

**Fyzikálny ústav SAV**

**Správa o činnosti Fyzikálneho ústavu SAV  
za rok 2012**



Bratislava  
Január 2013

## **Obsah osnovy Správy o činnosti organizácie SAV za rok 2012**

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3. Doktorandské štúdium, iná pedagogická činnosť a budovanie ľudských zdrojov pre vedu a techniku
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### ***PRÍLOHY***

- A Zoznam zamestnancov a doktorandov organizácie k 31.12.2012*
- B Projekty riešené v organizácii*
- C Publikáčná činnosť organizácie*
- D Údaje o pedagogickej činnosti organizácie*
- E Medzinárodná mobilita organizácie*

## 1. Základné údaje o organizácii

### 1.1. Kontaktné údaje

**Názov:** Fyzikálny ústav SAV

**Riaditeľ:** RNDr. Stanislav Hlaváč, CSc.

**Zástupca riaditeľa:** Ing. Peter Švec, DrSc.

**Vedecký tajomník:** Mgr. Peter Filip, PhD.

**Predseda vedeckej rady:** Doc. RNDr. Emil Běták, DrSc.

**Člen snemu SAV:** RNDr. Katarína Gmucová, CSc.

**Adresa:** Dúbravská cesta 9, 845 11 Bratislava 45

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

**Tel.:** 02/59 410 501; 02/20 910 790

**E-mail:** lucia.kuchtova@savba.sk

**Názvy a adresy detašovaných pracovísk:**

- **Spoločné pracovisko EIÚ a FÚ SAV**  
Vrbovská cesta 5051/110, 92101 Piešťany

**Vedúci detašovaných pracovísk:**

- **Spoločné pracovisko EIÚ a FÚ SAV**  
Ing. Rudolf Senderák, Piešťany

**Typ organizácie:** Príspevková od roku 1997

### 1.2. Údaje o zamestnancoch

Tabuľka 1a Počet a štruktúra zamestnancov

Štruktúra zamestnancov	K	K		K do 35 rokov		F	P	T
		M	Ž	M	Ž			
<b>Celkový počet zamestnancov</b>	119	84	35	22	13	107	81,76	59,94
<b>Vedeckí pracovníci</b>	75	65	10	15	2	65	55,94	55,94
<b>Odborní pracovníci VŠ</b>	25	10	15	7	10	23	10,12	4
<b>Odborní pracovníci ÚS</b>	19	9	10	0	1	19	15,7	0
<b>Ostatní pracovníci</b>	0	0	0	0	0	0	0	0

*K – kmeňový stav zamestnancov v pracovnom pomere k 31.12.2012 (uvádzať zamestnancov v pracovnom pomere, vrátane riadnej materskej dovolenky, zamestnancov pôsobiacich v zahraničí, v štátnych funkciách, členov Predsedníctva SAV, zamestnancov pôsobiacich v zastupiteľských zboroch)*

*F – fyzický stav zamestnancov k 31.12.2012 (bez riadnej materskej dovolenky, zamestnancov pôsobiacich v zahraničí v štátnych funkciách, členov Predsedníctva SAV, zamestnancov pôsobiacich v zastupiteľských zboroch)*

*P – celoročný priemerný prepočítaný počet zamestnancov*

*T – celoročný priemerný prepočítaný počet riešiteľov projektov*

*M, Ž – muži, ženy*

Tabuľka 1b Štruktúra vedeckých pracovníkov (kmeňový stav k 31.12.2012)

Rodová skladba	Pracovníci s hodnosťou				Vedeckí pracovníci v stupňoch		
	DrSc.	CSc./PhD.	prof.	doc.	I.	IIa.	IIb.
<b>Muži</b>	15	50	3	3	19	25	21
<b>Ženy</b>	4	6	1	0	4	2	4

Tabuľka 1c Štruktúra pracovníkov podľa veku a rodu, ktorí sú riešiteľmi projektov

Veková štruktúra (roky)	< 31	31-35	36-40	41-45	46-50	51-55	56-60	61-65	> 65
<b>Muži</b>	10	10	7	2	4	12	7	5	10
<b>Ženy</b>	3	2	0	0	0	0	2	2	2

Tabuľka 1d Priemerný vek zamestnancov organizácie k 31.12.2012

	Kmeňoví zamestnanci	Vedeckí pracovníci	Riešitelia projektov
<b>Muži</b>	48,5	49,0	47,7
<b>Ženy</b>	45,8	51,5	48,8
<b>Spolu</b>	47,7	49,3	47,9

### 1.3. Iné dôležité informácie k základným údajom o organizácii a zmeny za posledné obdobie (v zameraní, v organizačnej štruktúre a pod.)

