results of science, in particular those achieved by the Organization	15	8	11	19	10	63
appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	6	14	4	17	4	45
public popularisation lectures	9	12	9	30	41	101
documentary film popularising science		2			1	3

iii. Supplementary information and/or comments on popularisation activities

8. Background and management. Staffing policy and implementation of findings from previous assessments

i. Summary table of personnel

Personnel	2007	2008	2009	2010	2011
all personnel	115	114	110	125	119
research employees from Tab. Research staff	55	57	58	70	68
FTE from Tab. Research staff	50.60	53.40	52.70	61.20	54.96
average age of research employees with university degree	50.93	50.15	52.5	48.64	49.42

ii. Professional qualification structure

Number of	2007	2008	2009	2010	2011
D. Sc.	18	18	18	20	18
Ia (vedúci vedecký pracovník/director of research)	8	8	8	6	6
IIa (samostatný vedecký pracovník/senior scientist)	22	21	23	25	25
PhD / CSc.	16	19	14	26	24
prof.	4	5	5	4	4
doc./Assoc. prof.	1	1	1	5	2

iii. Status and development of research infrastructure incl. experimental, computing and technical base (description of the present infrastructure, premises, and material and technical resources. Infrastructure, instrumentation and major technical equipment necessary for the achievement of the objectives specified in the research Concept)

The scientific results, described in this questionnaire were obtained mostly using well established infrastructure either purchased or built in the previous period. The Institute participates at present in several projects aimed at improvement of scientific infrastructure, supported by Structural funds of EU. Technological pavilion of the Institute was renovated to get up-to-date laboratory areas for experimental studies. Within programme supported by Structural funds, several common laboratories with other Academy Institutes with similar research programme were established too. The new research infrastructure will be mostly used for material research. In nuclear physics we will continue to utilise world class European infrastructure, presently available at CERN, GSI, JYFL, other European Laboratories and JINR Dubna.

From the viewpoint of up-to-date materials with the parameters surpassing those available on the market that are designed, developed and produced / prepared at the Institute or in cooperations in significant quantities it is worthwhile to mention at least two classes. 1) Unique metallic and oxide nanoparticle solutions with the size dispersion below 10 percent and self-assembled nanoparticle structures deposited on diverse solid substrates or embedded in polymer blends to prepare new functionalized nanostructures for plasmonic, photovoltaic and various sensing applications available from Department of Multilayers and Nanostructures. 2) Unique metallic systems in the form of ribbons and recently as bulks with amorphous, quasicrystalline or nanocrystalline structures (or in general as complex metallic alloys) are available from the Department of Metal Physics, exhibiting excellent magnetic, mechanical, catalytical and structural characteristics. In both cases the materials can serve as a basis for further fundamental research of new physical phenomena as well as for applications as materials with high added value.

The present research infrastructure includes

- Technological laboratory with devices for preparation of materials by rapid quenching of the melt in laboratory and small-lot amounts in air, under protective atmosphere, and in vacuum; arc-melting and annealing vacuum furnaces for master-alloy preparation and sample preparation by suction-casting method.
- Transmission electron microscopes TEM JEOL 1200EX and JEOL 2000FX equipped with CCD camera, device for electron precession diffraction at JEOL 2000FX
- Laboratory for X-ray diffraction with several X-ray diffractometers like Bruker D8 Advance, Bruker-Siemens D5000HR with Euler cradle and parallel beam, X-ray optics with Bartels and graphite monochromators, heating chambers up to 600 and 1200 °C
- GISAX grazing incidence small angle X-ray scattering laboratory equipment
- Laboratories for complex thermodynamic analysis of materials low- and high-temperature thermal analyses - differential thermal analysis (DTA), differential scanning calorimetry (DSC), thermogravimetry (TGA), magnetic thermogravimetry (TMG), dynamic mechanical analysis (DMA).
- Cryogen-free He-3/He-4 dilution refrigerator (Leiden cryogenics) with $T_{min} < 10$ mK and cooling power 1.2 mW at 120 mK with top loading probe and 9 T superconducting magnet. Experimental setup, based on two low-noise cryogenic amplifiers for 4-8 GHz band and 7-12 GHz band mounted in the refrigerator, enables microwave measurements of electronic nanostructures at temperature ~ 10 mK.
- Laboratory of Ultrafast Laser Photonics (Joint Laboratory of IOP SAS and ILC) equipped with the COHERENT Legend DUO USX/USP equipped with two pairs of stretcher-compressor. The amplified system delivers 100 fs pulses at a rep. rate of 3 KHz with an output energy of 4 mJ. Alternatively the second "fast" output provides 25 fs pulses with the energy of 3.3 mJ. The system is complemented with COHERENT OPerA Solo, optical parametric amplifier with the tuning range of 1100 nm - 11 000 nm and the output pulse duration of 100 fs.
- Laboratory for fabrication of advanced nanometer sized thin films by conventional e-beam evaporation of the deposited materials and by UHV-compatible dual ion-beam deposition system (DIBS). Laboratory is equipped with dedicated UHV (ultra-high vacuum) chambers, one with two-pocket e-beam evaporator for co-deposition purposes, the second with two RF ICP (Radio Frequency Inductively Coupled Plasma) ion guns to ablate the target material and re-sputter/clean the deposited substrate. In-situ diagnostic techniques include quartz thickness monitor, spectroscopic ellipsometry and X-ray scattering and reflectometry.
- Laboratory for synthesis, characterization and deposition of colloidal nanomaterials. Laboratory equipment includes clean inert gas glove-box for the synthesis of the reactive colloidal nanoparticles, high speed centrifuge for the phases separation in synthesized colloidal suspensions. The laser-based apparatus for dynamic light scattering (DLS), two deposition Langmuir-Blodgett troughs and one high-compression ration analysis Langmuir trough for the nanoparticle deposition at the air/water interface and their characterization.
- Laboratory for fabrication and characterization of advanced solar cells based on organic materials. The key fabrication system is composed of a glove-box running under an inert atmosphere directly connected to the HV (high vacuum) deposition chambers. The first deposition chamber is equipped with the organic effusion cells. The second chamber accommodates two thermally heated crucibles for evaporation of metals up to temperature of 1900 K. Both HV chambers are interconnected with the load-lock chamber.
- Laboratory of metal magnetism devoted to soft-magnetic ribbons and ribbon-wound ring cores provides: Digital hysteresisgraph enabling loop recording and simultaneous exact evaluation of saturation magnetization, remanence, dynamic

