

## **Questionnaire**

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

*Period: January 1, 2003 - December 31, 2006*

#### **I. Formal information on the assessed Organisation:**

##### **1. Legal name and address**

Institute of Experimental Physics  
Slovak Academy of Sciences  
Watsonova 47  
040 01 Košice  
Slovak Republic

##### **2. Executive body of the Organisation and its composition**

Directoriat	name	age	years in the position
director	Peter KOPČANSKÝ	51	from 1991
deputy director	Karol FLACHBART	54	from 2003
scientific secretary	Ivan KRÁLIK	41	from 2003

##### **3. Head of the Scientific Board**

Karel KUDELA

##### **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 2003, 2004, 2005, 2006 and average number during the assessment period

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

Research staff	2003		2004		2005		2006		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
organisation in whole	79	76,58	83	76,9	84	75,2	84	74,42	82,5	75,775
Department of Magnetism	16	15,5	17	16,5	18	16,5	18	16,5	17,25	16,25
Department of Low Temperature Physics	10	9,4	10	9,4	11	10,9	11	10,9	10,5	10,15
Department of Metal Physics	4	4	4	4	4	4	4	4	4	4
Department of Subnuclear Physics	13	12,6	14	11,6	14	11,6	14	11,11	13,75	11,728
Department of Space Physics	10	9,28	10	9,6	10	9,1	10	9,1	10	9,27
Department of Biophysics	14	13,84	15	12,84	15	12,34	15	12,05	14,75	12,768
Department of Theoretical Physics	8	8	9	9	8	7,2	8	7,2	8,25	7,85
Computing Group	4	3,96	4	3,96	4	3,56	4	3,56	4	3,76

## 5. Basic information on the funding

i. Total salary budget<sup>1</sup> of the Organisation allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2003, 2004, 2005, 2006, and average amount for the assessment period

Salary budget	2003	2004	2005	2006	average
total salary budget (millions of SKK)	24,116	24,322	25,713	26,442	25,148

## 6. URL of the Organisation's web site

<http://www.saske.sk/Uef>

<sup>1</sup> Sum of the brutto salaries without the fund contributions.

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

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

The Institute of Experimental Physics is oriented on basic research in following directions of physics: condensed matter physics, sub-nuclear physics, space physics and biophysics.

In condensed matter physics the Institute carries out studies of transport, optical, thermal, mechanical and magnetic properties of condensed matter (metallic materials, superconductors, quantum liquids, magnetic liquids, molecule-based magnets) down to very low temperatures.

In the direction of sub-nuclear physics the Institute concerns on active participation in experimental projects realized in leading particle physics laboratories (CERN Geneva, DESY Hamburg etc.)

In the field of space physics the Institute performs studies of the energy distribution of space particles and space radiation using measurements carried out at space satellites and land observatories.

Biophysical research is oriented on the study of conformations, conformational changes, shape, dynamics of transport phenomena and inter-molecular interactions of biological macromolecules, their multi-molecular structures and models.

The theoretical research is focused mainly on non-linear stochastic dynamics and selected problems listed above.

The Institute accomplishes the production, storage and distribution of liquid helium for requirements of institutes of the Slovak Academy of Sciences as well as for other national customers.

The Institute provides advisory service, expertise and guards Internet services for institutes of SAS resident in Košice

The Institute carries out scientific research following generally valid legal rules, and releases the results of its scientific-research activities by publications in periodic and non-periodic journals.

### **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)**

Results achieved by the Institute during the assessment period 2003 - 2006 are in fact represented by research activities of its departments (Department of Magnetism, Department of Low Temperature Physics, Department of Metal Physics, Department of Subnuclear

Physics, Department of Space Physics, Department of Biophysics, and Department of Theoretical Physics). These results are presented in corresponding parts of this document.

Taking into account the fact that the majority of achieved results was published in well established international scientific journals, we believe that the research in the Institute (in its relevant fields) corresponds to current / up to date trends, and fulfils all domestic and international criteria for relevance, exactness and quality / excellence of scientific work.

### **Department of Magnetism**

The activities of the **Department of Magnetism** have been oriented to studies of nanostructured magnetic materials, ceramic superconductors, heavy fermion semiconductors, magnetic fluids, molecule-based magnets and intermetallic compounds.

The research activities in nanostructured magnetic materials have been focused on both fundamental and applied science in the field of Fe- and FeCo-based soft magnetic nanocrystalline materials with conventional as well as new compositions [1,2]. Special attention has been devoted to the tailoring of application - oriented properties of these materials by heat treatment under the presence of external magnetic field. Such investigations are of particular interest for active core parts of various high performance sensors (e.g. flux-gate sensors) as well as for high frequency and electromagnetic devices [3]. Part of activities have been devoted to the magnetocaloric effect in NANOPERM-type soft magnetic materials and in the PrFe-based alloys in order to check their potential for magnetic refrigeration near room temperature. Some research work has been performed in order to study magnetic and structural properties of Gd- and Dy-based nanoparticles and nanocapsules [4].

Important results were obtained in studies of crystal defects in single grain YBCO bulk superconductors, particularly in the formation of new nanosized pinning centres and weak links caused by cracking [5]. In the YBCO system alloyed with Ru a new phase of  $(\text{Ba}_3\text{Y})\text{Al}_2\text{PtO}_{9+\delta}$  type of platelet like shape was discovered [6]. Substituting the constituents of this new phase with elements of suitable ionic radius, coordination number and valence (W, Mo, Zr, Pt, etc.) new phases of platelet like form (cooperation with Cambridge University, IFW Dresden). Some results were patented. The formation of cracks during oxygenation of as grown YBCO bulk single-grain superconductors was comprehensively described [7,8]. The research activities in ceramic superconductors were conducted within the framework of multilateral (EU networks: EFFORT, SCENET, NESPA) and bilateral projects (Oxford University, ICMAB Barcelona, CRETA Grenoble), and as a part of the SAS Centre of Excellence NANOSMART.

Experimental studies of electrical transport phenomena of heavy fermion semiconductors  $\text{SmB}_6$ ,  $\text{YbB}_{12}$  and FeSi have revealed pseudo-gap properties of these compounds at the

Fermi level. Moreover, results of tunnelling spectroscopy studies of FeSi have shown that it contains two electron subsystems, where each of them exhibits a pseudo-gap [9]. Results of electrical resistivity studies of carbon doped  $\text{EuB}_6$ , which is low carrier ferromagnet, have revealed importance that spin-disorder scattering above the magnetic phase transition, and tunnelling spectroscopy has confirmed a metallic-like nature of this system with non-zero density of states at the Fermi level.

Proposed, completed and successfully tested was a novel experimental technique allowing to perform calorimetric tunnelling experiments (CTEs), which enables exact determination of heat generation in individual tunnel junction (TJ) electrodes. The method was successfully used for first experimental proof of the heating model of metal-vacuum-metal TJs [10].

Activities in magnetic fluids have been focused on light induced thermodiffusion, structural transitions in different type of ferronematics, on dynamics of structuralization of magnetic nanoparticles and on magnetic drug targeting. Using the Forced Rayleigh Scattering (FRS) method light induced thermodiffusion in magnetic fluids and consecutive self-diffraction were investigated. Obtained results indicate a negative value of the Soret diffusion constant in penthanol-based magnetic fluids. The development of structuralization of magnetic particles concentration in illuminated thin samples, after illumination intensity reaches critical value, was numerically simulated and experimentally verified. We proved that the FRS method can be successfully used for the determination of size distribution of colloidal magnetic particles in magnetic fluids, and thus for detection of the increased hydrodynamic diameter of magnetic particles after successful immobilization of biomolecules, what is very important for biomedical application. [11].

Structural transitions in different types of ferronematics (liquid crystals MBBA, 6CHBT, 8CB... doped by magnetic particles) exposed to external magnetic or electric fields, or to their combination, were investigated experimentally. Results show that the director of nematic molecules and the magnetic moment of magnetic particles are oriented parallel to each other [12]. Calculated values of surface density of the anchoring energy at nematic-magnetic particle boundaries correspond to soft anchoring.

Magnetically active ferronematic droplets were first observed in the mixture of 6CHBT with fine magnetic particles and phenyl isocyanate. Obtained results showed that magnetic particles play a role of natural nucleation centres for nematic droplets in the nematic phase. The expected decrease of critical fields of magnetic Frederickszon transition with increasing volume concentration of magnetic particles verified the supposed parallel boundary condition in 6CHBT ferronematic droplets [13].

In the previously assessed period significant contribution was made in application of magnetic nanoparticles in biomedicine by preparing a new form of magnetically active drug for magnetic drug targeting. The present finding clearly showed that it is possible to

covalently bind proteins and enzymes (such as BSA, dispase, chymotrypsine and streptokinase) onto magnetic particles the presence of Carbodiimide without the aid of primary coating of freshly prepared particles. The coupling reactions of these substances were carried out using various ratios of magnetic particles to protein and different values of pH to find out the optimum conditions of immobilization [14, 15].

Results of low-temperature magnetization, specific-heat, and electrical resistance measurements on a  $\text{TbFe}_2\text{Si}_2$  single crystal in magnetic fields up to 5 T applied parallel to the principal crystallographic axes are reported in [16]. We conclude that  $\text{TbFe}_2\text{Si}_2$  orders antiferromagnetically below  $T_N = 5$  K and exhibits strong uniaxial magnetocrystalline anisotropy. Analysis of specific-heat data has revealed a field-dependent Schottky contribution. The observed pronounced magnetocaloric effect points to a strong competition of the applied magnetic field and antiferromagnetic correlations in  $\text{TbFe}_2\text{Si}_2$ . Electronic structure of  $\text{TbFe}_2\text{Si}_2$  was studied by first principles calculations in the framework of the density functional theory, which has confirmed the nonmagnetic character of Fe sites.

**Department of Low Temperature Physics / Centre of Very Low Temperature Physics,  
Centre of Excellence of the Slovak Academy of Sciences**

In the previously assessed period a significant contribution to studies of **novel superconductors**, mainly to two-gap superconductivity - a novel phenomenon found in magnesium diboride, was made. Two our papers of this subject have been indexed among "Highly cited papers in 10 years" by ISI Thomson.

During this assessed period experimental studies on two-gap superconductivity have continued and were focused on doping effects in  $\text{MgB}_2$ . Aluminium and carbon doped samples (made in Ames labs, USA, Pohang Univ., Korea) have been studied. Results showed retention of two-gap superconductivity in a broad doping range due to only weak enhancement of inter-band scattering [17,18,19,20,21]. Intra-band scattering processes and their effect on the upper critical magnetic field were also studied showing a strong enhancement of  $H_{c2}$  in carbon doped  $\text{MgB}_2$  with good application perspectives. It was shown that two-gap superconductivity leads also to various unexpected phenomena as temperature and magnetic field dependent superconducting anisotropy [22].

Surprising discoveries of superconductivity near the metal/insulator transitions have brought unexpectedly the superconductivity of diamond and silicon. In studies with our participation the boron doping range, where the superconductivity exists, in diamond has been shown [23], and the superconducting energy gap has been explored [24]. Recently, superconductivity at ambient pressure in heavily doped silicon has been proved [25].

Results on  $\text{LuB}_{12}$  indicate that this compound is a weak-coupling BCS-type superconductor with  $T_C = 0.4$  K and a critical field of  $B_C \approx 1$  mT.

Spin precession waves of homogeneously precessing domains (HPD) in **superfluid 3He-B** were studied experimentally. When spin precession waves are excited, two nuclear magnetic resonances simultaneously co-exist: a high frequency resonance of HPD, and a low frequency resonance of HPD. In paper [26], we showed that non-linear features of spin precession waves are similar to those of simple systems as the physical pendulum.

Leggett's equations describing spin dynamics of superfluid 3He in spatially non-uniform external magnetic field with local minimum were solved theoretically. In paper [27] solutions are presented, they describe the precessing spin structures having properties similar to those experimentally observed in a persistently precessing domain. Paper of [28] summarizes the results of interfacial energy studies of the interface between A and B superfluid phases of 3He in zero-temperature limit.

A completely new type of thermometer and an experimental tool based on a quartz tuning fork was introduced. This type of mechanical resonators allows to measure the temperature of quantum liquids in the range from 4 K down to 150  $\mu$ K, and to generate and detect turbulence (R. Blaauwgeers, M. Človečko, P. Skyba, et al., J. Low Temp. Phys. - accepted). After modifications, we are now able to cool superfluid 3He down to 150  $\mu$ K (the nuclear stage temperature is around 50  $\mu$ K). This sets our laboratory among a dozen laboratories all over the world having such capabilities (P. Skyba - Prize of the Ministry of Education 2005).

The intermediate valence narrow-gap semiconductor  $\text{SmB}_6$  was investigated under pressure. We observed a continuous suppression of the gap, and a critical point at  $p_{\text{cr}} \approx 40$  kbar, characterizing the pressure induced transition from a Kondo insulator to metallic heavy Fermion liquid. In the metallic phase close to  $p_{\text{cr}}$  a non-Fermi-liquid region was observed [29]. We have studied the magnetic ordering of frustrated fcc-antiferromagnets based on rare earths dodecaborides. For antiferromagnetic  $\text{HoB}_{12}$  a complex phase diagram below  $T_N$  was observed. Above  $T_N$  neutron scattering shows diffuse scattering that indicates strong short-range correlations between rare earth magnetic moments [30]

We have studied the electron-quasiparticle interaction function in the class of compounds  $\text{RECu}_5$  (RE = heavy rare-earth metals). A review was published in M. Reiffers et al., Phys. Stat. Sol. (a) 196 (2003) 286. The contribution of crystalline electric field was determined. In the case of  $\text{YbCu}_5$  NMR spectra and electrical resistivity under high pressure showed a possible quantum critical point. We have measured the first point-contact spectra of non-Fermi liquid materials and studied their behaviour in high magnetic field (M. Reiffers et al., J. Magn. Mater. 272-276 (2004) 625).

### Department of Metal Physics

The activities of the department of metal physics were concentrated on the experimental study of metals, mainly their mechanical properties in a wide temperature range. The

scientific interest was focused on the homogeneous and inhomogeneous plastic deformation of amorphous metals. Creep and creep recovery processes in these materials were studied in detail.

Tensile creep tests of bulk and ribbon samples of  $Zr_{52.5}Ti_{5}Cu_{17.9}Ni_{14.6}Al_{10}$  and  $Pd_{40}Cu_{30}Ni_{10}P_{20}$  metallic-glass have been performed in a wide range of heating rates. It has been found that the change of quenching rate at least by three orders of magnitude exerts only little influence on shear viscosity below the glass transition temperature  $T_g$ . In all cases, a linear dependence of viscosity on inverse heating rate is observed. The viscosities of bulk and ribbon samples are nearly the same at temperatures  $T < 500$  K, while at  $500$  K  $< T < T_g$  the viscosity of ribbon samples is lower. [31, 32]

Details of the crystal structure of  $RE[Fe(CN)_6] \cdot 4D_2O$  ( $RE = Pr, Dy$ ), including deuterium atoms localization, were determined by powder neutron diffraction methods. On the ground of results the structure of hydrogen bonds net was described in details. By means of polarized light microscopy a twinning structure of the single crystal  $Pr[Fe(CN)_6] \cdot 4D_2O$  was observed. The described real structure could, together with other up to now reported mechanisms, influence the structural modification symmetry of studied crystals [33].

Bulk polycrystals of metals and alloys with ultra small grain size (nanostructured materials - NS) have been found to be applicable as structural materials in modern technology. We have described the fractographic manifestations of mechanical properties changes in temperature interval down to 4.2 K. At low temperatures the fracture of NS titanium under uniaxial compression is due to propagation of unstable plastic shear, which is accompanied by local adiabatic heating of the material.

Structural relaxation of the amorphous metallic glass FeNiB after long-time stress annealing was studied using differential scanning calorimetry and dilatometry. The creep recovery spectra calculated with Fourier technique have a discrete character consisting of a finite number of peaks. The creep strain recovery was interpreted as a set of irreversible atomic rearrangements in spatially separated "relaxation centres" oriented favourably or unfavourably to the external stress [34].

### **Department of Subnuclear Physics**

During last four years the department participated in following experiments: - H1 experiment on HERA collider at DESY, Hamburg, - NA57 experiment at SPS accelerator (CERN, Geneve), - ATLAS experiment at LHC collider (CERN, Geneve), - ALICE experiment at LHC collider (CERN, Geneve), and - CDF experiment at TEVATRON collider, (FERMILAB, Batavia, USA). All experiments represented large collaborations with approximately 100-450 participants from many countries all over the world. Experiments realized in CERN and DESY are parts of the European Research Area.



The H1 experiment at DESY is oriented to the study of e-p collisions at energies of approximately 300 GeV in centre of mass system. Among most important results are precise measurements of the cross section of deep inelastic scattering in e-p collisions using new instrumentation of the H1 detector, measurements of the jet production in deep inelastic scattering at large energies used for precise determination of the strong interaction coupling constant and gluon distributions in proton. Other topics of interest were the search for the rare and exotic states, tests of the quantum chromodynamics, the study of vector meson production, photoproduction and the real and virtual photon structure. Our group took part in various methodological studies and at the H1 upgrade programme [35 - 37].

The ATLAS experiment, planned for the LHC accelerator being built at CERN, is now in construction and building stage. Our group participates in technical and methodological tasks, and is responsible for the design, development and construction of hadronic end-cap calorimeters (HEC). Among most important achievements we may mention the successfully developed and tested on-line calibration system, development and tests of the so called cold electronics and the front-end readout boards for ATLAS calorimeters, finishing the development and production of some hardware components, as well as the realization of comparative analysis of GEANT-3.21 and GEANT-4 simulation packages for hadronic showers [38 - 40].

The CDF experiment at TEVATRON acceleration complex at Fermilab, was concentrated on the study of top quark properties (mass and charge) in the di-lepton decay channel. We were active within the Top Dilepton Physics and the Top Mass groups at CDF, and in off-line CDF data processing [41]. Till 2005 our group was the only one at CDF to measure the top mass in dilepton channel. From November 2006 our group received full CDF membership.

The NA57 experiment at CERN SPS accelerator, was designed for the study of strange baryon and antibaryon production in Pb-Pb collisions at energies 158 and 40 AGeV/c. Our group gave a significant contribution to the physics data analysis. The NA57 experiment finished the main physics analysis in 2006. The yields (number of particles per rapidity unit) of hyperons  $\Lambda$ ,  $\Xi$  and  $\Omega$ , and their antiparticles in Pb-Pb collisions at 158 AGeV/c, and  $\Lambda$ ,  $\Lambda^-$ ,  $\Xi$  and  $\Xi^-$  at 40 AGeV/c were measured. The transverse mass spectra of  $K_s^0$ ,  $\Lambda$ ,  $\Xi$ ,  $\Omega$  and negative particles in Pb-Pb collisions at 158 AGeV/c were analysed. The NA57 experiment confirmed (in a larger collision centrality range) the observation of the WA97 experiment of strange hyperon production enhancement in central Pb-Pb interactions, which indicates that a new phase of matter - the quark gluon plasma - was created [42, 43].