V roku 2012 vykonalo P SAV v súlade s §10 zákona č. 133/2002 Z.z. pravidelné hodnotenie ústavov SAV. **Fyzikálny ústav** sa v hodnotení umiestnil medzi najkvalitnejšie ústavy 1. oddelenia vied SAV a **bol predsedníctvom SAV zaradený do kategórie A.**

Fyzikálny ústav SAV vydáva **časopis Acta Physica Slovaca** s novou edičnou politikou, ktorú od roku 2006 zaviedol šéfredaktor prof. RNDr. Vladimír Bužek, DrSc. Od októbra 2012 sa novým šéfredaktorom stal doc. RNDr. Peter Markoš, DrSc. Prof. Ing. Ivan Štich, DrSc. je členom edičnej rady časopisu a Mgr. Andrej Gendiar, PhD. je managing editorom časopisu. Každé číslo časopisu je monotematické s jedným prehľadovým článkom s rozsahom od 100 do 200 strán. Všetky články sú iba na pozvanie, čím sa zabezpečuje vysoká kvalita príspevkov a **vysoký impakt faktor, ktorý je v súčasnosti 2,167.**

## 2. Vedecká činnosť

### 2.1. Domáce projekty

Tabuľka 2a Zoznam domácich projektov riešených v roku 2012

ŠTRUKTÚRA PROJEKTOV	Počet projektov		Čerpané financie za rok 2012 (v €)		
	A	B	A		B
			spolu	pre organi- záciu	
<b>1. Vedecké projekty, ktoré boli r. 2012 financované VEGA</b>	26	1	157687	154413	3274
<b>2. Projekty, ktoré boli r. 2012 financované APVV</b>	14	2	345502	302760	42742
<b>3. Projekty OP ŠF</b>	5	8	1054762	839751	215011
<b>4. Projekty centier excelentnosti SAV</b>	2	0	69190	69190	-
<b>5. Iné projekty (FM EHP, ŠPVV, Vedecko-technické projekty, ESF, na objednávku rezortov a pod.)</b>	0	0	-	-	-

*A - organizácia je nositeľom projektu*

*B - organizácia sa zmluvne podieľa na riešení projektu*

Tabuľka 2b Zoznam domácich projektov podaných v roku 2012

Štruktúra projektov	Miesto podania	Organizácia je nositeľom projektu	Organizácia sa zmluvne podieľa na riešení projektu
1. Účast' na nových výzvach APVV r. 2012	-	2	0
2. Projekty výziev OP ŠF podané r. 2012	Bratislava	1	0
	Regióny	1	1
3. Projekty výziev FM EHP podané r. 2012	-	0	0

## 2.2. Medzinárodné projekty

### 2.2.1. Medzinárodné projekty riešené v roku 2012

Tabuľka 2c Zoznam medzinárodných projektov riešených v roku 2012

ŠTRUKTÚRA PROJEKTOV	Počet projektov		Čerpané financie za rok 2012 (v €)		
	A	B	A		B
			spolu	pre organizáciu	
1. Projekty 7. rámcového programu EÚ	1	2	194683	194683	0
2. Multilaterálne projekty v rámci vedeckých programov COST, ERANET, INTAS, EUREKA, PHARE, NATO, UNESCO, CERN, IAEA, ESF (European Science Foundation), ERDF, ESA a iné	1	2	10333	5000	5333
3. Projekty v rámci medzivládnych dohôd o vedecko-technickej spolupráci	1	1	26000	26000	0
4. Bilaterálne projekty	4	1	572	372	200
5. Podpora medzinárodnej spolupráce z národných zdrojov (MVTs, APVV,...)	5	0	7962	7962	0
6. Iné projekty financované alebo spolufinancované zo zahraničných zdrojov	0	2	28076	0	28076

A - organizácia je nositeľom projektu

B - organizácia sa zmluvne podieľa na riešení projektu

## 2.2.2. Medzinárodné projekty v 7. RP EÚ podané v roku 2012

Tabuľka 2d Podané projekty 7. RP EÚ v roku 2012

	A	B
<b>Počet podaných projektov v 7. RP EÚ</b>	7	8

*A - organizácia je nositeľom projektu*

*B - organizácia sa zmluvne podieľa na riešení projektu*

2 podané projekty 7. RP boli schválené, 6 projektov bolo zamietnutých (ku dňu 30.1.2013)

Údaje k domácim a medzinárodným projektom sú uvedené v Prílohe B.

## 2.2.3. Zámery na čerpanie štrukturálnych fondov EÚ v ďalších výzvach

Evidujeme záujem pracovníkov FÚ SAV uchádzať sa o 3 nezávislé projekty ŠF EÚ v roku 2013.