coercivity, hard-ribbon-axis anisotropy energy density (10 Hz÷ 20 kHz) and loss measurement (on ring cores, up to 100 kHz). Other equipment enables determination of: amplitude permeability (initial one inclusive) and metal-range density (6÷15 g/cm³) for small-volume samples. Sample preparation/handling includes: annealing, etching, encapsulation.

- Software for analysis of X-ray and electron diffraction patterns and acces to the high power cluster based on Intel i7 processors and VASP system as well as to the computational clusters at TU Wien, Univ. Stuttgart - ITAP, Cornell University, Carnegie-Mellon University, GSI Darmstadt and other labs.
- High - preformance cluster based on the Sun Blade 6048 technology with ultrafast connectivity (Infiniband) consisting of more than 850 cores. The cluster is used mainly for purposes of computer modelling of condensed-matter systems

iv. Status and development of bibliographic resources, activities of the Organisation's library and/or information centre

In the present time our library is devoted to the elaboration of publishing activity and the citations of institute scientific staff. The evidence of published works (results) is kept in the data centre- Advanced Rapid Library. This data centre is obligatory for all libraries of Academy.

Our library evidences the citations of institute scientific staff from the year of 1980 . The library is using citations from the Web of Sciences and Scopus bibliographic databases, which are added as a supplement to the Annual Report of Institute. The library is keeping also the copies of publications.

From the year of 2007, the library is using for the librarian foundation a new system Emilda, containing the borrowing module too. The books are on-line accessible on the website of the Institute.

v. Describe how the results and suggestions of the previous assessment were taken into account

- [1] The structure of the Institute was modified, number of departments was reduced from nine to six and research groups with good results were strengthened.
- [2] Greater focus was given to popularization activities, the main actions being the "The night of the researcher", and the "Day of open doors", where except excursions to Institute laboratories, popular lectures for students of secondary schools are also given
- [3] Researchers were motivated to publish their results in journals with high impact factors. Average impact factor of all published papers in individual years increased during the period 2007- 2011. Number of papers (not counting papers by large collaborations) published in journals with high impact factor (i.e. Physical Review Letters) has increased too.

vi. Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

9. Supplementary information and/or comments important for the assessment of organisation which are not explicitly mentioned in the questionnaire (concerning each previously mentioned evaluation criteria, facts not included, evaluation of research teams by ARRA, etc.)

In the evaluation of the research teams of the Slovak Academy of Sciences by ARRA, two research teams from our Institute were evaluated as the excellent research teams. One research team, consisting of two groups from Institute of Physics and Polymer Institute of SAS was evaluated as team of extraordinary quality.

Other information relevant to the assessment

Questionnaire was completed using Institute's Annual Reports 2007-2011 and negotiated with Institute Board and Scientific Board of the Institute of Physics.

Bratislava, May 25th, 2012

RNDr. Stanislav Hlaváč, CSc.
Director of the Institute