The ALICE experiment, planned to study nucleus-nucleus collisions at the LHC accelerator at CERN is in the development and construction phase. Our activities are concentrated at the design and development of electronic modules for the pixel detector and the central trigger.

Another activities are concentrated on calculations of the radiation situation in the ALICE detector environment [44 - 46].

### **Department of Space Physics**

The activities of the Department of Space Physics (DSP) have been oriented to the study of (a) physical processes in near-Earth's space, where charged particles with energy below the typical cosmic rays and above the solar wind are important; (b) variability of low energy cosmic rays and (c) high energy solar neutral emissions. In all three directions the relations of energetic particles to space weather effects played a key role. Wide international collaboration was substantial for obtaining results both in the design of new experiments and in the physical analysis of satellite and ground based observations. Only few selected results are mentioned here. Computations of trajectories of cosmic rays within the magnetosphere by the code prepared by DSP yielded into (i) expectations of the changes of transmissivity of cosmic rays penetrating into magnetosphere during past 2000 years (reviewed in [47] according to available models of geomagnetic field); (ii) the estimate of flux of secondary cosmic rays created mainly as re-entrant albedo protons by comparison of the measurement on low altitude satellite with the prediction based on transmissivity function and galactic cosmic ray model [48]. An insight into the origin of energetic proton population in the region upstream from the Earth's bow shock was obtained by a statistical study of Interball-1 measurements [49]: the signatures of both processes, namely of particle leakage from the magnetosphere and of the acceleration of solar wind ions at the bow shock, are evident from 5 years of data. The relative contribution of these two processes is changing with energy. Analysis of data from low altitude polar orbiting satellite CORONAS-F showed (a) several cases of very high energy solar gamma ray emissions (up to at least 100 MeV) during a couple of solar flares [50]; (b) significant redistribution of relativistic electron fluxes during geomagnetic storms; (c) coincidence of enhanced bremsstrahlung emission due to electron precipitation into the atmosphere, most likely occurring as a consequence of a major severe weather outbreak in USA producing extensive lightning flashes, at the point magnetically connected with the point of observation [51] and (d) significant shift of the position of high latitude boundary of solar proton penetration into the disturbed magnetosphere. Gamma rays observed on CORONAS-I were found to be related to fluxes of high-energy electrons of magnetospheric origin [52]. Measurements of cosmic rays at Lomnicky stit were used e.g. for identification of solar neutron event during the strong flare on October 28, 2003 [53]. Relations of cosmic ray flux and its variability to space weather effects were discussed in [54, 55]. The energetic neutral atom imager developed for Double Star probe with substantial contribution of DSP has proven correctness of the design for space observations and provided extensive data for the period from August 2004 until present [56]. Empirical

relations between solar, interplanetary and geomagnetic activity vs. psycho-physiological parameters of the aviation personnel were found for the time period 1994-2004.

### **Department of Biophysics**

Research interests at the Department of Biophysics are in numerous areas including experimental and theoretical studies of biopolymers and their models, characterization of aggregation mechanisms, studies of analogies between solution behaviour of polymeric and nonpolymeric (low molecular mass) compounds, segmentation of images and application of stereological methods in various areas of physical and biomedical research.

The analysis of conformational properties of cytochrome c resulted in identification of novel conformers, description of conditions of their existence and stability [57, 58]. In order to analyse the molecular principles of protein aggregation, first-ever experimental measurements of reorganization energy of unfolded cyt c in urea were performed [59]. Our data indicated that polyanions are in complex with cyt c, which is stabilized by synergistic effect of Coulombic and non-Coulombic interactions [60].

Important results related to electron transfer in Cytochrome c oxidase (CcO) were obtained in cooperation with Rice University, Texas, USA [61, 62].

Theoretical models for computing the basic hydrodynamic parameters of macromolecules in water environment were proposed and the thickness of the thermal volume layer was calculated [63].

In the area of image segmentation modified interactive "Live wire" algorithm able to track the ridge of plasmid DNA in the topological sense was developed [64]. Stereological methods were successfully applied for quantification of surviving neurons upon transplantation.

The research group of the physics of polymers and supramolecular structures achieved original results giving evidence on so far unknown supramolecular organization in solutions of low molecular mass electrolytes, nonelectrolytes, and mixtures of liquids by methods of static and dynamic laser light scattering. A detailed light scattering study [65] was devoted to details of the nature and topology of such structures. Kinetics of the formation of this supramolecular organization and its long-time stability were investigated in detail, too [66]. Bizarre slow kinetic effects were found in systems, which have been considered so far as completely equilibrated. The presence and intensity of the supramolecular organization was correlated with molecular properties and interactions between constituent molecules and ions with the aim to shed light on the molecular mechanism behind observed structuring. The most plausible explanation was given that the structures form due to directional attractive interactions between solute molecules via hydrogen bond bridges formed by one or several solvent molecules, which are themselves hydrogen-bonded [67]. In the area of studies on polymer solution properties, the first real-time monitoring of the origination of multimacroion

supramolecular structures (domains) in an initially homogeneous polyelectrolyte solution was performed [68].

### **Department of Theoretical Physics**

The basic scientific investigation of Department of theoretical physics (DTP) is focused into three areas: 1) Physics of condensed matter, 2) Phenomenology of elementary particles, 3) Non-linear stochastic dynamics.

We have studied theoretically valence and metal-insulator transitions in strongly correlated electron systems within lattice Hamiltonians of the generalized Falicov-Kimball and Hubbard model. Using analytical and numerical methods a microscopic description of pressure, temperature and alloying induced valence and metal-insulator transitions has been elaborated [69, 70]. The results obtained have been used for a description of real materials (e.g., the solid solutions of samarium hexaboride) and a nice correspondence between experimental and theoretical results has been found.

It was found that when the superfluid B phase of helium 3 is put into a quadratic external magnetic field, a set of steady-state solutions of the equations of spin dynamics exists. These solutions describe the coherently precessing spin patterns localized around the minimum of external field. The behaviour of these patterns resembles some properties of observed PPD system [27].

Another purpose of our study was using topology and geometry to study new interesting carbon nanomaterials as e.g. fullerenes. Graphite is an example of a layered material that can be bent to form fullerenes, which promise important applications in electronic nanodevices. The elliptically deformed fullerenes C 70 as well as in C 60 and its spherical generalizations like big C 240 and C 540 molecules have been investigated. The field-theory model was proposed to study the electronic states near the Fermi energy in spheroidal fullerenes. It has been shown exactly how a small deformation of spherical fullerenes provokes an appearance of fine structure in the electronic energy spectrum and how this fine structure is splitted in the presence of magnetic field [71,72]. The physical investigation in elementary particle physics has been intent on the study of various phenomena occurred in production of elementary particles in deep-inelastic scattering of proton and nuclei. It has been described the space-time pattern of hadronization in production of leading particles in DIS off nuclear targets and developed pQCD model of hadronization describing successfully the nuclear effects at various photon energies and virtualities, at various energies and transverse momenta of the produced hadrons for different flavours and different nuclei. Besides, nuclear broadening in inclusive hadron production on DIS on nuclear targets has been studied and the parton propagation in nuclear matter of heavy ion collisions has been described [73, 74].

Within non-linear stochastic dynamics the theoretical investigation was focused on the study of developed turbulence, diffuse and transport phenomena in stochastic environments and on the generation of uniform magnetic fields using turbulent flows in electrically conductive fluids. The influence of various symmetry breakings (anisotropy, mirror symmetry etc.) on anomalous scaling, which expresses a multifractality (intermittency) of statistical fluctuations of random fields under consideration has been investigated by quantum-field methods including renormalization group approach [75, 76]. The most important physical result is that mirror symmetry breaking (helicity) considerably enhances the diffusivity coefficient, which leads to the acceleration of pollutants in random (turbulent) environments (e.g. Earth atmosphere) [77].

Cosmic ray transport was considered in terms of the kinetic equation describing particle scattering by magnetic irregularities and their focusing by regular interplanetary magnetic field. The analysis of angular particle distributions possesses information about properties of the particle scattering in the interplanetary space. Steady state solutions of the kinetic equation have been applied to the analysis of solar proton events [78].

All these results have been obtained within a broad international collaboration mainly with University in Helsinki, University in Genoa, University in St. Petersburg and Laboratory of Theoretical Physics of Joint Institute for Nuclear Research (JINR) in Dubna, Moscow region.

### **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**

All scientific results achieved by the Institute and mentioned in the "Summary of R&D activity..." were obtained in a vivid international collaboration, many of them with funding from international resources. As the research of the Institute will maintain this tendency, the ongoing research in related (above-mentioned) directions will present the current state of knowledge from both the international and national perspective also in next four years.

#### **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 significance of the IEP SAS on the national level can be documented by results of annual evaluation of Slovak Academy of Sciences (SAS) institutes, being organized by the Presidium of SAS in 2005 and 2006. According to evaluation criteria our Institute appears to be among the best three within the Section I of Non-living Nature.

The significance on international scale can be underlined by the fact that the majority of research activities is carried out in international collaboration with scientific institutes and

research centres in Europe, USA and all over the world, by lists of authors of published papers, and by bi-lateral agreements between the Institute and foreign institutes.

### iii. Objectives of the Concept

The future development of the **Department of magnetism** is planned in several directions. R&D activities of magnetic fluids will be devoted to studies of dielectric breakdown strength in isolative mineral oil based magnetic fluids with the aim to find magnetic fluids with suitable dielectric properties and better thermal properties. Using this type of magnetic fluid would enable to design smaller, more powerful power transformers, or to increase lifetime and load capacity of existing devices. Another plan is to study physical systems with magnetic nanoparticles - mainly ferronematic droplets. An important accent will be devoted to the preparation of new a magnetically active form of anticancer drugs and to the construction of a special magnet for magnetic drug targeting for cancer treatment.

R&D activities in nanostructured magnetic materials will be devoted to the development of novel soft and hard magnetic nanocrystalline materials, as well as to new alloy systems showing large magnetocaloric effect. Of particular interest will be the better understanding of correlations between the microstructure and the soft magnetic behaviour in new FeNi-based nanocrystalline alloys as well as in Co-rich compositions of HITPERM alloys. As for hard magnetic materials, we propose to study melt-spun FePtB alloys microalloyed with Nb, Zr, ..., which are expected to act as grain growth inhibitors during the processing leading to formation of the high anisotropy  $L1_0$  FePt phase with ultrafine grains. In prepared soft and hard magnetic samples, the effects of variation of grain sizes and the intergranular distances as well as the effects of magnetic properties of the matrix and the interphase boundaries will be investigated. The driving force behind these objectives is the optimisation of composition and preparation, in order to obtain materials with tailorable magnetic properties that can be used in various technical applications.

Main goal in molecule-based magnets will be the study of magnetostructural correlations in single crystals, powders, coloured films and nanoparticles. We will focus on the synthesis of metallo-cyano-complex (MCC) powders, in which hydrogen is substituted by deuterium, suitable for neutron diffraction measurements. Search for optimal synthesis to reach the highest value of  $T_C$  is another goal. We are going to study the effect of external parameters like pressure and light on their basic magnetic characteristics.

R&D activities in f- intermetallic compounds and borides will be devoted to magnetostructural correlations. We will study the effect of geometric frustration, Kondo effect and magnetic properties of systems related to heavy-fermion systems (HFS). Non-Fermi liquid behaviour, magnetic instabilities and the effect of chemical pressure will be studied by suitable chemical substitution and deviation from stoichiometric composition in systems related to HFS. We will

study the influence of mechanical milling on structural and magnetic properties of systems with strong electron-electron correlations.

We plan a continuation of tunnelling studies of heavy fermion semiconductors  $\text{SmB}_6$ ,  $\text{YbB}_{12}$  and  $\text{FeSi}$ . We plan to perform similar studies on further materials with a complex electronic structure, preferably strongly correlated electron systems. Among them, systems as non-conventional heavy fermion superconductor  $\text{CePt}_3\text{Si}$  and low-carrier ferromagnets  $\text{EuB}_{6-x}\text{C}_x$  and Ga-Mn-As are going to be investigated too.

The activities of the Ceramic superconductors and nanomaterials group in the research of HTSC superconductors will continue. The group plans to take part in the EU structural funds projects and to build a laboratory with infrastructure for preparation, structural and microstructural characterization of progressive ceramic and metallic materials suitable for basic physical research and applications.

The development of the **Centre of Ultra Low Temperature Physics**, a unique laboratory in the Middle European context, is planned in several directions. The success of the laboratory has always been based on the development of unique techniques, which are not available commercially and make the lab attractive for international collaborations.

Our nuclear demagnetisation refrigerator will undergo a thorough reconstruction. We will continue in the development of new thermometry based on tuning fork. Beside the existing dilution refrigerator (Oxford Instr. top-loading) a new economic dilution refrigerator is getting built within the 6th EU Framework project ExtreM. In this system capable to work down to 15 mK calorimetry as well as transport and magnetic measurements will be implemented, with a rotating sample holder for angular measurements up to 8 Tesla. Sensitive ac-calorimetry capable to measure minute relative changes of specific heat on very tiny samples smaller than 1 microgram is being developed in collaboration with the CEA Grenoble. Another ambitious project is to develop a scanning tunnelling microscope (STM) capable to work down to 300 millikelvin and in magnetic field up to 8 T. The STM head will be developed in collaboration with the Universidad Autonoma de Madrid.

As to the physical programme, we will continue in exploration of novel superconductors, superfluid helium-3 and strongly correlated electron systems. But, we want to broaden our scope also to nano-physics, to superconducting / ferromagnet hetero-structures, spin valves and superconducting qubits. A plan is to carry out research of superfluid  $^3\text{He}$  phases at ultra low temperatures with the aim to find and study phenomena having analogy to phenomena in cosmology and physics of quantum vacuum. The use of superfluid  $^3\text{He-B}$  as a model system to study quantum decoherence is planned. The influence of high-pressure, high magnetic field, as well as of alloying and vacancies, on the behaviour of intermediate valence compounds will be studied. We plan to investigate the magnetic structure and properties of

selected rare earth compounds. We will study the emergent behaviour of intermetallic compounds, especially in the vicinity of the quantum critical point.

Research activities of the **Department of metal physics** will be focused to solve actual problems of metastable materials. The aim of scientific investigations will be to study the substance of solidity and plastic deformation of metallic materials in metastable structural state. Our intention is to contribute to mechanisms of plasticity and failures occurring in several groups of metallic materials exhibiting metastability in their structural state. The subject of our study will be nanostructural metallic materials and quickly cooled composite materials on metallic base. This is a class of materials where the metastable structural state is reached by methods of fast cooling from liquid phase (amorphous or volume amorphous metals and metallic surface layers created by a laser beam) or metallic materials, where the nanocrystalline structure is induced by the plastic deformation accumulation. Scientific interest will be focused to creep and creep recovery of amorphous metals, fractography of metastable materials and computation of structure refinement.

The crystal structure of materials with interesting magnetic properties will be studied by X-ray and neutron diffraction methods with attention paid to the local crystal structure determination based on the non-Bragg diffraction.

The future development of the **Department of subnuclear physics** will be mainly determined by scientific programmes of CERN Geneva.

The ATLAS detector construction should end in 2007, when the first collisions are expected. In next four years we will concentrate mainly on the preparation of on-line and off-line calibration of all four HEC rings and its connection with other ATLAS sub-detectors, especially the backward calorimeter and the central hadronic calorimeter. A not negligible task is the software installation and tests in our institute, using the existing PC farm.

The ALICE detector construction should be finished in year 2007. Until then we plan to continue in the design and development of electronics for the pixel detector and the central trigger. We plan to extend our activities in off-line simulations and development of methods, and software for the physics data analysis.

Taking into account our participation in the LHC programme, we want to stress our LCG activities with intentions to build our ATLAS/ALICE Grid structure.

In the CDF experiment, where we received full membership in 2006, sufficient data statistics became available. Here we want to improve the precision of top quark mass measurement, and to participate in measurements of other top quark characteristics (width, charge, spin etc...). In order to achieve our goals, we want to develop new methods based e.g. on artificial



intelligence. We plan to be active in other interesting physics subjects, which data taking during the Run II may provide (e.g. Higgs boson search).

In the H1 experiment at end of June 2007 the data taking will be finished and next seven years will be devoted to data analysis only. Our main goal for this period is to study the e-p collisions with a special emphasis on the vector meson production.

**Department of Space Physics** intends to contribute to the understanding of relations between energetic particle characteristics near Earth and the effects of space weather. In addition to magnetospheric research, the analysis of interplanetary physical phenomena as well as of phenomena near other planets using available data, including those with participation of DSP, is a part of the concept. More specifically, the following topics will be studied: (a) transmissivity of Earth's variable magnetosphere for solar and galactic CR; (b) acceleration at the Sun observed by high energy gamma rays and neutrons; (c) atmospheric and eventually seismic effects related to high energy emissions from space (both charged and neutral); (d) variability of galactic and solar CR at neutron monitor energies and above in relation to space weather effects; (e) transport and loss processes of medium energy charged particles within the Earth's magnetosphere; (f) transport of energetic particles and low energy CR in interplanetary space; (g) physical processes in the vicinity of other planets.

The research focus of the **Department of biophysics** will continue in areas of experimental and theoretical studies for conformational changes of biomacromolecules due to various stimuli. Specifically, factors responsible and involved in conformational stability of macromolecules (like novel conformers and their stability) will be analysed. In addition, we will focus on proteins and polynucleotides that display high resistance towards temperature, pH and denaturation agents. In addition, mechanisms of formation of non-functional aggregates of proteins will be further analysed with the intention to identify new inhibitors able to prevent many degenerative diseases.

In the field of molecular modelling we plan further expand on the theoretical studies of macromolecular hydration. In conjunction, we intend to develop and build a new instrument, viscometer, in order to measure viscoelastic properties at phase boundaries in macromolecular solutions.

In the field of intermolecular interactions we will study protein-ligand interactions. Specifically, we will focus on carbohydrate-binding and carbohydrate-modifying proteins, due to their importance in cancer and cell type recognition. Grid-based computing and analysis of interaction profiles of protein-ligand complexes will provide deeper insights into the nature of intermolecular forces driving many biological and physiological processes.

In the area of image processing, future plans include analysis of moving objects (interfacial effects of fluids) or objects that are changing (*i.e.* changes in cell morphology, with emphasis on transplanted neuronal cells) or combination of both.

The plans in the research group of the physics of polymers and supramolecular structures are coming out from successful (accepted) project proposals for next four years. We will focus on the research on polymerisation kinetics of various ionic and non-ionic water-soluble polymers. Development of several unique experimental methods is an integral part of our interest. We will focus on the investigation of various routes towards preparation of tailor-made polymeric complexes (nanoparticles) with envisaged applications, mainly in targeted and controlled drug or gene delivery.