## 2.3. Najvýznamnejšie výsledky vedeckej práce

### 2.3.1. Základný výskum

#### 1. miesto: Peter Staňo (CVKI)

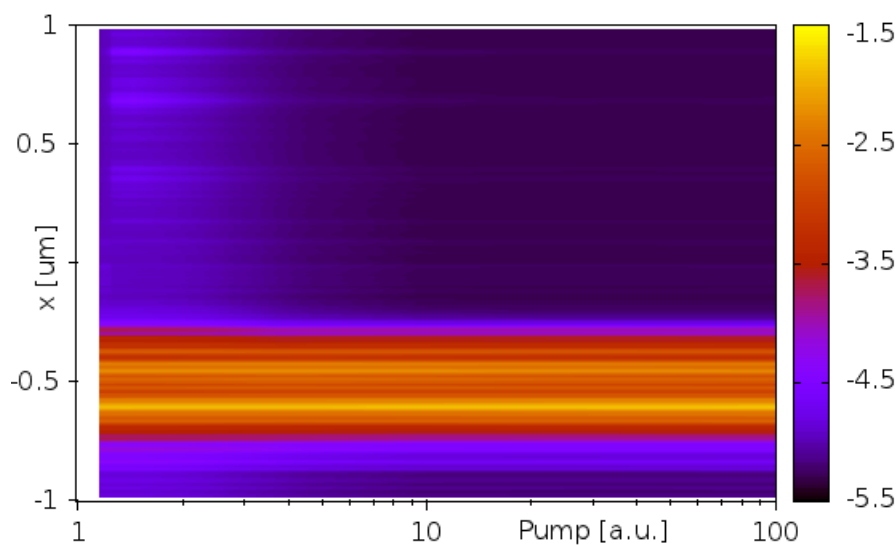
#### **Potlačenie interakcií v multimodálnych random-laseroch v Andersonovom lokalizovanom režime**

Teoretické skúmanie vlastností random-laseroch je nesmierne zložitá. Na rozdiel od klasického lasera, v random-laseroch sa nenachádza žiadny rezonátor, existuje v ňom množstvo aktívnych stavov navzájom potenciálne silne interagujúcich, a médium lasera svetlo silne rozptyľuje. Je známe, že interferenčné efekty majú zásadný vplyv na šírenie sa vln v takých rozptyľujúcich materiáloch, avšak o tom, k čomu tieto lokalizačné efekty vedú za prítomnosti interakcií, sa vie iba málo. V práci autori skonštruovali semiklasickú teóriu náhodného lasera v režime silného rozptyľu a ukázali, že Andersonova lokalizácia, dôležitý interferenčný efekt, nielenže existuje aj za prítomnosti nelinearit, ale dokonca, že lokalizácia potláča interakcie aj v silne nelineárnom systéme. Výsledkom je, že aktívne stavy náhodného lasera sú dané vlastnými stavmi prostredia bez opticky aktívneho média. Imunita aktívnych stavov voči vzájomným interakciám mimoriadne zjednodušuje analýzu nelineárneho systému.

#### **Suppression of interactions in multimode random lasers in the Anderson localized regime**

Understanding random lasing is a formidable theoretical challenge. Unlike conventional lasers, random lasers have no resonator to trap light, they are highly multimode with potentially strong modal interactions, and they are based on disordered gain media, where photons undergo random multiple scattering. Interference effects notoriously modify the propagation of waves in such random media, but their fate in the presence of nonlinearity and interactions is poorly understood. The authors developed a semiclassical theory for multimode random lasing in the strongly scattering regime. They showed that Anderson localization, a wave interference effect, is not affected by the presence of nonlinearities. To the contrary, its presence suppresses interactions between simultaneously lasing modes. Consequently, each lasing mode in a strongly scattering

random laser is given by a single long-lived, Anderson localized mode of the passive cavity, the frequency and wave profile of which do not vary with pumping, even in the multimode regime when modes spatially overlap.



Lasing state spatial structure as a function of the pump (x).

[1] P. Staňo and Ph. Jacquod, Nature Photonics 7, 66 (2013)

## 2. miesto: Ivan Štich (OKFS)

### Počítačové simulácie na nanoškále

Súbor prác, ktoré spája použitie metód superpočítačového modelovania na atomárnej/molekulárnej škále. Práce sa venujú trom okruhom: 1) štúdium *procesov indukovaných hrotom SPM technik* (práce [1, 2, 4, 5, 7]), 2) štúdium *excitovaných singletných a tripletných stavov fotospínateľných molekúl* (práca [3]), 3) štúdium *organometalických systémov s atómami prechodových kovov* (práce [6, 8]). Práce zo skupiny 1) používajú populárne metódy teórie hustotového funkcionálu (DFT) a sú priamo naviazané na experimenty ku ktorým poskytujú modely jednotlivých nano-tribologických režimov (translácia nanočastíc antimónu na povrchu HOPG hrotom statického AFM mikroskopu) (práce [1, 2, 4, 5]), resp. model interakcie hrot-vzorka v bezkontaknej silovej mikroskopii (práca [7]). Práce zo skupiny 2) boli tiež motivované experimentom, EELS spektrami fotospínateľnej molekuly azobenzénu, kde interpretácia silne sa prekrývajúcich singletných a tripletných spektier vyžadovala ultrapresné výpočty na báze kvantového Monte Carla (QMC). Techniky QMC boli použité aj v skupine prác 3), kde sme ukázali, že modelovanie týchto systémov populárnymi metódami DFT nemá prediktívnu hodnotu a nie je schopné popísať tieto magnetické nanoštruktúry. Tu sme navyše ukázali, že QMC metódy dokážu spočítať niektoré veličiny, napr. disociačné energie presnejšie, než je ich možné zmerať experimentálne (napr. fotodisociácia). Okrem vedeckých prác sme napísali aj dve popularizačné práce priamo späté s našou vedecko-výskumnou prácou.

### Publikácie v r. 2011-2012:

7 publikácií v CC časopisoch, 1 CC publikácia v tlači, 2 popularizačné publikácie

### CC:

1) J. Brndiar, R. Turanský, D. Dietzel, A. Schirmeisen, and I. Štich, Understanding frictional duality and bi-duality: Sb -nanoparticles on HOPG, Nanotechnology 22, 085704 (2011) [IF 2011: 3.979].

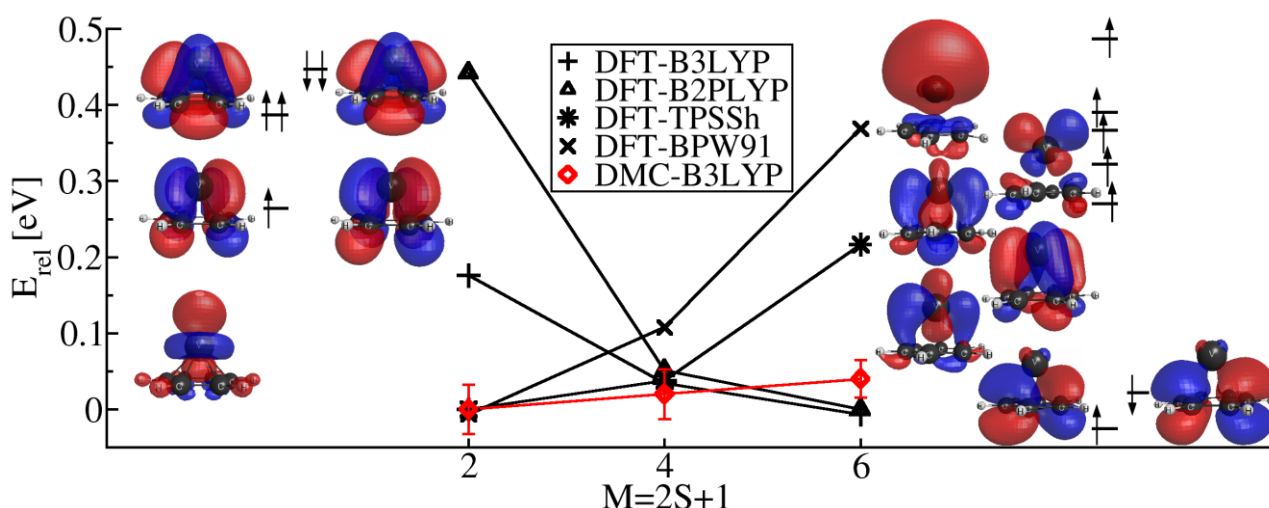
2) J. Brndiar, R. Turanský, and I. Štich, Simulation of frictional behavior of Sb nanoparticles on HOPG: frictional duality and bi-duality, Phys. Rev. B 84, 085449 (2011) [IF 2011: 3.691].