The plans of the **Department of theoretical physics** can be summarized as follows:

Study of strongly correlated electron systems beyond standard approximations with the attempt to elaborate the most realistic description of rare-earth and transition metal compounds exhibiting a number of exotic cooperative phenomena like inhomogeneous charge ordering, electronic ferroelectricity, high-temperature superconductivity, e.g.

Study superfluid He-3 as a model system for various astrophysical and cosmological phenomena.

Search for a correlation between resultant product properties, starting raw materials powders, composite constituents,...) and technological procedures (surface treatment, coating, compaction, sintering, heat treatment,...)

Contribute to the elucidation of electron transfer in reaction centres of higher plants. Investigate the electronic properties of carbon nanomaterials with exotic geometry as e.g. nanotubes, nanohorns, nanofibres, which can be used for the development of modern nanoscale electronic devices.

Make theoretical predictions for nuclear modification of the proton structure functions as a function of the Bjorken variable corresponding to RHIC and LHC energy range.

Study the nuclear broadening in inclusive hadron production in lepton-nucleus collisions. Continue the study of intermittency and anomalous scaling in diffusion processes with collective effects of compressibility, left- right and isotropy symmetry violation of adjective random environment.

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

The overall strategy common to all departments of the IEP SAS can be summarized as follows:

- a) Reliance on the already established international collaboration with international research centres and institutions in the European, U.S. and other areas. Seek possibilities to obtain international funding (COST, 7FP etc...) for joint projects.
- b) Proposals for national research grants (APVV, VEGA, government projects...).
- c) Seeking all possible opportunities to rejuvenate the Institute via attracting perspective graduate students for the PhD study, helping them in gaining experience in international environment, trying to locate support for post-docs (Fund of Stefan Schwarz, etc..) and eventually taking them into the staff.
- d) Publication of research results in established physical journals and the presentation of achieved results at international conferences, workshops and meetings.
- e) Increasing our involvement in the pedagogical / educational process.
- f) Continue in organization of well-established regional conferences (Small Triangle Meeting, Czech and Slovak Conference on Magnetism, Conference of Czech and Slovak Physicists, Hadrons Structure, Structure and Stability of Biomacromolecules, etc...). Participate in organizing of international conferences.

### **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**

- [1] I. ŠKORVÁNEK, J. KOVÁČ, J. KÖTZLER. Nanocrystalline soft magnetic materials: Intergrain coupling and spin freezing effects, *Physica Status Solidi (b)* 236, (2003) 303-309
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- [3] I. ŠKORVÁNEK, J. MARCIN, T. KRENICKÝ, J. KOVÁČ, P. ŠVEC, D. JANIČKOVIČ Improved soft magnetic behaviour in field-annealed nanocrystalline Hitperm alloys. *Journal of Magnetism and Magnetic Materials* 304 (2006) 203-207
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- [12] **N. TOMAŠOVIČOVÁ**, **M. KONERACKÁ**, **P. KOPČANSKÝ**, **M. TIMKO**, **V. ZÁVIŠOVÁ**, J. JADZYN. Temperature dependence of the critical magnetic field of the structural transition in MBBA-based ferronematics. *Phase Transition* 79 (2006) 595-603.
- [13] **P. KOPČANSKÝ**, **M. KONERACKÁ**, **M. TIMKO**, **I. POTOČOVÁ**, L. TOMČO, **N. TOMAŠOVIČOVÁ**, **V. ZÁVIŠOVÁ**, J. JADZYN. The structural transition in ferronematics and ferronematic droplets. *Journal of Magnetism and Magnetic Materials*. 300 (2006) 75-78.
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- [69] **FARKASOVSKY P**, Effects of nonlocal hybridization on valence and metal-insulator transitions in the Falicov-Kimball model, *Physical Review B* 70 (3) (2004) 035117
- [70] **FARKASOVSKY P, CENCARIKOVA H**, Ground states of the generalized Falicov-Kimball model in one and two dimensions, *European Physical Journal B* 47 (4) (2005) 517-526
- [71] **R. PINCAK**, Spheroidal geometry approach to fullerene molecules, *Physics Letters A* 340 (2005) 267.
- [72] **M. PUDLAK, R. PINCAK AND V. A. OSIPOV**, Low energy electronic states in spheroidal fullerenes, *Physical Review B*, 74 (2006) 235435.

- [73] B.Z. KOPELIOVICH, **J. NEMCHIK**, E. PREDAZZI AND A. HAYASHIGAKI Nuclear hadronization: within or without?, *Nuclear Physics A* 740 (2004) 211.
- [74] B.Z. KOPELIOVICH, **J. NEMCHIK**, I.K. POTASHNIKOVA, M.B. JOHNSON I. SCHMIDT, Breakdown of QCD factorization at large Feynman  $x$ , *Physical Review C* 72 (2005) 054606.
- [75] N.V.ANTONOV, **M. HNATICH**, J.HONKONEN, **M. JURCISIN**, Turbulence with pressure: Anomalous scaling of vector field, *Physical Review E* 68 (2003) 046306.
- [76] **M. JURCISIN**, **M. STEHLIK**, D-dimensional developed MHD turbulence: double expansion model, *Journal of Physics A: Mathematical and General*. Vol.39, no.25 (2006), p.8035-8050.
- [77] O. G. CHKHETIANI, **M. HNATICH**, **E. JURCISINOVA**, **M. JURCISIN**, A. MAZZINO, **M. REPASAN**, Influence of helicity on anomalous scaling of a passive scalar advected by the turbulent velocity field with finite correlation time: Two loop approximation, *Physical Review E* 74, (2006) 036310 - 26.
- [78] Y.U. FEDOROV, **M. STEHLIK**, SCR distribution function in the radial IMF approximation, *Astrophysics and Space Science*. Vol.301, no.1-4 (2006), p.33-41.

**ii. List of monographs/books published abroad**

[1] none

**iii. List of monographs/books published in Slovakia**

[1] none

**iv. List of other scientific outputs specifically important for the Organisation**

[1]

**v. 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).*

Research outputs	2003			2004			2005			2006			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	averaged number per year	av. No. / FTE	av. No. / salary budget
chapters in monographs, books published abroad	1	0,01	0,04	1	0,01	0,04	1	0,01	0,04	1	0,01	0,04	4	1,0	0,01	0,04
chapters in monographs, books published in Slovakia	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,0	0,00	0,00
CC publications	83	1,08	3,44	129	1,68	5,30	86	1,14	3,34	135	1,81	5,11	433	108,3	1,43	4,30
scientific publications indexed by other databases WOS	11	0,14	0,46	1	0,01	0,04	1	0,01	0,04	8	0,11	0,30	21	5,3	0,07	0,21
scientific publications indexed by other databases SCOPUS	4	0,05	0,17	6	0,08	0,25	6	0,08	0,23	28	0,38	1,06	44	11,0	0,15	0,44
scientific publications indexed by other databases SLAC SPIRES	0	0,00	0,00	1	0,01	0,04	1	0,01	0,04	0	0,00	0,00	2	0,5	0,01	0,02
scientific publications indexed by other databases PubMed	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	1	0,01	0,04	1	0,3	0,00	0,01
scientific publications in other journals	17	0,22	0,70	16	0,21	0,66	11	0,15	0,43	6	0,08	0,23	50	12,5	0,16	0,50
publications in proc. of international scientific conferences	51	0,67	2,11	70	0,91	2,88	48	0,64	1,87	26	0,35	0,98	195	48,8	0,64	1,94
publications in proc. of nat. scientific conferences	4	0,05	0,17	18	0,23	0,74	14	0,19	0,54	6	0,08	0,23	42	10,5	0,14	0,42
active participations at international conferences	242	3,16	10,03	255	3,32	10,48	157	2,09	6,11	158	2,12	5,98	812	203,0	2,68	8,07
active participations at national conferences	22	0,29	0,91	34	0,44	1,40	13	0,17	0,51	31	0,42	1,17	100	25,0	0,33	0,99

#### vi. Renormalized publications<sup>2</sup>

*Renormalized publications = number of CC publications in the given year times authorship's portion of the Organisation times the journal impact factor in 2005 divided by the median impact factor in the research field*

<sup>2</sup> This information is required only from the Organisations of the Section 2 of the Slovak Academy of Sciences.

Renormalised publications	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
Renormalized publications	0	#####	#####	0	#####	#####	0	#####	#####	0	#####	#####

#### vii. Standard manuscript page count<sup>3</sup>

Standard manuscript page count	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
page count	0	#####	#####	0	#####	#####	0	#####	#####	0	#####	#####

#### viii. List of patents and patent applications

[1] L. Shlyk, G. Krabbes and P. Diko, patent **DE10307643A1**, Hochtemperatursupraleitender Körper und Verfahren zu dessen Herstellung, owner: IFW Dresden, Germany. (2004)

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

In the summaries of the research output only those publications were presented, where the address of the Institute is mentioned.

A special case related with publications concerns **J. Antoš**, a member of the CDF collaboration at Fermilab since 1992. The scientific success of this collaboration may be documented by many important publications (20 CC publications/285 WOS citations in 2003, 14 CC publications/445 WOS citations in 2004, 44 CC publications/341 WOS citations in 2005 and 41 CC publications/119 WOS citations in 2006) with J. Antoš as a co-author, but without our Institute being given as his home institution. This situation is a

<sup>3</sup> This information is required only from the Organisations of the Section 3 of the Slovak Academy of Sciences.

result of the publishing policy of the CDF collaboration, due to the fact that neither Slovakia nor the IEP SAS Košice was an official member of the CDF. Nevertheless, we would like to remark that all his results were achieved by him as a permanent staff member of our Institute, but with CDF collaboration accomplished through cooperation with Academia Sinica, Taiwan (an official member of CDF). Recently, thanks to financing through an APVV project, Slovakia became a regular CDF member and the future publications of this collaboration will reflect this fact. For time being the activities of the research group led by **J. Antoš** in CDF can be documented by the Memorandum of Understanding between the Institute of Physics, Academia Sinica Taiwan, and the Institute of Experimental Physics Košice, awaiting signature of Taiwan representatives.

## **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 Organisations at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).*

Citations	2002			2003			2004			2005			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	averaged number per year	av. No. / FTE	av. No. / salary budget
Web of Science	895	11,7	37,1	1052	13,7	43,3	778	10,3	30,3	969	13,0	36,6	3694	923,5	12,2	36,7
SCOPUS	4	0,1	0,2	20	0,3	0,8	0	0,0	0,0	135	1,8	5,1	159	39,8	0,5	1,6
SLAC SPIRES	281	3,7	11,7	167	2,2	6,9	121	1,6	4,7	198	2,7	7,5	767	191,8	2,5	7,6
NASA ASTROPHYSICS	6	0,1	0,2	7	0,1	0,3	0	0,0	0,0	4	0,1	0,2	17	4,3	0,1	0,2
in monographs, conf. proceedings and other publications abroad	6	0,1	0,2	25	0,3	1,0	18	0,2	0,7	38	0,5	1,4	87	21,8	0,3	0,9
in monographs, conf. proceedings and other publications in Slovakia	0	0,0	0,0	0	0,0	0,0	2	0,0	0,1	0	0,0	0,0	2	0,5	0,0	0,0

i. List of 10 top-cited publications and number of their citations in the assessment period

- [1] **SZABÓ, P. – SAMUELY, P. – KAČMARČÍK, J. – KLEIN, T. – MARCUS, J. – FRUCHAR, D. – MIRAGLIA, S. – MARCENAT, C. – JANSEN, A.G.M.** Evidence for Two Superconducting Energy Gaps in MgB<sub>2</sub> by Point-Contact Spectroscopy. In *Physical Review Letters* Vol. 87, no. 13 (2001), p. 137005-1-4. cond-mat/0105598. WOS: 215 citations.
- [2] H1 Collaboration (**ADLOFF, C. - ... - BRUNCKO, D. - ... - FERENCEI, J. - ... - KURČA, T. - ... - MURÍN, P. - ...**) Deep-inelastic inclusive ep scattering at low x and a determination of  $\alpha_s$ . Preprint DESY-00-181, Dec 2000, 68 pp. In *European Physical Journal C*. Vol. 21, no. 1 (2001) p.33-61. e-Print Archive: hep-ex/0012053. WOS: 127 citations.
- [3] H1 Collaboration (**AKTAS, A. - ... - BRUNCKO, D. - ... - FERENCEI, J. - ... - MURÍN, P. - ...**) Evidence for a Narrow Anti-Charmed Baryon State. Preprint DESY-

- 04-038. In *Physics Letters B*. Vol.588, no.1-2 (2004), p. 17-28. hep-ex/0403017. WOS: 92 citations.
- [4] LYARD, L. – **SAMUELY, P.** – **SZABÓ, P.** – KLEIN, T. – MARCENAT, C. – PAULIUS, L. – KIM, K.H.P. – JUNG, C.U. – LEE, H.S. – KANG, B. – CHOI, S. – LEE, S.I. – MARCUS, J. – BLANCHARD, S. – JANSEN, A.G.M. – WELP, U. – KARAPETROV, G. – KWOK, W.K. Anisotropy of the upper critical field and critical current in single crystal MgB<sub>2</sub>. cond-mat/0206231. In *Physical Review B. – Condensed Matter*, Vol. 66, no.18 (2002), p. R180502-1-4. WOS: 52 citations.
- [5] KOPELIOVICH, B.Z. – **NEMCHIK, J.** – SCHAFFER, A. – TARASOV, A.V. Cronin effect in hadron production off nuclei. In *Physical Review Letters*. Vol.88, no.23 (2002) p. 232303-1-4. hep-ph/0201010. WOS: 45 citations.
- [6] WA97 Collaboration (ANDERSEN, E. - ... - **BÁN, J.** - ... - **JUSKO, A.** - ... - **KRÁLIK, I.** - ... - **LUPTÁK, M.** - ... - **PASTIRČÁK, B.** - ... - **ŠAFAŘÍK, K.** - ... - **ŠÁNDOR, L.** - ... - **URBÁN, J.** - ...) Enhancement of central Lambda, Xi and Omega yields in Pb-Pb collisions at 158 AGeV/c. CERN-EP-98-064, CERN-EP-98-64, Apr. 1998, 9pp. In *Physics Letters B*. Vol.433, no.1-2 (1998) p.209-216. WOS: 36 citations.
- [7] WA97 Collaboration (ANDERSEN, E. - ... - **BÁN, J.** - ... - **JUSKO, A.** - ... - **KRÁLIK, I.** - ... - **LUPTÁK, M.** - ... - **PASTIRČÁK, B.** - ... - **ŠAFAŘÍK, K.** - ... - **ŠÁNDOR, L.** - ... - **URBÁN, J.** - ...) Strangeness enhancement at mid-rapidity in Pb-Pb collisions at 158 A GeV/c. In *Physics Letters B*. vol.499 (1999) p.401-406. CERN-EP-99-029, CERN-EP-99-29, Jan 1999, 9pp. WOS: 36 citations.
- [8] **KONERACKÁ, M.** – **KOPČANSKÝ, P.** – **ANTALÍK, M.** – **TIMKO, M.** – RAMCHAND, C.N. – LOBO, D. – MEHTA, R.V. – UPADHYAY, R.V. Immobilization of proteins and enzymes to fine magnetic particles. In *Journal of Magnetism and Magnetic Materials*. Vol.201, no.1-3. (1999) p.427-430. WOS: 31 citations.
- [9] **DIKO, P.** Growth-related Microstructure of Melt-Grown REBa<sub>2</sub>Cu<sub>3</sub>O<sub>y</sub> Bulk Superconductors. Invited talk at Superconducting Materials Research and Technology conference, Giens Peninsula – Heyres, France, September 19 – 23, 1999. In *Superconductors Science Technology*. Vol.13, no.8 (2000) p.1202-1213. WOS: 29 citations.
- [10] **SEDLÁK, M.** – Amis, E.J. Dynamics of moderately concentrated salt-free polyelectrolyte solutions: molecular weight dependence. In *Journal of Chemical Physics*. Vol.96, no.1 (1992) p.817-825. WOS: 21 citations.

**ii. List of top-cited authors from the Organisation (at most 10 % of the research employees) and their number of citations in the assessment period**

Where majority of citations is due to a collective work, all authors are listed as a single entry.

- [1] H1 Collaboration: **D. Bruncko**, **J. Ferencei** and **P. Murín**. WOS: 1366 citations, Scopus: 77 citations, SLAC SPIRES: 565 citations.
- [2] **P. Samuely** (WOS: 375 citations), **P. Szabó** (WOS: 369 citations) and **J. Kačmarčík** (WOS: 264 citations). Majority citations is due to: SZABÓ, P. – SAMUELY, P. – KAČMARČÍK, P. – KLEIN, T. – MARCUS, J. – FRUCHART, D. – MIRAGLIA, S. – MARCENAT, C. – JANSEN, A.G.M. Evidence for Two Superconducting Energy Gaps in MgB<sub>2</sub> by Point-Contact Spectroscopy. In Physical Review Letters. Vol.87, no.13 (2001) p.137005-1-4. cond-mat/0105598. WOS: 215 citations.)
- [3] WA97 Collaboration: **I. Králik**, **B. Pastirčák**, **K. Šafařík** and **L. Šándor**. WOS: 297 citations, SCOPUS: 6 citations, SLAC SPIRES: 73 citations.
- [4] **P. Diko**. WOS: 205 citations, SCOPUS: 7 citations, in monographies: 15 citations, other: 8 citations.
- [5] **J. Nemčík**. WOS: 186 citations, SLAC SPIRES: 99 citations.
- [6] **K. Kudela**. WOS: 146 citations, SCOPUS: 3 citations, NASA ASTROPHYSICS: 13 citations, monographs: 33 citations, other: 4 citations.
- [7] **M. Antalík**. WOS:144 citations, SCOPUS: 8 citations.
- [8] **M. Sedlák**. WOS: 120 citations, monographs: 21 citations.
- [9] **J. Kováč**. WOS: 106 citations, SCOPUS: 10 citations.
- [10] **P. Kopčanský**. WOS: 79 citations, SCOPUS: 9 citations.