- 3) M. Dubecký, R. Derian, M. Allan, and I. Štich, Disentanglement of triplet and singlet states of azobenzene: Direct EELS detection and QMC modeling, *Phys. Chem. Chem. Phys.* 13, 20939 (2011) [IF 2011: 3.573].
- 4) B. Such, T. Glatzel, S. Kawai, E. Meyer, R. Turanský, J. Brndiar, I. Štich, Interplay of tip-sample junction stability and image contrast reversal on Cu(111) surface revealed by 3D force field, *Nanotechnology* 23, 045705 (2012) [IF 2011: 3.979].
- 5) Ján Brndiar and Ivan Štich, Van der Waals interaction energies of small fragments of P, As, Sb, S, Se, and Te; comparison of complete basis set limit CCSD(T) and DFT with approximate dispersion, *J. Chem. Theor. Comput.* 8, 2301 (2012) [IF 2011: 5.215].
- 6) L. Horváthová, M. Dubecký, L. Mitás, I. Štich, Spin multiplicity and symmetry breaking in vanadium-benzene complexes, *Phys. Rev. Lett.* 109, 053001 (2012) [IF 2011: 7.370].
- 7) J. Bamidele, Y. Kinoshita, R. Turanský, S. H. Lee, Y. Naitoh, Y. J. Li, Y. Sugawara, I. Štich, and L. Kantorovich, Chemical tip fingerprinting in scanning probe microscopy of an oxidized Cu(110) surface, *Phys. Rev. B* 86, 155422 (2012) [IF 2011: 3.691].
- 8) L. Horváthová, M. Dubecký, L. Mitás, I. Štich, Quantum Monte Carlo Study of  $\pi$ -bonded Transition-metal Organometallics: Neutral and Cationic Vanadium-benzene and Cobalt-benzene Half-sandwiches *J. Chem. Theor. Comput.* 9, 390 (2013) [IF 2011: 5.215].

#### Popularizačné články:

- 1) L. Horváthová, M. Dubecký, L. Mitás, I. Štich, Elektrónová štruktúra: populárne versus presné metódy, *ChemZi* 8, 8 (2012).
- 2) J. Brndiar, R. Turanský, I. Štich, Nanotribológia: chémia na pohybujúcich sa rozhraniach *ChemZi* 8, 10 (2012).



#### **Computer Simulations for the Nanoscale**

A series of articles with use methods of atomic/molecular-scale supercomputer modeling as a common denominator. The manuscripts deal with three subjects: 1) study processes induced by SPM tip (manuscripts [1, 2, 4, 5, 7]), 2) study of excited singlet and triplet states of photoswitchable

molecules (manuscript [3]), 3) study of *organometallic systems with transition metal atoms* (manuscripts [6, 8]). Manuscripts from group 1) use popular density functional methods (DFT) and are directly coupled to experiments to which they provide models of the nanotribological regimes (translation of antimony nanoparticles on HOPG surface with the tip of static AFM microscope) (manuscripts [1, 2, 4, 5]) or model of the tip-sample interaction in the non-contact atomic force microscopy (manuscript [7]). Manuscript from group 2) were also experimentally motivated by EELS spectra of the photoswitchable azobenzene molecule, where interpretation of the strongly overlapping singlet and triplet spectra requires ultra-accurate quantum Monte Carlo results. QMC techniques were also used in the group of manuscripts 3), where we have shown that DFT modeling of these systems with the popular DFT methods does not have predictive power and is not capable to describe these magnetic nanostructures. In addition, we have shown that the QMC techniques can calculate certain physical properties, such as for instance, dissociation energies more accurately than they can be measured experimentally (e.g. photodissociation). We have also published two popularization manuscripts directly related to our research work.

### 3. miesto: Emília Illeková (OFK)

#### **Termická analýza mikro-, nano- a nekryštalických materiálov**

Súbor vedeckých prác, ktoré sa zaoberajú fundamentálnou fenomenologickou kinetikou procesov v mikro-, nano- a nekryštalických tuhých látkach. Práce tvoria prehľad poznatkov a metód vyšetovania kinetiky štruktúrnej relaxácie skiel a kryštalizácie, jednak klasických kovových skiel, ako aj prekursorov nanokryštalických kovových zliatin. Všetky kinetické analýzy formulujú, zovšeobecňujú a využívajú dva kinetické modely dr. Illekovovej (model štruktúrnej relaxácie s distribúciou nelineárnych relaxačných časov (DNLR) a model kryštalizácie s hypotézou existencie dvoch principiálne odlišných tried nekryštalických kovových zliatin a to klasických kovových skiel a prekursorov nanokryštalických kompozitov). Súbor prác vytvára modelovú aj metodickú modernú školu termickej analýzy nekryštalických tuhých látok.

Vedecký výsledok reprezentujú 2 kapitoly vo vedeckej monografii a 6 publikácií CC.

#### **Thermal analysis of micro-, nano and non-crystalline materials**

Set of scientific papers within the scope of fundamental, phenomenological kinetics of processes in micro-, nano- and non-crystalline solids. The set of articles forms the review of known facts and methods of investigation of structural relaxation of glasses and of crystallization of both classic metallic glasses and precursors of nanocrystalline metallic alloys. All kinetic analyzes formulate, generalize and utilize two kinetic models of Dr. Illeková (model of structural relaxation with the distribution of non-linear relaxation times (DNLR) and model of crystallization based on the hypothesis of the existence of two principally different groups of non-crystalline metallic alloys, namely the classic metallic glasses and the precursors of nanocrystalline composites. The set of articles creates the model and methodical modern school of thermal analysis of non-crystalline solids.

Scientific results are represented by 2 chapters in the scientific monography and 6 papers in CC journals.

[1] Kinetics of structural relaxation in glasses, E. Illeková, Chapter 8, in Thermal Analysis of Micro, Nano-, and Non-Crystalline Materials, J. Šesták, P. Šimon, Eds., Springer, 2013, p. 175-194, in Transformation, Crystallization, Kinetics and Thermodynamics Series: Hot Topics in Thermal Analysis and Calorimetry, Vol. 9 (2013) XXI, 484 p., ISBN 978-90-481-3150-1

[2] Crystallization of metallic micro-, nano-, and non-crystalline alloys, E. Illeková, J. Šesták, Chapter 13 in Thermal Analysis of Micro, nano-, and Non-Crystalline Materials, J. Šesták, P.

Šimon, Eds., Springer 2013, p. 257-290, in Transformation, Crystallization, Kinetics and Thermodynamics Series: Hot Topics in Thermal Analysis and Calorimetry, Vol. 9 (2013) XXI, 484 p., ISBN 978-90-481-3150-1

[3] E. Illeková. Comment on F.A. Al-Agel et al. "Kinetics of non-isothermal crystallization and glass transition phenomena in Ga<sub>10</sub>Se<sub>87</sub>Pb<sub>3</sub> and Ga<sub>10</sub>Se<sub>84</sub>Pb<sub>6</sub> chalcogenide glasses" by DSC, J. Non-Cryst.Solids 358 (2012) 564-570." J. Non-Cryst. Solids, 358 (2012) 2931-2934

[4] P. Priputen, I. Černíčková, M. Kusý, E. Illeková, P. Švec, J. Buršík, M. Svoboda, J. Dolinšek, J. Janovec. A study of phase transformations in complex metallic alloys Al<sub>73</sub>Mn<sub>23</sub>Pd<sub>4</sub> and Al<sub>73</sub>Mn<sub>21</sub>Pd<sub>6</sub>. Key Engineering Materials, 465 (2011) 302-305

[5] P. Sebo, P. Svec, D. Janickovic, E. Illekova, Y. Plevachuk: Interface between Sn-Sb-Cu solder and copper substrate, Mat.Sci.Eng., A528 (2011) 5955-5960

[6] E. Illeková, I. Maťko, P. Švec Sr., P. Švec, D. Janičkovič: The crystallization behavior of amorphous Fe-Sn-B ribbons. JALCOM, 509S (2011) S46-S51

[7] Yu. Plevachuk, V. Sklyarchuk, A. Yakymovych, P. Svec, D. Janickovic, E. Illekova. Electrical conductivity and viscosity of liquid Sn-Sb-Cu alloys. Journal of Materials Science: Materials in Electronics, 22 (2011) 631-638

[8] Černíčková, P. Priputen, T.Y. Liu, A. Zemanová, E. Illeková, D. Janičkovič, P. Švec, M. Kusý, Ľ. Čaplovič, J. Janovec, Evolution of phases in Al-Pd-Co alloys. Intermetallics, 19 (2011) 1586-1593