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

**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). Collective membership in the international research organisations, in particular within the European Research Area**

- [1] **6FP EU: MTKD-CT-2005-030002 ExtreM** Condensed matter at extreme experimental conditions. Duration: 2006 – 2009. P. Samuely, coordinator.
- [2] **INTAS 03-51-3036** Nature of magnetism in fcc and bcc systems based on rare earths borides. Duration: 2004 – 2006. K. Flachbart, coordinator.
- [3] **GRD 3-2001-60036 TATLYS (5FP GROWTH)** Novel specific biomimetic and magnetically traced nanoparticles for the targeted transport of fibrinolytic drugs. Duration: 2002 – 2005. M. Timko, P. Kopčanský, investigators.
- [4] **5FP EU: SCENET-2** The European Network for Superconductivity. Duration: 2003 – 2006. P. Diko, investigator. .
- [5] **6FP EU: MRTN-CT-2006-0135619 NESPA** NanoEngineered Superconductors for Power Applications. Duration: 2006 – 2010. P.Diko, investigator.
- [6] **INTAS 05-103-7555** A proposal for R&D to establish the limitations on the operation of the ATLAS end-cap calorimeters at high LHC luminosities. Duration: 2006 – 2008. D. Bruncko, investigator.
- [7] **COST 523** Magnetic structural and functional properties of soft magnetic nanocrystalline materials. Duration: 2001 – 2004. I. Škorvánek, investigator.
- [8] **COST 724** Cosmic radiation, energetic cosmic particles and space weather. Duration: 2003 – 2007. K. Kudela, investigator.
- [9] **COST ECOM P16** Emergent behaviour of correlated matter. Duration: 2005 – 2008. M. Reiffers, investigator.
- [10] **COST P17 (Electromagnetic processing of Materials)** Improvement of functional properties of Fe- and Co- based nanocrystalline magnetic materials by heat treatment in magnetic field. Duration 2006 – 2009. I. Škorvánek, investigator.
- [11] **COST D43** Colloid and interface chemistry for nanotechnology. Duration: 2006 – 2011. M. Sedlák, investigator.
- [12] **NATO No.LST. CLG. 977500.** NATO Collaborative linkage grant: Applications of magnetic fluids in medicine. Duration: 2001 – 2003. P. Kopčanský, principal investigator.
- [13] **NATO PST.EAP.CLG 981072** Novel soft alloys with high critical temperatures. Duration: 2004 – 2006. I. Škorvánek, investigator.
- [14] **CERN ALICE KE** – A study of new forms and phase transitions of nuclear matter at high energy densities. Contribution to the development and building of the electronics

for silicon pixel detector (SPD) and for central trigger system of the ALICE experiment. Duration: 1998 – 2007. L. Šándor, investigator.

- [15] **CERN ATLAS KE** – Development and tests of calibration system for hadronic end-cap calorimeters for ATLAS detector at CERN. Duration: 1998 – 2007. D. Bruncko, investigator.
- [16] **CERN NA57 KE** – Study of possible quark-gluon plasma production in heavy-ion collisions. Duration: 1998 – 2007. I. Králik, investigator.
- [17] **VW-I/75961** Soft magnetic nanocrystalline materials with improved combination of application oriented properties. Duration 2000 – 2003. I. Škorvánek, investigator.
- [18] **H1 Experiment:** mutual agreement between DESY, Hamburg, Germany and IEP SAS Košice. Participation in the experimental programme at HERA collider since 1987. D. Bruncko, J. Ferencej, coordinators.

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

- [1] **Structure Solution from Powder Diffraction Data SSPD'03**, 14 – 19 September 2003, Stará Lesná, Slovak Republic
- [2] **International Solar Cycle Studies Symposium 2003:** Solar Variability as Input to the Earth's Environment, **ICSC 2003**, 23 – 28 June 2003, Tatranská Lomnica, Slovak Republic.
- [3] **The 5-th Small Triangle Meeting on Theoretical Physics**, 2 – 4 September 2003, Medzev, Slovak Republic.
- [4] **INTAS Meeting**, 16 – 18 December 2004, Košice, Slovak Republic.
- [5] **XII International Workshop on Deep Inelastic Scattering – DIS2004**, 14 – 18 April 2004, Štrbské pleso, Slovak Republic
- [6] **ATLAS Collaboration Calorimetry Workshop – ACCW**, 1 – 4 December 2004, Tatranská Štrba, Slovak Republic
- [7] **Hadron Structure 2004 – HS2004**, 29 August – 3 September 2004, Smolenice, Slovak Republic
- [8] **XIII-th Regional Powder Diffraction Conference**, 22 – 24 September 2004, Liptovský Mikuláš, Slovak Republic
- [9] **12-th Czech and Slovak Conference on Magnetism**, 12 – 16 July 2004, Košice, Slovak Republic
- [10] **MECO29**, International conference on statistical physics, 28 March – 1 April 2004, Bratislava, Slovak Republic
- [11] **Small Triangle Meeting on Theoretical Physics**, 27 – 29 September 2004, Vyshka, Ukraine

- [12] **XIV-th Regional Powder Diffraction Conference**, 21 -27 September 2005, Liptovský Mikuláš, Slovak Republic
- [13] **Soft Magnetic Materials, SMM17**, 7 – 9 September 2005, Bratislava, Slovak Republic
- [14] **15-th Conference of Czech and Slovak Physicists**, 5 – 8 September 2005, Košice, Slovak Republic
- [15] **INYS International Networking for Young Scientists workshop: Intermetallics, Superconductors, Quantum Fluids at Low Temperatures**, 27 – 30 October 2005, Stará Lesná, Slovak Republic
- [16] **COSLAB conference of the European Science Foundation ala carte programme**, 28 August – 4 September 2005, Smolenice, Slovak Republic
- [17] **Small Triangle Meeting on Theoretical Physics**, 19 – 21 September 2005, Sninské rybníky, Slovak Republic
- [18] **XV-th Regional Powder Diffraction Conference**, 1 – 4 September 2006, Liptovský Mikuláš, Slovak Republic
- [19] **Mathematical Modelling and Computational Physics**, 28 August – 1 September 2006, Tatranská Štrba, Slovak Republic

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

none

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

- [1] Proceedings of the 5-th Small Triangle Meeting on Theoretical Physics, 2 – 4 September 2003, Medzev, Slovak Republic. Eds. **M. Hnatič**, **M. Stehlík**. Košice: IEP SAS, 2003. 61 p.
- [2] SSB 2003: Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia. Book of Abstracts, Košice, ÚEF SAV and UPJŠ, 2003. 142pp.
- [3] Proceedings of the 12-th International Workshop on Deep Inelastic Scattering, 14 – 18 April 2004, Štrbské Pleso, Slovak Republic. Eds. **D. Bruncko**, **J. Ferencei**, **P. Stríženec**. Vol I – Vol. II. Bratislava: Academic Electronic Press, 2004. 1176 p. ISBN 80-88880-57-2.
- [4] Proceedings of the 12-th Czech and Slovak Conference on Magnetism, 12 – 15 July 2004, Košice, Slovakia. Eds. **J. Kováč**, **P. Kollár**. *Czechoslovak Journal of Physics* Vol. 54, Suppl. D (2004) pp. D1 – D700.

- [5] CSMAG 04: 12<sup>th</sup> Czech and Slovak Conference on Magnetism, 12 – 15 July 2004, Košice. Programme, abstracts. Eds. **M. Zentková**, M. Orendáč. Košice, UPJŠ, 2004, 261pp.
- [6] Proceedings of abstracts of the 15-th Conference of Slovak and Czech Physicists, 5 – 8 September 2005, Košice, Slovak Republic. Eds. **J. Kováč**, **M. Reiffers**. Bratislava: SFS, 2006. ISBN 80-969124-2-9. 120 p. Selected papers in *Acta Physica Slovaca*, Vol. 56, no.2 (2006).
- [7] SSB 2005: 4<sup>th</sup> Conference Structure and Stability of Biomacromolecules, 12 – 14 September 2005, Košice, Slovakia. Book of Contributions. Košice, ÚEF SAV and UPJŠ, 2005. 115pp.
- [8] Hadron Structure 2004: Proceedings of the International Conference, 30 August – 3 September 2004, Smolenice Castle, Slovakia. Eds. A.Z. Dubničková, **P. Stríženec**, J. Urbán. Košice, UPJŠ, 2005. 260pp. ISBN 80-7097-590-3.

- **National position of the Organisation**

- i. **List of selected most important national projects (Centres of Excellence, National Reference Laboratories, Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA), and others)**

- [1] **Centre of Excellence: CFNT CE-I/2/2003** Centre of Low Temperature Physics Košice. Duration: 2002 – 2006. Responsible person: **P. Samuely**, head of the Centre.
- [2] **Centre of Excellence: NANOSM.1, NANOSM.2** – Nanosmart. Duration: 2002 – 2006. Responsible persons: P. Diko and I. Škorvánek.
- [3] **Support programme for excellent projects SAS: G-2/8001/22** Ion-containing polymers: solution behaviour and selected methods of characterization. Duration: 2002 – 2005. Responsible person: **M. Sedlák**.
- [4] **APVT-51-020102** Nanostructures in superconductors. **P. Samuely**, principal investigator.
- [5] **APVT-20-018402** Synthesis and characterization of nanomaterials prepared by non-traditional methods from metal-based material precursors. **I. Škorvánek**, investigator.
- [6] **APVT-20-009902** Low-dimensional magnetic and magneto-optical materials based on analogues of Prussian blue and nitropruside complexes. **M. Mihalik**, principal investigator.

- [7] **APVT-20-025902** Monitoring of energetic particles in near surrounding of Earth: relations to space weather – influence on flight personnel. **K. Kudela**, Rincipal investigator.
- [8] **APVT-51-021602** Strongly correlated and disordered electron systems. **P. Farkašovský**, investigator.
- [9] **APVT-51-016604** Superconductors for future technologies. **P. Samuely**, principal investigator.
- [10] **APVT-51-031704** Magnetic properties and electron structure of d- and f- metal compounds. **M. Reiffers**, principal investigator.
- [11] **APVT-51-027904** Study of phase transitions, cooperative phenomena and structural changes in nanomaterials, critical and stochastic dynamics. **M. Hnatič**, principal investigator.
- [12] **APVT-20-005204** Magnetostructural correlations in unconventional magnetic materials. **M. Mihalik**, investigator.
- [13] **APVT-51-052702** Novel multipurpose materials with defined structure and extraordinary properties. **I. Škorvánek**, investigator.
- [14] **APVT-20-008404** Study of structural and magnetic properties of nanophase and amorphous systems based on 3-d transition metals Fe, Co, Ni. **J. Kováč**, investigator.
- [15] **APVV-51-061505** Microstructural design of YBCO superconductors. **P. Diko**, principal investigator.
- [16] **APVV-51-037905** Water-soluble polymers: from the fundamentals of interaction, structure and dynamics in solution to controlled polymer synthesis and self-assembly. **M. Sedlák**, principal investigator.
- [17] **APVV-51-053805** Monitoring of energetic particles in space for selected problems of space weather. **K. Kudela**, principal investigator.
- [18] **APVV-20-057305** The advanced top quark physics studies. **J. Antoš**, investigator.
- [19] **APVV 26-026505** Targeted transport of anticancer drugs in magnetically labelled nanoparticles. **M. Koneracká**, investigator.
- [20] **APVV LPP-0030-06** Scientific incubator for pupils and students. **M. Zentková**, principal investigator.
- [21] **APVV LPP-0041-06** Molecular based magnetic materials based n Prussian blue analogues. **M. Mihalik**, principal investigator.
- [22] **APVV LPP-0047-06** Study of strongly correlated electron systems beyond standard approximations. **P. Farkašovský**, principal investigator.

- [23] **APVV LPP-0101-06** Perspective superconductors. **P. Samuely**, principal investigator.
- [24] **APVV LPP-0334-06** Singlegrain YBCO composite superconductors. **P. Diko**, principal investigator.
- [25] **VEGA 2/1145/21** Microstructure parameters limiting macroscopic properties of bulk high temperature superconductors. **P. Diko**, principal investigator.
- [26] **VEGA 2/1146/21** Fast hierarchical algorithms for segmentation of biomedical images and their exploitation in medical diagnostics. **Z. Tomori**, principal investigator.
- [27] **VEGA 2/1147/21** Transport of cosmic energetic particles in the magnetosphere and heliosphere. **K. Kudela**, principal investigator.
- [28] **VEGA 1/9036/02** Production of secondary particles in nuclear interactions of relativistic nuclei in emulsion detector. **L. Just**, investigator.
- [29] **VEGA 2/1148/21** Exotic superconductors and strongly correlated electron systems at low temperatures and in high magnetic fields. **P. Samuely**, principal investigator.
- [30] **VEGA 2/1149/21** Magnetic and mechanical properties of Fe- and Co- based nanocrystalline alloys. **I. Škorvánek**, principal investigator.
- [31] **VEGA 2/1168/21** Comparative phenomena in compounds containing f- electrons. **A. Zentko**, principal investigator.
- [32] **VEGA 2/1169/21** Study of the electron-proton interactions in the H1 experiment at enhanced collider luminosity. **P. Murín**, principal investigator.
- [33] **VEGA 2/2101/02** Deformation and failure mechanisms in metastable metallic materials. **K. Csach**, principal investigator.
- [34] **VEGA 2/2098/22** The proposal and the development of the calibration procedures of the measurements of the hadron jets in the hadron end-cap calorimeter for ATLAS detector. **D. Bruncko**, principal investigator.
- [35] **VEGA 2/2102/22** Study of new forms and phase transitions of nuclear matter under extreme conditions. **I. Králik**, principal investigator.
- [36] **VEGA 2/2099/22** Study of heavy quarks production in pp collisions at 1.8(2) TeV. **J. Antoš**, principal investigator.
- [37] **VEGA 2/2085/22** Ion containing polymers: solution behaviour and selected methods of characterization. **M. Sedlák**, principal investigator.
- [38] **VEGA 2/3195/23** Influence of temperature, magnetic field and pressure on the transport, magnetic, thermal and point-contact properties of the selected rare-earth intermetallic compounds. **M. Reiffers**, principal investigator.
- [39] **VEGA 2/3196/23** Bose and Fermi excitations in superfluid phases of  $^3\text{He}$ . **P. Skyba**, principal investigator.

- [40] **VEGA 2/3197/23** Electron transfer in biosystems. **M. Pudlák**, principal investigator.
- [41] **VEGA 2/3198/23** Molecular principles of protein aggregation. **M. Antalík**, principal investigator.
- [42] **VEGA 2/3199/23** The role of magnetic nanoparticles in various physical systems. **P. Kopčanský**, principal investigator.
- [43] **VEGA 2/3211/23** Study of scaling laws in nonlinear systems and developed turbulence by renormalization group methods. **M. Hnatič**, principal investigator.
- [44] **VEGA 1/1021/24** Structure and magnetic properties of magnetically soft powdered and compacted ferromagnetics. **J. Kováč**, investigator.
- [45] **VEGA 2/4050/24** Study of cooperative phenomena and strong electron correlations in compounds containing f- elements. **M. Mihalik**, principal investigator.
- [46] **VEGA 2/4060/24** The study of the electron correlations in the narrow energy bands. **P. Farkašovský**, principal investigator.
- [47] **VEGA 2/4061/04** Strongly correlated electron systems at low temperatures in the high magnetic fields and under high pressure. **K. Flachbart**, principal investigator.
- [48] **VEGA 2/4062/04** REBCO-superconducting permanent magnets with nanoparticle pinning centres. **P. Diko**, principal investigator.
- [49] **VEGA 2/4063/04** Study of hadronization dynamics and colour transparency, quantum coherence and gluon shadowing in hadron-nucleus and lepton-nucleus interactions. **J. Nemčík**, principal investigator.
- [50] **VEGA 2/4064/04** Energetic particles in space: relations to space weather. **K. Kudela**, principal investigator.
- [51] **VEGA 2/4065/04** Structure and magnetic properties of transition metal based nanocrystalline materials prepared by crystallization of amorphous precursors. **I. Škorvánek**, principal investigator.
- [52] **VEGA 2/4067/04** Study of ep collisions in H1 experiment in the conditions of the HERA increased luminosity. **J. Ferencei**, principal investigator.
- [53] **VEGA 2/4068/04** Effect of osmolytes on stability of proteins. **J. Bágel'ová**, principal investigator.
- [54] **VEGA 2/5137/25** Calibration of hadronic energy in the ATLAS calorimeters – design and implementation of software procedures, installation, testing and improvements of the electronics. **P. Stríženec**, principal investigator.
- [55] **VEGA 2/5048/25** Interactive segmentation algorithms based on active contours models and their exploitation in the measurement of physical processes. **Z. Tomori**, principal investigator.

- [56] **VEGA 2/5045/25** Deformation and failure mechanisms in amorphous and nanocrystalline metals. **K. Csach**, principal investigator.
- [57] **VEGA 2/6165/26** Emergent behaviour of intermetallic compounds at low temperatures. **M. Reiffers**, principal investigator.
- [58] **VEGA 2/6166/26** The study of some physical processes in systems containing magnetic nanoparticles in electromagnetic fields. **P. Kopčanský**, principal investigator.
- [59] **VEGA 2/6167/26** Molecular mechanisms of protein stability. **M. Antalík**, principal investigator.
- [60] **VEGA 2/6168/26** Superfluid  $^3\text{He}$  – model system for cosmology. **P. Skyba**, principal investigator.
- [61] **VEGA 2/6192/26** Study of nuclear matter under extreme conditions in NA57 and ALICE experiments. **I. Králik**, principal investigator.
- [62] **VEGA 2/6193/26** Study of correlation functions of random fields in critical and stochastic dynamics. **M. Hnatič**, principal investigator.
- [63] **VEGA 2/6197/26** Association properties of ion-containing polymers and low-molecular-weight compounds with potential application in the design of complexes for targeted drug delivery. **M. Sedlák**, principal investigator.

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

- [1] **Small Triangle Meeting on Theoretical Physics**, 2 -3 September 2003. Medzev, Slovak Republic
- [2] **Structure and Stability of Biomacromolecules**, 3 – 5 September 2003, Košice, Slovak Republic
- [3] **NANOVED 2004**, 13 – 14 September 2004, Košice, Slovak Republic.
- [4] **Structure and Stability of Biomacromolecules**, 12 – 14 September 2005, Košice, Slovak Republic
- [5] **15. Konferencia slovenských fyzikov** (15-th Conference of Slovak Physicists), 11 – 14 September 2006, Stará Lesná, Slovak Republic

#### iii. List of national journals published by the Organisation

- [1] none

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

- [1] 13<sup>th</sup> Conference of Slovak Physicists, 25 – 28 August 2003, Smolenice, Slovakia. Proceedings. Ed. M. Reiffers. Bratislava, SFS, 2004. 176pp. ISBN 80-88880-57-2.



- [2] Proceedings of NANOVED 2004: Celoslovenská konferencia o nanovedách, nanotechnológiách a nanomateriáloch, 13 – 14 September 2004, Košice, Slovak Republic. Eds. **P. Diko** and **I. Škorvánek**. Košice: Cex NANOSMART 2004. 59 p.
- [3] Space Research in Slovakia 2002 – 2003. Eds. **K. Kudela**, J. Feranec, L. Macho. Košice: SAV, COSPAR Slovak National Committee, ÚEF SAV, 2004. 59pp. ISBN 80-968060-1-7.
- [4] 14<sup>th</sup> Conference of Slovak Physicists, 11 – 15 September 2004. Congress Centre Smolenice. Book of Abstracts. Eds. **M. Reiffers**. Bratislava: SFS, 2005. 96pp. ISBN 80-969124-1-0.
- [5] Space Research in Slovakia 2004 – 2005. National Committee of COSPAR in Slovak Republic, SAS, IEP SAS, Košice, 2006. Eds. K. Kudela, J. Feranec. L. Macho. Košice: Copy Center, 2006. 66pp. ISBN 80-968060-2-5.