### 2.3.2. Aplikčný typ

#### 1. miesto: Pavol Butvin (OFK)

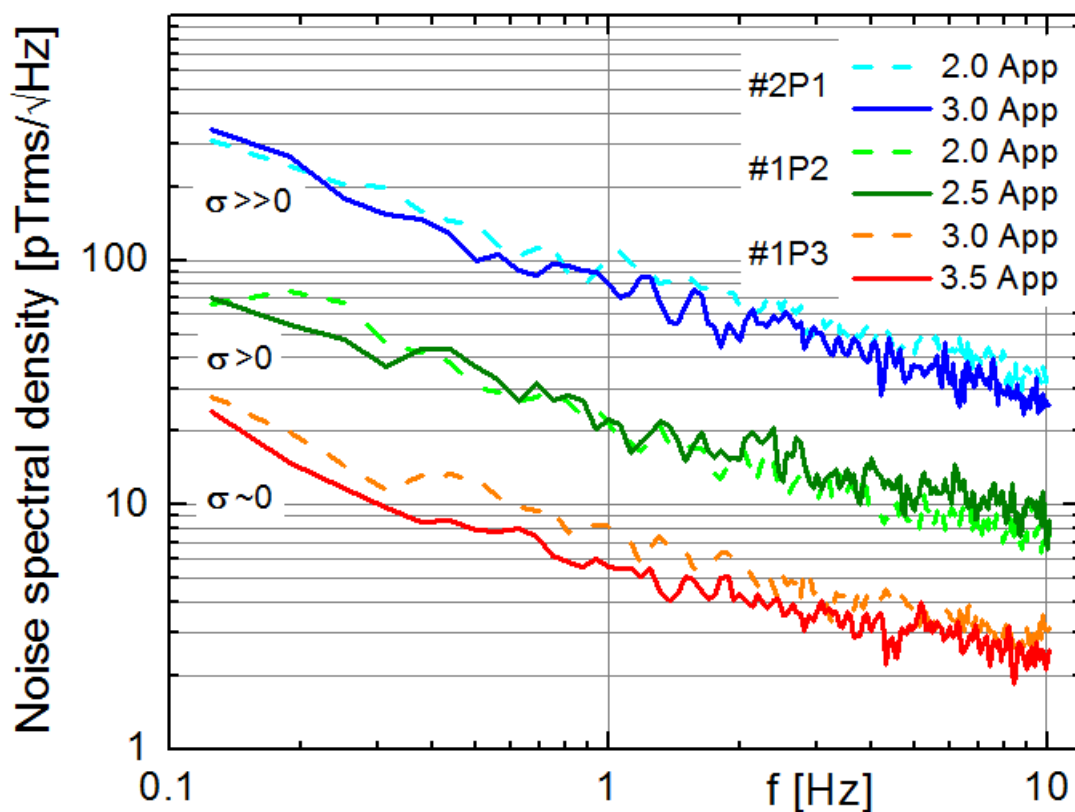
##### **Rekordne nízkošumový malý senzor magnetického poľa typu fluxgate**

Nepriaznivé výsledky testovania a analýzy šumu oválnych uzavretých jadier (netreba ich ohýbať), ako aj naše hlboké poznatky o prirodzenej makroskopickej heterogenite pások pripravených rýchlym ochladením taveniny nás priviedli k odbočeniu od hlavného prúdu vývoja. Ten vychádza z nutnosti znemožniť pohyb doménových stien pomocou silnej priečnej anizotropie a použiť materiál s naozaj homogénnou minimálnou magnetostrikciou, aby ohybové napätie prostredníctvom magnetoelastickkej interakcie nedeformovalo priečnu anizotropiu. Z vybranej nízkomagnetostrickkej pásky kovového skla sme navinuli toroidné jadro a zaviedli sme iba miernu priečnu anizotropiu pričom sme súčasnú redukciu ohybového napätia podporili žiňaním už zapuzdreného jadra v axiálnom magnetickom poli. Reprodukateľný šum dosiahol  $7 \text{ pT}/\sqrt{\text{Hz}}$  @ 1 Hz, najlepšie jadro iba  $5 \text{ pT}$ ... na malých jadrách s priemerom 12 mm. Úplný vývoj a testovanie jadier sme vykonali na FÚ SAV Bratislava, kompletizácia senzora a meranie šumu sa konali na pracovisku so špičkovou expertízou v senzoroch – na FEL ČVUT Praha. Tvrdeniu, že ide o rekordne nízku hodnotu šumu pre tak malé jadrá, neoponoval nikto z recenzentov našich prác, ani nikto v diskusiách pri konferenčných prezentáciách týchto výsledkov.

##### **Current world-best low-noise small fluxgate magnetic field sensor**

The discouraging results and analysis of racetracks (avoid bending stress) noise testing and our experience with natural macroscopic heterogeneity of RQ ribbons led us to detour from the mainstream development, which necessitates to disable domain wall motion by strong transverse anisotropy and to have a material with truly homogeneous minimal magnetostriction not to

deteriorate the transverse anisotropy by bending stress engaged by magnetoelastic coupling. Instead, we induced a modest transverse anisotropy and provided for simultaneous bending stress reduction by in-sheath axial-field annealing of toroidal core wound of selected low-magnetostrictive metallic-glass ribbon. Well reproducible noise figure of  $7 \text{ pT}/\sqrt{\text{Hz}}$  @  $1 \text{ Hz}$  with best cores showing  $5 \text{ pT}$ ... has been attained with  $12 \text{ mm}$  diameter small cores. While the complete core development and testing comes from FU SAV Bratislava, sensor expertise, completion and noise testing is based at FEL CVUT Prague. The statement that the attained noise figure is the best one for this small fluxgate so far was objected neither by reviewers of our papers nor within discussions at conference presentations.