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

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

- [1] **I. Škorvánek**, Soft magnetic nanocrystalline Fe(Co)NbB alloys: Intergrain coupling versus temperature. In *NATO/ARW Workshop PROSIZE, June 9-13 2003, Budmerice Castle, Slovakia*.
- [2] **P. Diko**, G. Krabbes, Cracks in TSMG REBCO superconductors and their elimination. In *EUCAS 2003: 6<sup>th</sup> European Conference on Applied Superconductivity, September 14-18 2003, Sorrento, Napoli, Italy*.
- [3] L. Lyard, **P. Samuely**, **P. Szabó** et al., Critical fields in MgB<sub>2</sub>. In *Joint 9<sup>th</sup> International Workshop on Vortex Dynamics and Vortex Matter (ESF), June 22-27 2003, Oléron Island, France*.
- [4] **P. Szabó**, **P. Samuely**, **J. Kačmarčík**, A. G. M. Jansen, Andreev reflection in MgB<sub>2</sub>. In *Workshop Open Questions in Understanding the Superconducting and Normal State Properties of MgB<sub>2</sub>, July 2-4 2003, University La Sapienza, Rome, Italy*.
- [5] **L. Šándor** for NA57 Collaboration (F. Antinori, ..., **M. Bombara**, ..., **I. Králik**, ..., **B. Pastirčák**, ..., **K. Šafařík**, ..., **L. Šándor**), Hyperon production at the CERN SPS: results from the NA57 experiment. In *SQM 2003: 7<sup>th</sup> International Conference on Strangeness in Quark Matter, March 2003, Atlantic Beach, North Carolina, USA*.
- [6] **L. Šándor**, Hyperon production from the NA57 experiment. In *RHIC SCHOOL 2003: 3<sup>rd</sup> Budapest Winter School on Heavy Ion Physics, December 8-11 2003, Budapest, Hungary*.

- [7] **L. Šándor**, Strange baryon production in Pb-Pb interactions at the CERN SPS. In *ISMD: 33<sup>rd</sup> International Symposium on Multiparticle Dynamics, September 2003, Krakow, Poland.*
- [8] **L. Šándor**, Physics with heavy liquid bubble chamber – lessons and heritage. In *Memorial Conference to 90<sup>th</sup> Birthday of Prof. Dzhelepov, April 2003, Dubna, Russia.*
- [9] **K. Kudela**, Kosmické počasí a energetické kosmické častice (Space weather and energetic cosmic particles), In *Seminar “Človek vo svojom pozemskom a kozmickom prostredí” (Human in his Earthly and cosmic environment), May 20-22 2003, Úpice, Czech Republic.*
- [10] **K. Kudela**, Solar neutron observations: contribution of IEP SAS to the study. In *International mini-conference at the Symposium Hall of Nagoya University, July 28-30 2003, Nagoya, Japan.*
- [11] **P. Kopčanský, I. Potočová, M. Koneracká, M. Timko, J. Jadzyn, G. Czechowski, A. G. M. Jansen**, Ferronematics-liquid crystals doped with fine magnetic particles. In *RAMF 2003: International Workshop on Recent Advances in Nanotechnology of Magnetic Fluids, January 22-24 2003, New Delhi, India.*
- [12] **P. Kopčanský, I. Potočová, M. Timko, M. Koneracká, A. G. M. Jansen, J. Jadzyn, G. Czechowski**, The structural transitions in ferro-nematics in combined electric and magnetic fields. In *ICM 2003: International Conference on Magnetism, July 27 – August 1, 2003, Roma, Italy. Incorporating The Symposium on Strongly Correlated Electron Systems.*
- [13] **E. Demjénová**, Interactive segmentation of AFM images. In *Séminaire de Physique de la Matière Vivante, 19 May 2003, Université de Lausanne, Institut de Physique de la Matière Condensée, Lausanne, France.*
- [14] **M. Antalík**, Cytochrome C conformational transitions. In *Séminaire de Physique de la Matière Vivante, 26 May 2003, Université de Lausanne, Institut de Physique de la Matière Condensée, Lausanne, France.*
- [15] **M. Timko, P. Kopčanský, M. Koneracká, C. N. Ramchand, L. Vékas, D. Bica**, Application of magnetizable complex systems in biomedicine. In *CSMAG 04: 12<sup>th</sup> Czech and Slovak Conference on Magnetism, July 12-15 2004, Košice, Slovakia.*
- [16] **M. Reiffers**, Point-contact spectroscopy – a method for study of electron-quasiparticle interaction in metals. In *Kobe University, June 2004, Kobe, Japan.* Invited talk at a foreign academic institution.
- [17] **P. Samuely, J. Kačmarčík, P. Szabó, J. G. Rodrigo, H. Suderow, S. Vieira**, Intrinsic Josephson junctions superconductor based on NbSe<sub>2</sub>. In *4<sup>th</sup> International Workshop Solid State Surfaces and Interfaces, November 2004, Smolenice, Slovakia.*

- [18] C. Marcenat, **Z. Hořanová**, **P. Szabó**, **P. Samuely**, Anisotropies of the lower and upper critical fields in single crystal MgB<sub>2</sub>. In *4<sup>th</sup> International Workshop Solid State Surfaces and Interfaces, November 2004, Smolenice, Slovakia*.
- [19] **P. Skyba**, Search for a condensed matter analog of the Unruh effect. In *Coslab 2004, Ambleside, United Kingdom*.
- [20] **L. Šándor**, Results on strangeness production for NA57 experiment. In *SQM 2004: 8<sup>th</sup> International Conference on Strangeness in Quark Matter, September 15-20 2004, Cape Town, South Africa*.
- [21] **K. Kudela**, **P. Bobík**, Long term variations of cutoff rigidity. In *1<sup>st</sup> International Symposium of Space Climate: Direct and Indirect Observations of Long-Term Solar Activity, June 20-23 2004, Oulu, Finland*.
- [22] **K. Kudela**, M. Storini, Useful tools for Space Weather issues from cosmic ray continuous records. In *COSPAR 2004: 35<sup>th</sup> COSPAR Sci. Assembly, July 18-25 2004, Paris, France*.
- [23] **J. Nemchik**, Energy loss of parton propagating through nuclear matter. In *International Workshop "Creation and Flow of Baryons in Hadronic and Nuclear Collisions", May 3-7 2004, Trento, Italy*.
- [24] **P. Diko**, L. Ceniga, S. Kračunovská, W. Gawalek, G. Krabbes, L. Shlyk, H. Babu, D. Cardwell, Microstructure modification of TSMG YBCO bulks by artificial holes of cyclic growth. In *2<sup>nd</sup> SCENET WG Meeting, WG 1c: High Critical Current Superconductors for Applications, April 22-24 2005, Rust, Austria*.
- [25] **M. Mihalik**, Summary Physics. In *35<sup>th</sup> Journées des Actinides, April 23-26 2005, Schloss Weiersdorf, Baden, Austria*.
- [26] **I. Škorvánek**, Soft magnetic FeCo-based nanocrystalline alloys: Induced anisotropy and applicability at high temperatures. In *Seminar über Magnetismus und Supraleitung, May 2 2005, Hamburg, Germany*. Invited talk at a foreign academic institution.
- [27] **I. Škorvánek**, Magnetic nanomaterials. In *NENAMAT Summer School "Advanced Nanotechnologies, Testing, Production and Application of Nanoscale Materials", June 1-7 2005, Primorsko, Bulgaria*.
- [28] M. Deanko, M. Pavluga, D. M. Kepatsoglou, D. Muller, P. Mrafko, D. Janičkovič, E. Hristoforou, **I. Škorvánek**, P. Švec, Peculiarities of electrical resistivity during transformations in amorphous and nanocrystalline alloys. In *ISMANAM 2005: 12<sup>th</sup> International Symposium on Metastable and Nano Materials, July 3-7 2005, Paris, France*.

- [29] **I. Škorvánek**, Nanocrystalline materials for soft magnetic and magnetocaloric applications. In *Department of Physics, Chungbuk National University, August 18 2005, Cheongju, Korea*. Invited talk at a foreign academic institution.
- [30] D. M. Keppatsoglou, M. Deanko, D. Janičkovič, E. Hristoforou, **I. Škorvánek**, P. Švec, Local-ordering and formation of metastable phases in amorphous Fe-Co and Fe-Ni based systems. In *RQ12: 12<sup>th</sup> International Conference on Rapidly Quenched Materials, August 22-26 2005, Jeju, Korea*.
- [31] **I. Škorvánek**, **J. Marcin**, **T. Krenický**, **J. Kováč**, P. Švec, D. Janikovič, Improved soft magnetic behaviour in field-annealed nanocrystalline HITPERM alloys. In *SMM 17: 17<sup>th</sup> Soft Magnetic Materials Conference, September 7-9 2005, Bratislava, Slovakia*.
- [32] **P. Diko**, Research on high T<sub>c</sub> bulk superconductors at IEP SAS Košice. In *Shibaura Institute of Technology, October 2005, Tokyo, Japan*. Invited talk at a foreign academic institution.
- [33] **P. Diko**, S. Kračunovská, W. Gawalek, Cracking at oxygenation of TSMG 123 bulks. In *PARSEG 2005: 5<sup>th</sup> International Workshop on Processing and Application of Superconducting [RE]BCO Large Grain Materials, October 21-23 2005, Tokyo, Japan*.
- [34] **P. Diko**, Microstructural limits of TSMG REBCO bulk superconductors. In *ISS 2005: 18<sup>th</sup> International Symposium on Superconductivity, October 24-26 2005, Tsukuba, Japan*.
- [35] **P. Skyba**, Superfluid <sup>3</sup>He as a model system for cosmology – experimental point of view. In *COSLAB 2005: International Workshop Quantum Simulations via Analogues, July 25-28 2005, Dresden, Germany*.
- [36] **P. Skyba**, NMR in superfluid <sup>3</sup>He. In *INYS: International Networking for Young Scientists – Workshop on Intermetallics, Superconductors and Quantum Fields at Low Temperatures, October 27-30 2005, Stará Lesná, Slovakia*.
- [37] **P. Samuely**, **P. Szabó** – Two gap superconductivity, case of MgB<sub>2</sub>. In *INYS: International Networking for Young Scientists – Workshop on Intermetallics, Superconductors and Quantum Fields at Low Temperatures, October 27-30 2005, Stará Lesná, Slovakia*.
- [38] **L. Šándor**, What we have learnt studying strangeness production in heavy-ion collisions at SPS? In *ISMD 2005: 35<sup>th</sup> International Symposium on Multiparticle Dynamics, August 9-15 2005, Kroměříž, Czech Republic*.
- [39] **L. Šándor**, Program ALICE. In *15<sup>th</sup> Conference of Slovak and Czech Physicists, September 5-8 2005, Košice, Slovakia*.

- [40] **D. Bruncko**, Slovak entry to CERN and current status of ATLAS experiment. In *Fundamental Problems of Current Physics, October 16-18 2005, Uzhorod, Ukraine*.
- [41] **P. Kopčanský, M. Hnatič, M. Repašan, I. Potočová, M. Timko**, I. Turek, J. Štelina, J. Bracíník, Light induced structuralization in magnetic fluids with negative Soret constant. In 10<sup>th</sup> Workshop on Acoustoelectronics & Optoelectronics, March 2-4 2005, Gliwice, Poland.
- [42] **P. Kopčanský, M. Koneracká, M. Timko, I. Potočová**, J. Jadzin, The structural transitions in ferronematics and ferronematic droplets. In *MISM 2005: Moscow International Symposium on Magnetism, June 25-30 2005, Moscow, Russia*.
- [43] **P. Kopčanský, N. Tomašovičová, M. Koneracká, I. Potočová, M. Timko**, L. Tomčo, **V. Závishová**, Magnetic fluids and their technical biomedical applications. In ICNCT: The 12<sup>th</sup> International Conference on Nonconventional Technologies, November 3-4 2005, Bucharest, Romania.
- [44] **P. Diko**, Processing and microstructure of REBCO bulk superconductors. In 2<sup>nd</sup> Topical Workshop of SCENET-2 and the 11<sup>th</sup> CHEM/HTSC Workshop Superconductivity, the Present and the Future (Materials, Enabling Science, Processing and Applications), March 16-18 2006, Majorca, Spain.
- [45] **P. Diko**, Cracking at oxygenation of YBCO bulk superconductors. In *Joint Meeting of the 10<sup>th</sup> EFFORT Group Forum and 3<sup>rd</sup> SCENET WG Meeting, WG 1c: High Critical Current Superconductors for Applications, April 6-8 2006, London, U.K.*
- [46] **M. Timko**, Dielectric properties of magnetic fluids. In *Workshop on Magnetic Nanofluid and Composites: "Synthesis, Properties and Applications", COST Action 17: Electromagnetic processing of materials, July 24-25 2006, Timisoara, Romania*.
- [47] **P. Samuely**, Scanning tunnelling microscopy and spectroscopy of  $(\text{LaSe})_{1.14}(\text{NbSe}_2)$  at very low temperatures and in magnetic field. In *VORTEX 2006: 11<sup>th</sup> International Workshop on Vortex Matter, July 3-8 2006, Wroclaw, Poland*.
- [48] **P. Samuely et al.**, Aluminium and carbon substitution in  $\text{MgB}_2$ . Electron doping and scattering effects. In *M2S-HTSC VIII: The 8<sup>th</sup> International Conference on Materials and Mechanisms of Superconductivity, July 9-14 2006, Dresden, Germany*.
- [49] **P. Samuely**. In *EPIOPTICS 2006: International School of Solid State Physics 37<sup>th</sup> Course "Twenty years from the discovery of High Tc Superconductivity", July 20-26 2006, Erice, Sicily*.
- [50] **P. Samuely**, In *Stripes 06: 5<sup>th</sup> International Conference, University "La Sapienza", December 17-21 2006, Roma, Italy*.

- [51] **P. Skyba**, Tuning fork – tool-probing properties of superfluid  ${}^3\text{He}$ . In *ULTI IV user meeting “Quantum Phenomena at Low Temperatures”*, April 24 2006, Lammi, Finland.
- [52] **L. Šándor**, Strangeness productions in heavy-ion collisions at SPS. In *SQM 2006: International Conference on Strangeness in Quark Matter*, March 26-31 2006, Los Angeles, U.S.A.
- [53] **K. Kudela**, Transmissivity in the disturbed magnetosphere. In *ICTP-COST-USNSWP-VAWSES-INAF-INFN International Advanced School on Space Weather*, May 2-19 2006, Trieste, Italy.
- [54] **K. Kudela**, Magnetospheric optics for cosmic rays. In *ICTP-COST-USNSWP-VAWSES-INAF-INFN International Advanced School on Space Weather*, May 2-19 2006, Trieste, Italy.
- [55] **K. Kudela**, Solar particle penetration into magnetosphere. In *ICTP-COST-USNSWP-VAWSES-INAF-INFN International Advanced School on Space Weather*, May 2-19 2006, Trieste, Italy.
- [56] **K. Kudela**, Direct effects of cosmic ray on materials (Satellites, Airplanes, Atmosphere). In *ICTP-COST-USNSWP-VAWSES-INAF-INFN International Advanced School on Space Weather*, May 2-19 2006, Trieste, Italy.
- [57] **P. Kopčanský**, Ferronematics and ferronematic droplets. In *Workshop on Magnetic Nanofluid and Composites: “Synthesis, properties and applications”*, COST Action 17: *Electromagnetic processing of materials*, July 24-25 2006 Timisoara, Romania.
- [58] **J. Nemčík**, Large rapidity gap reactions on nuclei: Breakdown of QCD factorization. In *5<sup>th</sup> International Conference on Perspectives in Hadronic Physics: International Conference on Particle-Nucleus and Nucleus-Nucleus Scattering at Relativistic Energies*, May 22-26 2006 Trieste, Italy.
- [59] **M. Sedlák**, Large-scale supramolecular structure in solutions of polar and ionic molecules and macromolecules. In *ESF Exploratory Workshop: Self-assembly of Guanosine*, September 13-15 2006, Bled, Slovenia.
- [60] **M. Sedlák**, Large-scale supramolecular structures. In *1<sup>st</sup> Annual Conference on the Physics, Chemistry and Biology of Water 2006*, October 26-29 2006, Brattleboro, Vermont, U.S.A.
- [61] **K. Flachbart**, Magnetic ordering in a frustrated fcc-antiferromagnet below and above  $T_n$ . In *Koloqium*, October 20 2006, University of Stuttgart, Stuttgart, Germany. Invited talk at a foreign academic institution.
- [62] **D. Bruncko**, View into microworld and fundamental open questions. In *Seminár Laboratorul de Lichide Magnetice, Centrul National pentru Ingineria Sistemelor cu*

*Fluide Complexe, Universitatea "Politehnica" Timisoara, June 6 2006, Timisoara, Romania.* Invited talk at a foreign academic institution.

- [63] **M. Seman**, Kozmické častice v energetickom rozsahu  $5.10^{17}$ - $10^{21}$  eV. (Výsledky stereo analýzy v experimente HiRes.) (Cosmic particles in the energy range  $5.10^{17}$ - $10^{21}$  eV. Results of the HiRes stereo analysis.) In *Seminar of Astronomical Institute of the Charles University, March 3 2006, Prague, Czech Republic.* Invited talk at a foreign academic institution.
- [64] **M. Hnatič**, Actual problems in developed turbulence in fluid flow. In *Seminár Laboratorul de Lichide Magnetice, Centrul National pentru Ingineria Sistemelor cu Fluide Complexe, Universitatea "Politehnica" Timisoara, June 6 2006, Timisoara, Romania.* Invited talk at a foreign academic institution.
- [65] **M. Hnatič**, Anomalous scaling in simplified models of developed turbulence: Field-theoretic approach. In *Seminar of the Department of Physics of University Genova, October 3 2006, Genova, Italy.* Invited talk at a foreign academic institution.
- [66] **M. Pudlák**, Electron transfer dynamics in reaction centres. Computation of the quantum yields. In *Max-Planck-Institute für Bioanorganische Chemie Mulheim, September 2006, Mulheim, Germany.* Invited talk at a foreign academic institution.
- [67] **M. Antalík**, Prínos štúdia cytochrómu c k základným poznatkom v oblasti biochémie a biofyziky. (Contribution of cytochrom c to basic knowledge in the field of biochemistry and biophysics.) In *Masaryk University Brno, October 10 2006, Brno, Czech Republic.* Invited talk at a foreign academic institution.

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

- [1] **M. Antalík** – organizing committee of the Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia.
- [2] **J. Bágel'ová** - organizing committee of the Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia.
- [3] **E. Demjénová** - organizing committee of the Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia.
- [4] **D. Fedunová** - organizing committee of the Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia.
- [5] **Z. Tomori** - organizing committee of the Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia.

- [6] **G. Kozáková** - organizing committee of the Structure and Stability of Biomacromolecules, 3 – 5 September 2003, Košice, Slovakia.
- [7] **L. Šándor** – international advisory committee of the XXXIII International Symposium on Multiparticle Dynamics, ISMD 2003, 5 – 11 September 2003, Kraków, Poland.
- [8] **K. Kudela** – international advisory committee of the ICRC International Cosmic Ray Conference, July 2003, Tsukuba, Japan.
- [9] **V. Kavečanský** – organizing committee of the XIII Regional Powder Diffraction Conference, 22 – 24 September 2004, Liptovský Mikuláš, Slovakia.
- [10] **V. Kavečanský** – programme committee of the XI EPDIC European Powder Diffraction Conference, 2 – 5 September 2004, Prague, Czech Republic.
- [11] **D. Bruncko** – local organizing committee of the XII International Workshop on Deep Inelastic Scattering DIS 2004, 14 – 18 April 2004, Štrbské Pleso, Slovakia.
- [12] **J. Ferencei** - local organizing committee of the XII International Workshop on Deep Inelastic Scattering DIS 2004, 14 – 18 April 2004, Štrbské Pleso, Slovakia.
- [13] **P. Kopčanský** - local organizing committee of the XII International Workshop on Deep Inelastic Scattering DIS 2004, 14 – 18 April 2004, Štrbské Pleso, Slovakia.
- [14] **P. Murín** - local organizing committee of the XII International Workshop on Deep Inelastic Scattering DIS 2004, 14 – 18 April 2004, Štrbské Pleso, Slovakia.
- [15] **P. Stríženeč** - local organizing committee of the XII International Workshop on Deep Inelastic Scattering DIS 2004, 14 – 18 April 2004, Štrbské Pleso, Slovakia.
- [16] **I. Králik** - local organizing committee of the XII International Workshop on Deep Inelastic Scattering DIS 2004, 14 – 18 April 2004, Štrbské Pleso, Slovakia.
- [17] **K. Flachbart** – international advisory committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [18] **A. Zentko** - international advisory committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [19] **M. Mihalik** – organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [20] **M. Zentková** - organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [21] **J. Kováč** - organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [22] **M. Koneracká** - organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [23] **M. Reiffers** - organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.



- [24] **G. Pavlík** - organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [25] **M. Timko** - organizing committee of the 12th Czech and Slovak Conference on Magnetism, CSMAG´04, 12 – 15 July 2004, Košice, Slovakia.
- [26] **L. Šándor** – international advisory committee of the XXXV International Symposium on Multiparticle Dynamics, ISMD 2005, 9 – 15 August 2005, Kroměříž, Czech Republic.
- [27] **L. Šándor** – local advisory committee of the 18<sup>th</sup> International Conference on Nucleus Nucleus Collisions, Quark Matter 2005, 4 – 9 August 2005, Budapest, Hungary.
- [28] **V. Kavečanský** – garant of the Regional Powder Diffraction Conference RPKD 2005, 21 – 23 September 2005, Demänovská dolina, Slovakia.
- [29] **M. Antalík** – organizing committee of the Structure and Stability of Biomacromolecules, 12 – 14 September 2005, Košice, Slovakia.
- [30] **J. Bágel'ová** - organizing committee of the Structure and Stability of Biomacromolecules, 12 – 14 September 2005, Košice, Slovakia.
- [31] **D. Fedunová** - organizing committee of the Structure and Stability of Biomacromolecules, 12 – 14 September 2005, Košice, Slovakia.
- [32] **Z. Tomori** - organizing committee of the Structure and Stability of Biomacromolecules, 12 – 14 September 2005, Košice, Slovakia.
- [33] **E. Demjénová** - organizing committee of the Structure and Stability of Biomacromolecules, 12 – 14 September 2005, Košice, Slovakia.
- [34] **K. Kudela** – international advisory committee of the ICRC International Cosmic Ray Conference, August 2005, Pune, India.
- [35] **K. Kudela** – scientific programme committee of the Solar Extreme Events 2005, Yerevan, Armenia.
- [36] **D. Bruncko** – international advisory committee of the XIII International Workshop on Deep Inelastic Scattering DIS 2005, 27 April – 1 May 2005, Madison, Wisconsin, USA.
- [37] **D. Bruncko** – international advisory committee of the XIV International Workshop on Deep Inelastic Scattering DIS 2006, 20 – 24 April 2006, Tsukuba, Japan.
- [38] **L. Šándor** – international advisory committee of the XXXVI International Symposium on Multiparticle Dynamics, ISMD 2006, 2 – 8 September 2006, Paraty, Rio de Janeiro, Brazil.

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

- [1] **K. Kudela** – chairman of National Committee of COSPAR, member of COSPAR, Slovak representative in COSPAR, member of National Committee of URSI, member IUPAP Commission for Cosmic Rays, member of the American Geophysical Union
- [2] **M. Slivka** – member of National Committee of SCOSTEP
- [3] **A. Zentko** – member of NC IUPAP, editorial board of the Czechoslovak Journal of Physics
- [4] **M. Reiffers** – member of EPS, IOP, NC IUPAP, NC UNESCO for physics
- [5] **J. Antoš** – member of NC IUPAP
- [6] **I. Škorvánek** – member of the American Association for Advancement of Science, member of executive committee of EU consortium “Nanostructural materials” COST 523, vice president of Humboldt Club in Slovakia, member of the International Advisory Committee for Soft Magnetic Materials
- [7] **M. Sedlák** – member of the American Physical Society and the American Chemical Society
- [8] **J. Ferencei** – member of NC IUPAP
- [9] **P. Kopčanský** – member of the International Advisory Committee for Magnetic Fluids, editorial board of the Annals of the University of Petroşany
- [10] **P. Samuely** – member of the American Physical Society
- [11] **P. Szabo** – member of the American Physical Society
- [12] **K. Flachbart** – member of the German Physical Society DPG
- [13] **Z. Tomori** – member of the IEEE Society
- [14] **L. Šándor** – editorial board of the Czechoslovak Journal of Physics

**iv. List of international scientific awards and distinctions**

- [1] **P. Diko** – award of the Scientific gremium of PARSEG (Processing and Application of Superconducting (RE)BCO Large Grain Materials) Tokyo 2005 for his excellent contribution to the research and applications of massive REBCO superconductors.
- [2] **K. Zmorayová, P. Diko, S. Heindl, H. Weber and G. Krebbs** – award for the best poster (“Quantitative Study of Oxygenation Cracking in Top-Seeded Melt-Grown Y-Ba-Cu-O Bulk Superconductors”) at PARSEG 2005, 21 – 23 October 2005, Tokyo, Japan.
- [3] **P. Szabó, P. Samuely, J. Kačmarčík, T. Klein, J. Marcus, D. Fruchart, S. Miraglia, C. Marcenat and A. G. M. Jansen** – diploma of the Thomson Institute of Scientific Information for the best cited paper in field: Evidence of two superconducting energy

gaps in  $\text{MgB}_2$  by point-contact spectroscopy, *Phys. Rev. Lett.* 87 (2001) 137005. More than 250 citations before award in 2005.

- [4] **R. Bučík** – took part in the session of the General Assembly of the International Union of Radio Sciences in New Delhi, India (23 - 29 October 2005) as invited scientist in the framework of the URSI Young Scientist Award Scheme
- [5] **K. Kudela** – awarded European Space Agency Certificate for his excellent contribution to the space research near Earth during the Cluster mission (2005).
- [6] The article **P. Diko, S. Kracunovska, L. Ceniga, J. Bierlich, M. Zeisberger, W. Vasalek**: Microstructure of top seeded melt-grown YBCO bulks with holes, *Supercond. Sci. Technology* 18 (2005) 1-5, was selected into the SUST 2005 Highlights list of the best scientific results published in the Superconductor Science and Technology.
- [7] **J. Baláž** – appreciation letter for successful contribution to the Double Star Programme. Cooperation between Chinese National Space Administration and European Space Agency 1999 – 2004.
- [8] **I. Strhársky** - appreciation letter for successful contribution to the Double Star Programme. Cooperation between Chinese National Space Administration and European Space Agency 1999 – 2004.

- **National position of the individual researchers**

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

- [1] **M. Reiffers, S. Ilkovič, A. Zorkovská, E. Bauer**, Mikrokontaktové vlastnosti zlúčeniny  $\text{YbCu}_{3.5}\text{Al}_{1.5}$  typu nie Fermiho kvapaliny. (Microcontact properties of  $\text{YbCu}_{3.5}\text{Al}_{1.5}$  compound of the non-Fermi liquid type). In *13<sup>th</sup> Conference of Slovak Physicists, August 25-28 2003, Smolenice, Slovakia*.
- [2] **S. Gabáni, K. Flachbart, V. Pavlík, E. Bauer, S. Berger, M. Della Mea, C. Paul, Y. Paderno, N. Shitsevalova**, Tlakom indukovaný fázový prechod polovodič-kov v  $\text{SmB}_6$ . (Pressure induced semiconductor-metal phase transition in  $\text{SmB}_6$ .) In *13<sup>th</sup> Conference of Slovak Physicists, August 25-28 2003, Smolenice, Slovakia*.
- [3] **P. Skyba**, Čo je nové vo výskume supratekutého hélia-3. (What is new in superfluid helium-3 research.) In *13<sup>th</sup> Conference of Slovak Physicists, August 25-28 2003, Smolenice, Slovakia*.
- [4] **P. Szabó, P. Samuely, J. Kačmarčík, Z. Hoľanová, T. Klein, A. G. M. Jansen**,  $\text{MgB}_2$  – unikátny dvojmedzerový supravodič. ( $\text{MgB}_2$  – unique two-gap

- superconductor.) In *13<sup>th</sup> Conference of Slovak Physicists, August 25-28 2003, Smolenice, Slovakia.*
- [5] **P. Szabó**, Fyzikálne vlastnosti MgB<sub>2</sub> – dvojmedzerová supravodivosť. (Physical properties of MgB<sub>2</sub> – two-gap superconductivity.) In *13<sup>th</sup> Conference of Slovak Physicists, August 25-28 2003, Smolenice, Slovakia.*
- [6] **M. Seman**, Štúdium vysokoenergetických častíc kozmického žiarenia. (Study of high-energy particles in cosmic radiation). In *13<sup>th</sup> Conference of Slovak Physicists, August 25-28 2003, Smolenice, Slovakia.*
- [7] **P. Samuely**, Dvojpásmová/dvojmedzerová supravodivosť v diboride horčíka. (Two-band/Two-gap superconductivity in MgB<sub>2</sub>.) In *Seminar at FMFI Comenius University, April 24 2004, Bratislava, Slovakia.* Invited talk at a national academic institution.
- [8] **P. Samuely**, Intrinsic Josephson junctions superconductor based on NbSe<sub>2</sub>. In *Seminar at FMFI Comenius University, December 2004, Bratislava, Slovakia.* Invited talk at a national academic institution.
- [9] **K. Kudela, M. Slivka**, Energetické častice v kozme a kozmické počasie. Slovenský príspevok k štúdiu efektov október-november 2003. (Energetic particles in space and space weather. Slovak contribution to study of october-november 2003 effects.) In *17<sup>th</sup> Nation-wide Solar Seminar, May 5 2004, Stará Lomnica, Slovakia.*
- [10] **M. Zentková, A. Zentko, M. Mihalik, Z. Mitróová, S. Maťaš, V. Kavečanský, Z. Arnold, J. Kamarad**, Prussian blue analogues – successful update of an ancient compound. In *15<sup>th</sup> Conference of Slovak Physicists, September 11-14 2006, Stará Lesná, Slovakia.*
- [11] **P. Skyba**, Nelineárne javy v supratekutom <sup>3</sup>He-B: Andrejevovská reflexia a JMR v rotujúcej sústave. (Nonlinear phenomena in superfluid <sup>3</sup>He-B: Andreev reflection and NMR in rotating system.) In *15<sup>th</sup> Conference of Slovak Physicists, September 11-14 2006, Stará Lesná, Slovakia.*
- [12] **K. Kudela, R. Bučík, P. Bobík**, O priechodnosti kozmického žiarenia v premenlivej magnetosfére. (On passage of cosmic radiation through variable magnetosphere.) In *18<sup>th</sup> Nation-wide Solar Seminar. May 22-26 2006, Modra, Slovakia.*
- ii. **List of employees who served as members of organising and programme committees of national conferences**
- [1] **M. Reiffers** – organizing and programme committee of 13-th Conference of Slovak Physicists, 25 – 29 August 2003 Smolenice, Slovak Republic

- [2] **M. Reiffers** - organizing and programme committee of the 14-th Conference of Slovak Physicists, 11 – 15 October 2004.
- [3] **M. Reiffers** – preparatory committee of “SR and EU from the point of view of Slovak industrial development”, 4 – 5 December 2003, Bratislava, Slovak Republic.
- [4] **I. Škorvánek** – organizing and programme committee of the NANOVED conference, 28 -29 January 2003, Bratislava, Slovak Republic.
- [5] **P. Diko** – programme committee of the NENAMAT, Mobilization Workshop – Slovakia, 13 – 16 February 2005, Stará Lesná, Slovak Republic.
- [6] **M. Timko** – organizing committee of the 15-th Conference of Slovak Physicists, 11 – 14 September 2006, Stará Lesná, Slovak Republic.

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

- [1] **M. Timko** – editorial board of the Acta Electrotechnica et Informatica.
- [2] **M. Antalík** – editorial board of the Chemical Papers.
- [3] **P. Kopčanský** – Collegium of Slovak Academy of Sciences for Mathematics, Physics and Informatics.
- [4] **P. Samuely** - Collegium of Slovak Academy of Sciences for Mathematics, Physics and Informatics.
- [5] **L. Šándor** - Collegium of Slovak Academy of Sciences for Mathematics, Physics and Informatics.
- [6] **K. Kudela** – Collegium of SAS for Earth and Space Sciences, Collegium of SAS for Mathematics, Physics and Informatics.
- [7] **P. Diko** – Collegium of SAS for Electronics, Material Research and Technologies.
- [8] **M. Sedlák** – Collegium of SAS for Chemical Sciences.
- [9] **M. Reiffers** – Collegium of SAS for Electronics, Material Research and Technologies, Collegium of SAS for Chemical Sciences.
- [10] **M. Hnatič** – Commission nr. 2 for Physics, Scientific Grant Agency of the Ministry of Education of Slovak Republic and the Slovak Academy of Sciences - VEGA.
- [11] **K. Csach** – Commission nr. 5 for Mechanical Engineering, Metallurgy and Material Engineering, Slovak VEGA grant agency.
- [12] **P. Samuely** – Commission nr. 2 for Physics, Slovak VEGA grant agency.
- [13] **I. Škorvánek** – Commission nr. 2 for Physics, Slovak VEGA grant agency.
- [14] **M. Antalík** – Commission nr. 8 for Molecular and Cellular Biology, Slovak VEGA grant agency.

- [15] **P. Diko** – Commission nr. 5 for Mechanical Engineering, Metallurgy and Material Engineering, Slovak VEGA grant agency.
- [16] **K. Flachbart** – Commission nr. 2 for Physics, Slovak VEGA grant agency.
- [17] **K. Kudela** – vice chairman of the Commission for Research and Peaceful Use of Outer Space, by the Government Council for Science and Technology. Chairman of Expert council for space physics of the Commission, Representative of Slovak ministry of Education at COPUS UN (Commission for Peaceful Use of Outer Space), appointed as one alternate representative from Slovakia in High Level Space Policy Group.
- [18] **M. Slivka** – member of Expert council for space physics of the Commission for Research and Peaceful Use of Outer Space, by the Government Council for Science and Technology.
- [19] **L. Just** – member of Expert council for space physics of the Commission for Research and Peaceful Use of Outer Space, by the Government Council for Science and Technology.
- [20] **J. Baláz** - member of Expert council for space physics of the Commission for Research and Peaceful Use of Outer Space, by the Government Council for Science and Technology.
- [21] **P. Samuely** – member of group Physics of the Accreditation commission of the Slovak Government.
- [22] **M. Hnatič** – member of the Committee for cooperation with JINR Dubna.
- [23] **P. Stríženec** – member of the Committee for cooperation with JINR Dubna.
- [24] **J. Antoš** – member of Working group for physics – advisory body for the Slovak Government.
- [25] **L. Šándor** – member of the Committee for cooperation with CERN.
- [26] **D. Bruncko** – member of the Committee for cooperation with CERN.
- [27] **I. Králik** – member of the Committee for cooperation with CERN.
- [28] **M. Reiffers** – member of the Council of State Programme: Advancement of Progressive Technologies for Efficient Economics.

#### iv. List of national awards and distinctions

- [1] **D. Bruncko** and **P. Kopčanský** – Silver Medal of the Faculty of Electrotechnics, University of Žilina, 2003.
- [2] **P. Szabó** – Young Scientist of the Year 2004 - award of Journal.-Studio, Bratislava.
- [3] **P. Samuely**, **P. Szabó** and **J. Kačmarčík** – SAS Award “For experimental proof of the two-gap superconductivity in  $MgB_2$ ”. 2004.

- [4] **P. Skyba** – Minister of Education Award for Science and Research for advancement and results in ultra-low temperature physics and liquid helium-3.
- [5] **P. Diko** – Extraordinary reward from the Presidium of SAS for the results achieved in study of microstructure of bulk REBCO superconductors. 2005.
- [6] **M. Človečko** – Volksbank award for the best graduate in 2005.
- [7] **L. Šándor** – SAS Medal for Support of Science, awarded on the occasion of the CERN anniversary. Honorary membership in Slovak Physical Society. 2005.
- [8] **K. Kudela, J. Baláž and J. Macko** – SAS Award for Popularization of space physics. 2006.
- [9] **K. Kudela** – Honorary Plaquette of Dionýz Ilkovič from SAS
- [10] **M. Seman** - Honorary Plaquette of Dionýz Ilkovič from SAS
- [11] **H. Čenčariková** – 3. place in “Competition of young researchers of SAS 2006”.
- [12] **J. Baláž** – “Technologist of the Slovak Republic 2005” Award. 2006.
- [13] **H. Čenčariková** – Honourable mention in the Competition “Scientist of the year 2006” in the category “Young Scientist of Slovakia in 2005”, awarded in 2006 by the Journalist Studio and the Club of Scientific and Technological Journalists of the Slovak Journalist Syndicate.
- [14] **P. Skyba** – Honourable mention in the competition “Scientist of the year 2006” in the category “Scientific achievement in Slovakia 2005”, awarded in 2006 by the Journalist Studio and the Club of Scientific and Technological Journalists of the Slovak Journalist Syndicate.

### **Supplementary information and/or comments documenting international and national status of the Organisation**

The Institute of Experimental Physics signed several bilateral agreements with foreign institutes and universities about mutual cooperation in the following areas:

#### **Department of Magnetism**

- [1] Institute of Molecular Physics Polish Academy of Sciences, Poznan, Poland, 2007 – 2009
- [2] Institute for Low Temperature Physics and Engineering of National Academy of Sciences of Ukraine, Kharkov, Ukraine, 2006 – 2010
- [3] Institute of Nuclear Physics Polish Academy of Sciences, Krakow, Poland, 2005 – 2007
- [4] Centre for Fundamental and Advanced Technical Research of Romanian Academy, Timisoara, Romania, 2004 – 2007

- [5] Research Institute for Solid State Physics and Optics, Hungarian Academy of Sciences, Budapest, Hungary, 2004 – 2007
- [6] Institute for Low Temperature Physics and Engineering of National Academy of Sciences of Ukraine, Kharkov, Ukraine, 2004 – 2007
- [7] Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic, 2001 – 2006

#### **Department of Low Temperature Physics**

- [1] Department of Physics Lancaster University, United Kingdom 2005 – 2007
- [2] Institut obshchej fiziki RAS (Institute of General Physics), Moscow, Russia, till the end of 2007
- [3] Institut for Problems of Materials Science NAS Ukraine 2004 – 2008

#### **Department of Metal Physics**

- [1] Institut for Metal Physics of NAS of Ukraine 2005 – 2007
- [2] The Material Science Center, Department of Applied Physics, University of Groningen, Netherlands, 2006 – 2008

#### **Department of Subnuclear Physics**

- [1] Max-Planck-Institut fur Physik Werner-Heisenberg Institut Munchen, Germany

#### **Department of Theoretical Physics**

- [1] Main Astronomical Observatory National Academy of Sciences of Ukraine 2005 – 2009
- [2] Objedinenyj institut jadernych isledovanij (Joint Institute for Nuclear Research), Dubna, Russia, 2005 – 2008
- [3] Uzhorod National University, Uzhorod, Ukraine 2005 – 2009
- [4] Institute for Condensed Matter Physics NAS, Ukraine 2003 – 2007
- [5] Institute of Physics St. Petersburg University, Russia 2001 – 2006

#### **Department of Space Physics**

- [1] Space Research Institute, RAS, Moscow, Russia 2005 – 2008
- [2] Space Research Laboratory, Democritus University of Thrace, Xanthi, Greece 2005 – 2008
- [3] Ústav jadrovej fyziky AV ČR (Institute of Nuclear Physics Czech Academy of Sciences), Prague, Czech Republic, 2006 – 2010
- [4] IZMIRAN, Russian Academy of Sciences, Troitsk, Russia 2004 – 2007



- [5] Lebedev Physical Institute of Russian Academy of Sciences, Moscow, Russia 2006 – 2010

#### Department of Biophysics

- [1] Ústav organické chémie a biochémie Akademie věd České republiky (Institute of Organic Chemistry and Biochemistry), Prague, Czech Republic, 2002 – 2006
- [2] Biofyzikální ústav Akademie věd České republiky (Biophysical Institute Czech Academy of Sciences), Brno, Czech Republic, 2002 - 2006

#### 4. Project structure, research grants and other funding resources

- **International projects and funding**

- i. **List of major projects within the European Research Area – 5th and 6th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, etc. (here and in items below please specify: type of project, title, grant number, duration, funding, responsible person in the Organisation and his/her status in the project, e.g. coordinator, principal investigator, investigator)**

- [1] **6FP EU: MTKD-CT-2005-030002 Extrem** Condensed matter at extreme experimental conditions. Duration: 2006 – 2009. Funding: 898 000 Sk in 2006, 327 737 Eur for the duration of the project. Responsible person: **P. Samuely**, coordinator.
- [2] **INTAS 03-51-3036** Nature of magnetism in fcc and bcc systems based on rare earths borides. Duration: 2004 – 2006. Funding: 80 000 Sk in 2004, 92 000 Sk in 2005, 69 000 Sk in 2006. Responsible person: **K. Flachbart**, coordinator.
- [3] **5FP EU: GROWTH** - New biocompatible nanoparticle delivery system for targeted release of fibrinolytic drugs. Duration: 2002 – 2004. Funding: 396 000 Sk in 2003, 270 000 Sk in 2004. Responsible person: **M. Timko**, investigator. **GRD 3-2001-60036 TATLYS (5FP GROWTH)** Novel specific biomimetic and magnetically traced nanoparticles for the targeted transport of fibrinolytic drugs. Duration: 2002 – 2005. Funding: 396 000 Sk in 2003, 300 000 Sk in 2004, 311 970 Sk in 2005. Responsible person: **P. Kopčanský**, investigator.
- [4] **5FP EU: SCENET-2** The European Network for Superconductivity. Duration: 2003 – 2006. Funding: 37 000 Sk in 2004, 40 000 Sk in 2005, 3744 Sk (104 Euro) in 2006. Responsible person: **P. Diko**, investigator.
- [5] **6FP EU: MRTN-CT-2006-0135619 NESPA** NanoEngineered Superconductors for Power Applications. Duration: 2006 – 2010. Funding: 27096 Eur for the duration of the project. Responsible person: **P. Diko**. Investigator.

- [6] **INTAS 05-103-7555** A proposal for R&D to establish the limitations on the operation of the ATLAS end-cap calorimeters at high LHC luminosities. Duration: 2006 – 2008. Funding: 125 000 Sk in 2006. Responsible person: **D. Bruncko**, investigator.
- [7] **COST 523** Magnetic structural and functional properties of soft magnetic nanocrystalline materials. Duration: 2001 – 2004. Funding: 80 000 Sk in 2003, 30 000 Sk in 2004. Responsible person: **I. Škorvánek**, investigator.
- [8] **COST 724** Cosmic radiation, energetic cosmic particles and space weather. Duration: 2003 – 2007. Funding: 20 000 Sk in 2003, 30 000 Sk in 2004, 50 000 Sk in 2005, 100 000 Sk in 2006. Responsible person: **K. Kudela**, investigator.
- [9] **COST ECOM P16** Emergent behaviour of correlated matter. Duration: 2005 – 2008. Funding: 50 000 Sk in 2005, 100 000 Sk in 2006. Responsible person: **M. Reiffers**, investigator.
- [10] **COST P17 (Electromagnetic processing of Materials)** Improvement of functional properties of Fe- and Co- based nanocrystalline magnetic materials by heat treatment in magnetic field. Duration 2006 – 2009. Funding: 80 000 Sk in 2006. Responsible person: **I. Škorvánek**, investigator.
- [11] **COST D43** Colloid and interface chemistry for nanotechnology. Duration: 2006 – 2011. Funding: 0 Sk in 2006. Responsible person: **M. Sedlák**, investigator.
- [12] **NATO No.LST. CLG. 977500.** NATO Collaborative linkage grant: Applications of magnetic fluids in medicine. Duration: 2001 – 2003. Funding: 72 468 Sk in 2003. Responsible person: **P. Kopčanský**, principal investigator.
- [13] **NATO PST.EAP.CLG 981072** Novel soft alloys with high critical temperatures. Duration: 2004 – 2006. Funding: 35 000 Sk in 2005, 27 000 Sk in 2006. Responsible person: **I. Škorvánek**, investigator.
- [14] **CERN ALICE KE** – A study of new forms and phase transitions of nuclear matter at high energy densities. Contribution to the development and building of the electronics for silicon pixel detector (SPD) and for central trigger system of the ALICE experiment. Duration: 1998 – 2007. Funding: 0 Sk in 2003, 1070 000 Sk in 2004, 690 000 Sk in 2005, 1440 000 Sk in 2006. Responsible person: **L. Šándor**, coordinator.
- [15] **CERN ATLAS KE** – Development and tests of calibration system for hadronic end-cap calorimeters for ATLAS detector at CERN. Duration: 1998 – 2007. Funding: 0 Sk in 2003, 890 000 Sk in 2004, 200 000 Sk in 2005, 1310 000 Sk in 2006. Responsible person: **D. Bruncko**, coordinator.
- [16] **CERN NA57 KE** – Study of possible quark-gluon plasma production in heavy-ion collisions. Duration: 1998 – 2007. Funding: 0 Sk in 2003, 454 000 Sk in 2004, 80 000 Sk in 2005, 167 000 Sk in 2006. Responsible person: **I. Králik**, coordinator.

- [17] **VW-I/75961** Soft magnetic nanocrystalline materials with improved combination of application oriented properties. Duration 2000 – 2003. Funding: 276 000 Sk in 2003. Responsible person: **I. Škorvánek**, investigator.
- [18] **EFFORT** The European Forum for Processors of Large Grain (RE)BCO, funded by the UK government and by the European commission. Duration: 2001 – 2007. Funding: 60 000 Sk in 2004, 100 000 Sk in 2005, 100 000 Sk in 2006. Responsible person: **P. Diko**, investigator.

## ii. List of other international projects incl. funding

- [1] **Project No. 37s14** (Action Austria – Slovakia). Magnetic fluids and mixtures with liquid crystals. Duration 2001 – 2003. Funding: 6535 Sk in 2003. Responsible person: **P. Kopčanský**, principal investigator.
- [2] **Czecho – Slovak project 139/100**. Measurement of geometrical characteristics of 3D objects by using image analysis and stereology methods. Duration: 2004 – 2005. Funding: 32 000 Sk in 2004, 32 000 Sk in 2005. Responsible person: **Z. Tomori**, investigator.
- [3] **SR-FRN-03 (Stefanik)** Medium Tc superconductors  $MgB_2$  and  $(Ba,K)BiO_3$  in high magnetic fields. Duration: 2004 – 2006. Funding: 60 000 Sk in 2005. Responsible person: **P. Samuely**, investigator.
- [4] **SR-China 2-3-8** Structure and properties of magnetic metal nanocapsules. Duration 2002 – 2004. Funding: 56 000 Sk in 2004. Responsible person: **I. Škorvánek**, investigator.
- [5] **SR-China 2-3-16** Prediction of space weather using cosmic ray measurement network. Duration: 2003 – 2004. Funding: 56 000 Sk in 2004. Responsible person: **K. Kudela**, investigator.
- [6] **SK-FR-2306** Slovakia-France joint project Cracking during oxygenation of YBCO bulk, Pr. No. Stefanik 23. Duration: 2006 – 2007. Funding: 80 000 Sk in 2006. Responsible person: **P. Diko**, investigator.
- [7] **SK-11306** Bistable molecular magnetic materials with utilizable properties. Duration 2006 – 2007. Funding: 35 000 Sk in 2006. Responsible person: **M. Zentková**, principal investigator.
- [8] **SK-CZ-05506** Association of weak polyanions by hydrogen bonding – new candidates for targeted drug delivery. Duration: 2006 – 2007. Funding: 18 065 Sk in 2006. Responsible person: **M. Sedlák**, principal investigator.

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

- [1] **SR-PL-26** Properties of molecule-based magnetic materials. Duration: 2005 – 2007. Responsible person: **M. Mihalik**, principal investigator.
- [2] **Slovak-Polish Project:** Physics of magnetic materials. Duration: 2004 – 2006. Responsible person: **M. Timko**, principal investigator.
- [3] **Slovak and Spanish Gov. Pr. No. 05/2006** Slovakia-Spain joint project “Welding of YBCO bulk superconductors. Duration 2006 – 2007. Responsible person: **P.Diko**, principal investigator.
- [4] **CNR-SAV** Modern theoretical methods in the models associated with theory of developed turbulence. Study of anomalous scaling, stability, intermittency, anisotropy and compressibility effects. Duration: 2004 – 2006. Responsible person: **M. Hnatič**, principal investigator.
- [5] **DAAD** Magnetische Eigenschaften von Borreichen Verbindungen mit seltenen Erden unterhalb und oberhalb der Ordnungstemperatur. Duration: 2006 – 2007. Responsible person: **K. Flachbart**, principal investigator.
- [6] **SM1406** Recovery of Fermi-liquid ground state in point-contacts of non-Fermi-liquid – normal metal by an application of high magnetic fields. Duration: 2006 (10 days of measurement time). Responsible person: **M. Reiffers**, principal investigator.
- [7] **SM1806** Recovery of Fermi-liquid ground state in homo point-contact of non-Fermi-liquid – non-Fermi-liquid metal by an application of high magnetic fields. Duration: 2006 (7 days of measurement time). Responsible person: **M. Reiffers**, principal investigator.
- [8] **MA0106** Temperature dependence of critical magnetic field of structural transitions in ferromagnetic droplet state. Duration: 24 – 30 April 2006. Responsible person: **P. Kopčanský**, principal investigator.
- [9] **MA1206** Type of anchoring of liquid crystal molecules to fine magnetic particles in ferromagnetic droplets. Duration: 9 – 15 October 2006. Responsible person: **M. Koneracká**, principal investigator.

- **National projects and funding**

#### i. List of projects supported by the Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, and their funding

- [1] **APVT-51-020102** Nanostructures in superconductors. Duration: 2002 – 2005. Funding: 534 000 Sk in 2003, 888 000 Sk in 2004. Responsible person: **P. Samuely**, principal investigator.

- [2] **APVT-20-018402** Synthesis and characterization of nanomaterials prepared by non-traditional methods from metal-based material precursors. Duration: 2002 – 2005. Funding: 101 750 Sk in 2003, 159 000 Sk in 2004, 59 250 Sk in 2005. Responsible person: **I. Škorvánek**, investigator.
- [3] **APVT-20-009902** Low-dimensional magnetic and magneto-optical materials based on analogues of Prussian blue and nitropruside complexes. Duration: 2002 – 2005. Funding: 240 640 Sk In 2003, 293 000 Sk in 2004, 200 000 Sk in 2005. Responsible person: **M. Mihalik**, principal investigator.
- [4] **APVT-20-025902** Monitoring of energetic particles in near surrounding of Earth: relations to space weather – influence on flight personnel. Duration: 2002 – 2006. Funding: 219 000 Sk in 2003, 305 000 Sk in 2004, 134 000 Sk in 2005, 134 000 Sk in 2006. Responsible person: **K. Kudela**, principal investigator.
- [5] **APVT-51-021602** Strongly correlated and disordered electron systems. Duration: 2002 - 2005. Funding: 63 500 Sk in 2003, 104 717 Sk in 2004, 0 Sk in 2005. Responsible person: **P. Farkašovský**, investigator.
- [6] **APVT-51-016604** Superconductors for future technologies. Duration: 2005 – 2007. Funding: 2782 000 Sk in 2005, 2886 000 Sk in 2006. Responsible person: **P. Samuely**, principal investigator.
- [7] **APVT-51-031704** Magnetic properties and electron structure of d- and f- metal compounds. Duration: 2005 – 2007. Funding: 530 000 Sk in 2005, 530 000 Sk in 2006. Responsible person: **M. Reiffers**, principal investigator.
- [8] **APVT-51-027904** Study of phase transitions, cooperative phenomena and structural changes in nanomaterials, critical and stochastic dynamics. Duration: 2005 – 2007. Funding: 702 000 Sk in 2005, 667 000 Sk in 2006. Responsible person: **M. Hnatič**, principal investigator.
- [9] **APVT-20-005204** Magnetostructural correlations in unconventional magnetic materials. Duration: 2005 – 2007. Funding: 200 000 Sk in 2005, 200 000 Sk in 2006. Responsible person: **M. Mihalik**, investigator.
- [10] **APVT-51-052702** Novel multipurpose materials with defined structure and extraordinary properties. Duration: 2005 – 2007. Funding: 0 Sk in 2005, 0 Sk in 2007. Responsible person: **I. Škorvánek**, investigator.
- [11] **APVT-20-008404** Study of structural and magnetic properties of nanophase and amorphous systems based on 3-d transition metals Fe, Co, Ni. Duration: 2005 – 2007. Funding: 83 000 Sk in 2005, 83 000 Sk in 2006. Responsible person: **J. Kováč**, investigator.

- [12] **APVV-51-061505** Microstructural design of YBCO superconductors. Duration: 2006 – 2009. Funding: 1201 000 Sk in 2006. Responsible person: **P. Diko**, principal investigator.
- [13] **APVV-51-037905** Water-soluble polymers: from the fundamentals of interaction, structure and dynamics in solution to controlled polymer synthesis and self-assembly. Duration: 2006 – 2009. Funding: 4178 000 Sk in 2006. Responsible person: **M. Sedlák**, principal investigator.
- [14] **APVV-51-053805** Monitoring of energetic particles in space for selected problems of space weather. Duration: 2006 – 2008. Funding: 2151 000 Sk in 2006. Responsible person: **K. Kudela**, principal investigator.
- [15] **APVV-20-057305** The advanced top quark physics studies. Duration 2006 – 2008. Funding: 487 000 Sk in 2006. Responsible person: **J. Antoš**, investigator.
- [16] **APVV 26-026505** Targeted transport of anticancer drugs in magnetically labelled nanoparticles. Duration: 2006 – 2009. Funding: 935 000 Sk in 2006. Responsible person: **M. Koneracká**, investigator.
- [17] **APVV LPP-0030-06** Scientific incubator for pupils and students. Duration: 2006 – 2009. Funding: 5000 Sk in 2006. Responsible person: **M. Zentková**, principal investigator.
- [18] **APVV LPP-0041-06** Molecular based magnetic materials based n Prussian blue analogues. Duration 2007 – 2010. Responsible person: **M. Mihalik**, principal investigator.
- [19] **APVV LPP-0047-06** Study of strongly correlated electron systems beyond standard approximations. Duration: 2006 – 2009. Funding: 53 000 Sk in 2006. Responsible person: **P. Farkašovský**, principal investigator.
- [20] **APVV LPP-0101-06** Perspective superconductors. Duration: 2006 – 2009. Funding: 104 000 Sk in 2006. Responsible person: **P. Samuely**, principal investigator.
- [21] **APVV LPP-0334-06** Singlegrain YBCO composite superconductors. Duration: 2006 – 2009. Funding: 268 000 Sk in 2006. Responsible person: **P. Diko**, principal investigator.

- 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	2003	2004	2005	2006
number	19	22	19	20
funding (millions of SKK)	1,979	2,234	2,180	2,764

• Summary of funding from external resources

External resources	2003	2004	2005	2006	total	average
external resources (millions of SKK)	7,131	9,015	13,989	67,250	97,385	24,346
external resources transferred to cooperating research organisations (millions of SKK)	1,613	1,098	2,969	3,064	8,744	2,186
ratio between external resources and total salary budget	0,296	0,371	0,544	2,543	-	0,938
overall expenditures (millions of SKK)	46,838	53,766	55,139	111,106	266,849	66,712

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)

**Programmes of doctoral studies in the previously effective legislation:**

- [1] 11-22-9 Physics of condensed matter and acoustics  
 [2] 11-24-9 Nuclear and subnuclear physics

**Programmes of doctoral studies in the recently amended Act on the Universities:**

- [1] 2.4.1 General physics and mathematical physics  
 [2] 4.1.3 Physics of condensed matter and acoustics  
 [3] 4.1.5 Nuclear and subnuclear physics

- 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	31.12.2003			31.12.2004			31.12.2005			31.12.2006		
number of potential PhD supervisors	40,8			41,7			40,9			44,4		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
internal	11	3	0	13	1	1	10	3	2	11	2	0
external	1	0	0	2	0	0	1	0	0	1	1	0
supervised at external institution by the research employees of the assessed organisation	5	0	0	5	2	0	3	2	0	1	1	0

- iii. Postdoctoral positions supported by

a) *external funding (specify the source)*

none

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

[1] H. Čenčančariková

[2] Z. Hoľanová

[3] F. Tomasz

[4] I. Potočová

[5] Z. Mitróová

[6] R. Pinčák

[7] J. Marcin



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

Teaching	2003	2004	2005	2006
lectures (hours/year)	483	565	617	743
practicum courses (hours/year)	436	390	698	493
supervised diploma works (in total)	12	5	5	11
members in PhD committees (in total)	10	7	13	10
members in DrSc. committees (in total)	4	3	3	6
members in university/faculty councils (in total)	2	2	2	2
members in habilitation/inauguration committees (in total)	2	4	2	2

**v. List of published university textbooks**

none

**vi. Number of published academic course books**

none

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

[1] Laboratory of magnetism: department of magnetism with the Faculty of Science, P. J. Šafárik University, Košice.

[2] Centre of Low Temperature Physics – Centre of Excellence, joint laboratory with the Faculty of Science, P. J. Šafárik University, Košice.

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

Inaugurated Professors: K. Kudela (2005), M. Antalík (2005)

Inaugurated Associated Professor: Z. Tomori (2006)

### Other pedagogical activities:

- [1] **V. Kavečanský:** Rietveld refinement of X-ray diffraction, **25 hours** - lecture at Technisch-Naturwissenschaftliche Fakultät, Chemische Technologie Anorganischer Stoffe, Johannes Kepler Universität Linz, Austria, 15 October – 15 November 2005.
- [2] **K. Kudela:** Magnetospheric optics for cosmic rays, **1 hour**, Transmissivity in the disturbed magnetosphere, **1 hour**, Solar particle penetration into magnetosphere, **1 hour**, Direct effects of cosmic ray on materials, **1 hour** – lectures at Satellites, Airplanes, Atmosphere, Lectures at ICIP-COST-UNSNSWP-CAWSES-INAF-INFN International Advanced School on Space Weather, Trieste, Italy, 2 – 19 May 2006.

## 6. Direct output to the society

### (applications of results, popularisation and outreach activities)

#### i. List of the most important results of applied research projects

- [1] Methods for calculation of magnetospheric transmission functions. Authors: P. Bobík, R. Bučík, K. Kudela. User: International Standardization Organization. (2005)
- [2] Development of cryogenics infrastructure at Košice. Authors: Centre of Low Temperature Physics. User: Medical facilities in Eastern Slovakia, Technical University, Košice, Basic research laboratories under SAS and Ministry of Education.

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

- [1] **I. Škorvánek** – member of commission at Košice Self-governing Region responsible for the compilation of the regional innovation report for the Košice Self-governing Region. 2005

#### iii. List of the most important popularisation activities

- [1] Active participation in creation of the film “Journey to the depth of matter”, shown on TV in 2003 (**D. Bruncko, I. Králik**)
- [2] Contribution to the CERN Courier in 2003 (**D. Bruncko**).
- [3] Translation of 2 articles in the Quark – national journal for popularization of science in 2003. (**M. Bombara**).
- [4] Participation in popularization show at the Regina radio station in 2003. (**P. Samuely**).
- [5] Slovaks participate at the Chinese space research, newspaper PRAVDA 5 March 2003. (**J. Baláž**)

- [6] Solar eruptions may cause increase of radiation in airplanes, newspaper Korzár, 30 May 2003. (**K. Kudela**)
- [7] UEF Košice participates at space experiments, TASR 6 October 2003. (**J. Baláž**)
- [8] A neutral atom detector is nearing completion at UEF, newspaper Hospodárske noviny, 8 October 2003. (**J. Baláž**)
- [9] It is sufficient to send robots into space, says scientist, newspaper PRAVDA, 16 October 2003. (**J. Baláž**)
- [10] Open Doors Day, 10 November 2004, Institute of Experimental Physics, Košice.
- [11] Also thanks to Slovaks a mission to a comet is under way, newspaper PRAVDA, 26 February, 2004. (**J. Baláž**)
- [12] Ariane rocket starting today has their service system, newspaper Košický večer, 1 March 2004. (**K. Kudela**)
- [13] Double star, journal Plus 7 dní Nr. 47, 22 November 2004. (**J. Baláž**)
- [14] Interview about the research of the bulk superconductors at the IEP SAS, part of the science programme "SOLARIUM", broadcasted by the Slovenský rozhlas, 2005. (**P. Diko**)
- [15] Press conference about the "Record low temperature experiment" for newspapers, TV, internet media, 2005. (**P. Skyba, P. Samuely**)
- [16] A shot about the Centre of Low Temperature Physics in the programme Blesk, broadcasted by the Slovenská Televízia, 2005.
- [17] **P. Skyba**, Kozmológia v laboratóriu (Cosmology in laboratory), an article in the Quark science popularization journal, 2005.
- [18] Open Doors Days 2005 – lectures, demonstration experiments (**P. Skyba, P. Szabó, P. Priputen, S. Gabáni, K. Flachbart**).
- [19] **J. Baláž**, Can we observe cosmic plasma?, journal Quark, 7/2005.
- [20] "Nočná pyramída" (Night pyramid) at Slovenský rozhlas, 28 September 2005. Popularization of the cosmophysical research. (**K. Kudela, J. Langer**).
- [21] "Dobré ráno" (Good morning) programme at the Slovenský rozhlas, 3.10.2005. (**K. Kudela**)
- [22] "Košice cosmodrom celebrates 35 years", presentation for the secondary school students at P.J. Šafárik University, Košice, 7 October 2005. (**K. Kudela, M. Slivka**)
- [23] Open Doors Day, 9 November 2005. Presentation of the Space physics department. (**K. Kudela, M. Slivka, J. Baláž**).
- [24] "The mountain not only as a sport, but also as science territory", poster prepared in collaboration with the Astronomical Institute SAS for the Torino 2006: XX Olympic Winter Games. (**K. Kudela, I. Strhárský**).

- [25] **L. Šándor**: "Participation of Slovakia in the programme of the CERN – European Laboratory for Particle Physics – in Geneva", lecture for secondary school teachers on 28 September 2005, Gymnasium J. A. Rayman, Košice.
- [26] **D. Bruncko**: "Connection of microworld with macroworld", lecture at the Astronomy Day, 3 April 2005, Humenné.
- [27] Open Doors Days in the Centre of Low Temperature Physics – three laboratories with demonstration experiments, lectures and presentations – (**E. Gažo, J. Kačmarčík, P. Skyba, Z. Hoľanová, P. Priputen, M. Vasil'ová, P. Samuely**), and in IEP SAS – presentation of research activities in magnetic fluids, magnetic materials at low temperatures and superconductivity, lectures and demonstrations (**I. Baťko, M. Baťková, M. Timko, M. Koneracká, K. Zmorayová, M. Šefčíková, P. Diko**), November 2006.
- [28] Active participation in the Open Doors Day at the laboratory at Lomnický štít, 18 November 2006. (**R. Langer, V. Kollár**).
- [29] Popularization grant **APVV LPP-0030-06** Scientific incubator for pupils and students, responsible person: **M. Zentková**.
- [30] "Cosmic probes in solar wind" – lecture about the equipment for measurements in cosmic space developed at the Institute of Experimental Physics, presented in the framework of the World Space Week 2006, live Internet broadcast on 6 October 2006. (**J. Baláž**)
- [31] TV TA3, 15 March 2006, Interview with the technologist of the year **J. Baláž**.
- [32] TV NAUTIK, 15 March 2006, A story about the scientists awarded the Scientist of the Year Award, mentioned **J. Baláž**.
- [33] Slovak Radio – Slovensko, 15 March 2006, A story about the Scientist of the Year Award, mentioned **J. Baláž**.
- [34] Radio REGINA, 15 March 2006, „Today we get to know prize winners of the 9th Scientist of the Year Award for 2005“, mentioned **J. Baláž**.
- [35] Radio TWIST, 17 March 2006, A story about awarding the Scientist of the Year Award, mentioned **J. Baláž**.
- [36] Radio OKEY, 17 March 2006, A story about the Scientist of the Year Award, interviews with prize winners, mentioned **J. Baláž**.
- [37] Radio HEY, 17 March 2006, „We introduce the technologist of the year – Ján Baláž from IEP SAS, Košice“.
- [38] Radio TWIST, 20 March 2006, A story about awarding the Technologist of the Year Award, mentioned **J. Baláž**.

- [39] Newspaper Hospodárske Noviny, 20 March 2006, „Science is beautiful, science is adventure“. (**J. Baláž**)
- [40] Newspaper Hospodárske Noviny, 20 March 2006, „Scientists are not media stars. Slovakia has other priorities“. (**J. Baláž**)
- [41] Newspaper SME, 18 March 2006, „Awarded scientist of the year: Mathematics will be the key to discovery“. (**J. Baláž**)
- [42] Newspaper Večerník, 16 March 2006, „Celebrities, only a few people know about“. (**J. Baláž**)
- [43] TASR agency, 15 March 2006, Information about scientists awarded the Scientist of the Year Award. **J. Baláž** awarded Technologist of the Year Award.
- [44] Radio LUMEN, 15 June 2006, A story about the Centre of the Very Low Temperature Physics in Košice (**joint laboratory of IEP SAS and P. J. Šafárik University**).
- [45] TASR agency, 15 June 2006, Information about the new cryogenic equipment in Košice.
- [46] TV STV, 28 July 2006, Programme „Kvarteto“, information about Lomnický štít, place of the **joint laboratory of the IEP SAS** and other 2 institutes of SAS.
- [47] Journal QUARK, Nr.9, 2006, „New helium liquefier in Košice“, about the **Centre of Very Low Temperatures** in Košice.
- [48] Newspaper SME, 23 November 2006, „Superconducting silicon is here“. (J. Kačmarčík)
- [49] Newspapers Košický KORZÁR, Tatranský KORZÁR, 21 November 2006, „Also Košice takes part in the European Science Week“, mentioned **IEP SAS**.
- [50] Agency TASR, 20 November 2006, „Also Košice takes part in the European Science Week“, mentioned **IEP SAS**.
- [51] Newspaper PRAVDA, 7 December 2006, „Slovak research is interested in flights to the Moon“, mentioned **IEP SAS**.
- [52] Newspaper PRAVDA, 11 December 2006, „Also a Slovak helped superconducting silicon“. (**J. Kačmarčík**)
- [53] Journal SLOVENKA, 22 December 2006, „Closest relatives must wait“. (**R. Langer**)

#### iv. List of patents issued abroad, incl. revenues

- [1] L. Shlyk, G. Krabbes and **P. Diko**, patent **DE10307643A1**, Hochtemperatursupraleitender Körper und Verfahren zu dessen Herstellung, owner: IFW Dresden, Germany. Revenue: 0. (2004)

**v. List of the patents issued in Slovakia, incl. revenues**

none

**vi. List of licences sold abroad, incl. revenues**

[1] none

**vii. List of licences sold in Slovakia, incl. revenues**

[1] none

**viii. List of contracts with industrial partners, incl. revenues**

[1] none

**ix. List of research projects with industrial partners, incl. revenues**

[1] none

**x. Summary of outreach activities**

<b>Outreach activities</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>total</b>
studies for the decision sphere, government and NGOs, international and foreign organisations	0	0	1	0	1
articles in press media/internet popularising results of science, in particular those achieved by the Organization	7	3	3	14	27
appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	2	0	5	10	17
public popularisation lectures	0	1	4	7	12

**xi. Supplementary information and/or comments on applications and popularisation activities**

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

### i. Summary table of personnel

Personnel	2003	2004	2005	2006
all personel	138	145	136	129
research employees from Tab. Research staff	79	83	84	84
FTE from Tab. Research staff	76,58	76,9	75,2	74,42
averaged age of research employees with university degree	46,6	45,4	45,6	44,48

### ii. Professional qualification structure

Number of	2003	2004	2005	2006
DrSc.	8	9	8	8
PhD / CSc.	55	60	61	57
Prof.	0	1	2	2
Doc./Assoc. Prof.	7	6	5	6

### 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)

#### Department of magnetism

The infrastructure of the Department of magnetism consists of following instruments: calorimetric tunnelling spectroscopy, commercial SQUID Magnetometer by Quantum Design, Infrared spectrometer Bruker IFS 113, VSM-magnetometers (low field configuration with magnetic field up to 80 kA/m for estimation of coercive field up to 1 A/m and Curie temperature with reproducibility  $\pm 0.1K$  suitable for magnetic soft materials; high field configuration working in magnetic field up to 5 MA/m in the temperature range from 4.2 up to 800 K), differential flux gate magnetometer working in magnetic field up to 20 kA/m in the temperature range from room temperature up to 800 K, equipment for thermal treatment of

samples in longitudinal or transversal external magnetic field up to 0.6 MA/m in protective gas or high vacuum up to temperature 1000 K, apparatus for measurement of electrical resistivity of metals and semiconductors in temperature range from 4 up to 300 K, milling and mixing arrangements (Milles Fritsch: Pulverisette 6, Pulverisette 2), tubular and chamber furnaces with protecting atmospheres, optical microscopy with image processing analysis, thermal analysis complex (DSC calorimeter Perkin Elmer, Setaran TG, DTA, TMA analyser) can be used for the preparation and microstructural characterization of samples, fully equipped chemical laboratory for preparing and the first characterization of magnetic fluids, magnetic nanoparticles and molecular based magnets

**Centre of Low Temperature Physics, Centre of Excellence of the Slovak Academy  
of Sciences / Department of Low Temperature Physics**

The infrastructure of the Department of magnetism consists of following instruments: several  $^4\text{He}$  cryostats with superconducting magnets operated in the temperature range from 1.5 to room temperature - suitable for measurements of electrical and thermal conductivity, point-contact spectroscopy and calorimetry;  $^3\text{He}$ - $^4\text{He}$  dilution refrigerator with a top loading system from 'Oxford Instruments' able to cool samples down to millikelvin temperatures - methods of thermal and electrical conductivity, point-contact / tunneling spectroscopy as well as specific heat and magnetic susceptibility are integrated; a nuclear demagnetization refrigerator with diffusion welded stage capable to cool down  $^3\text{He}$  to temperatures below 200 mikrokelvin.

During the last four years a lot of effort was accomplished to develop the infrastructure and technical base of the Department, to achieve the objectives in various research directions. A new, fully automatic Helium Liquefier system model 1410 manufactured by the Cryogenic Plants and Services (CPS), USA, was put into operation in 2006. Its liquid helium production rate is up to 35 litres per hour with liquid nitrogen pre-cooling.

In the same time, based on the Cryogenics development project supported by the Slovak government, two new up-to-date equipments for investigation of the properties of solid states were purchased and activated. The PPMS - equipment for automated measurement of physical properties (heat capacity, electrical resistivity, Hall voltage) in temperature range 2 - 350 K and in magnetic field up to 9 T, and the MPMS - very sensitive equipment for automated measurement of magnetic properties of solids in temperature range 1.9 - 400 K and in magnetic field up to 5 T.

After modifications of the nuclear demagnetisation refrigerator it became possible to cool superfluid  $^3\text{He}$  down to 150  $\mu\text{K}$ , the temperature of the nuclear stage is in this case around 50  $\mu\text{K}$ . This sets our Institute among about a dozen places all over the world having such capabilities.



### **Department of metal physics**

Experimental methods of the department include mechanical testing in a wide range of low temperatures (4.2 – 300 K), thermomechanical analysis (creep, relaxation of tensions) at higher temperatures (300 – 1000 K), the study of structure and structural stability (XRD, DSC, DTA) and microscopic observation of plasticity manifestations. We plan to enhance the experimental possibilities to dynamical thermomechanical analysis.

### **Department of subnuclear physics**

The experimental infrastructure for activities of the department are located in international research centres – CERN Geneva, DESY Hamburg, FERMILAB Batavia, USA. In order to be incorporated into the overall computing infrastructure needed by the large experiments at LHC (simulation, reconstruction and data analysis), a GRID computer farm has being built. In 2006 it had 16 CPU and 8 TB of mass data storage, in the years to follow its size will gradually increase, until it reaches the planned size of 100 CPU's and 50 TB of mass data storage in 2009.

### **Department of Space Physics**

Experimental infrastructure of the department consists of the laboratory at Lomnický štít with neutron monitor as its main apparatus, and of the laboratory in Košice, where devices for space missions are developed. The neutron monitor provides neutron flux data in real time available at <http://neutronmonitor.ta3.sk>. In the near future, upgrades and improvements at both places are foreseen.

### **Department of biophysics**

The capability of the research group of the physics of polymers and supramolecular structures comprises state-of-the-art set-ups for static and dynamic laser light scattering, electrophoretic laser light scattering, membrane osmometry, vapour pressure osmometry, differential refractometry, and computer controlled centrifugation.

The capability of the department for biomolecular modelling has been significantly improved by the acquisition and development of new software for molecular modelling. “State-of-the-art” programs for molecular docking, molecular mechanics, molecular and quantum dynamics were acquired and installed, creating thus a modern laboratory for computer-aided molecular design and computer-aided nanodesign.

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

The institutional library services are handled by two qualified librarians, one with a university degree, one with a fully secondary school qualification. Both work on full time contract.

Services provided by the library are:

- Scientometric database (WOS, SCI, SCOPUS, ...) searches and scientometric analysis for the Institute (annual reports, accreditations, ...) as well as for individual researchers.
- Copying of documents (40 500 pages in 2003, 46 000 pages in 2004, 44 000 pages in 2005 and 52 000 pages in 2006).
- Acquisitions of photocopies of documents from otherwise inaccessible sources – databases.
- Performing revisions of the existing library collection, excluding obsolete materials and acquisitions of new modern books.
- Performing “traditional” library functions – book loans, obtaining literature for loan from other libraries etc...

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

[1] The suggestion to increase the dynamism of DrSc theses submission was taken into account by introducing a new process of regular attestation of scientific employees. This helps to identify physicists with necessary potential and advise them to start working on their DrSc theses. During the assessed period two physicists were awarded DrSc degree (M. Antalík and K. Flachbart in 2003), and two DrSc theses were submitted (M. Hnatič - submitted in 2006, defended in 2007, P. Skyba - submitted in 2006).

[2] Every year a couple of new employees are accepted to work in the Institute. The actual numbers depend on the availability of salary resources.

[3] As far as the change on the post of the director of the Institute is concerned, the existing law does not limit the number of terms one person can serve as a director. At the moment a new selection process has started.

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

## **Other information relevant to the assessment**

Košice, 28 February 2007

Doc. RNDr. Peter Kopčanský, CSc.  
Director of IEP SAS Košice