Frekvenčná závislosť šumu toroidných jadier (pre fluxgate magnetické senzory).

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**2. miesto:** Eva Majková (OMN)

## Príprava, vlastnosti a pilotné aplikácie samousporiadaných nanočasticových súborov

Kolektív OMN v zložení: E. Majková, M. Jergel, P Šiffalovič, Š. Luby, K. Gmucová, J. Ivančo, V. Nádaždy, K. Végő, M. Benkovičová

Metódou malouhlového rozptylu rtg žiarenia pri šikmom dopade (GISAXS) bol objavený a v reálnom čase študovaný vznik novej metastabilnej štruktúrnej fázy na samousporiadanom súbore nanočastíc uväznených na rozhraní kvapalina/vzduch. Táto fáza bola analyzovaná ako rýchly prechodový jav predchádzajúci 2D-3D štruktúrnej transformácii pri zvyšovaní povrchového napätia. Na analýzu bol vypracovaný originálny difrakčný model 2D a 3D súborov nanočastíc založený na koncepcii dvojrozmerného hexagonálneho parakryštálu, ktorý umožnil prvýkrát komplexne analyzovať štruktúru samousporiadaných súborov nanočastíc vrátane stupňa korelácie medzi monovrstvami. Získané poznatky boli použité pre prípravu nových typov senzorov na báze samousporiadaných polovodičových nanočastíc pre monitorovanie čistoty ovzdušia a detekciu nitrátových výbušnín (plynové senzory s nanočasticami  $\gamma$ -Fe<sub>2</sub>O<sub>3</sub> a CoFe<sub>2</sub>O<sub>4</sub> pre monitorovanie CO a NO<sub>2</sub>) a monitorovanie čistoty vôd (selektívne elektrochemické senzory s nanočasticami Fe-O). Možnosť realizovať v nanočasticiach oba typy vodivosti otvára cestu k mimoriadne citlivým a selektívnym senzorom na báze n-p súborov.

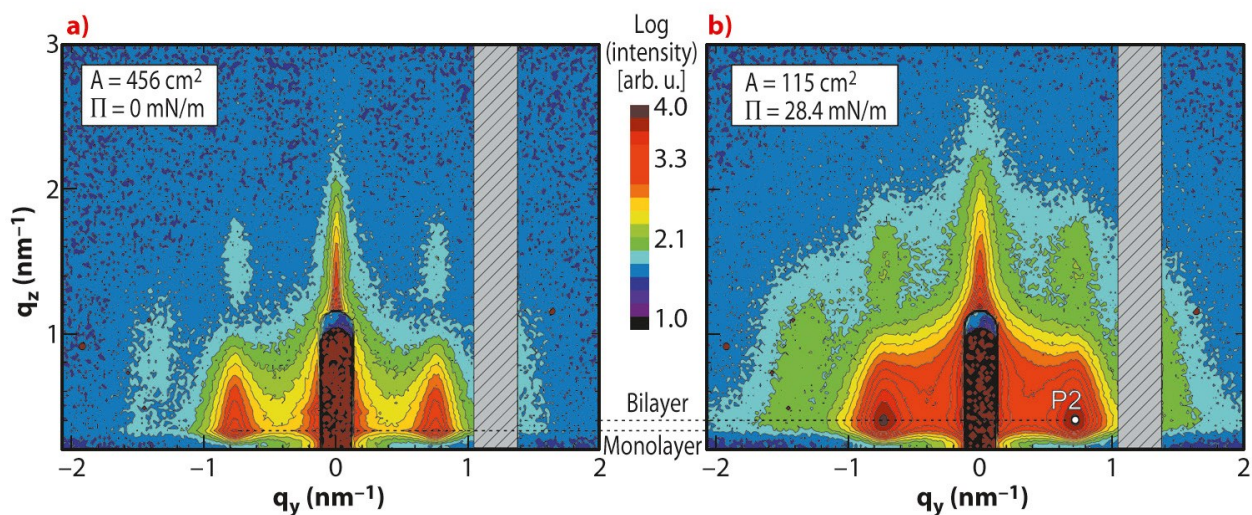


Diagram malouhlového rtg rozptylu GISAXS strieborných nanočastíc na vodnej hladine pri rôznych povrchových tlakoch – (a) neuzavretá monovrstva, (b) skolabovaná monovrstva.

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### **Preparation, properties and pilot applications of self-assembled nanoparticle arrays**

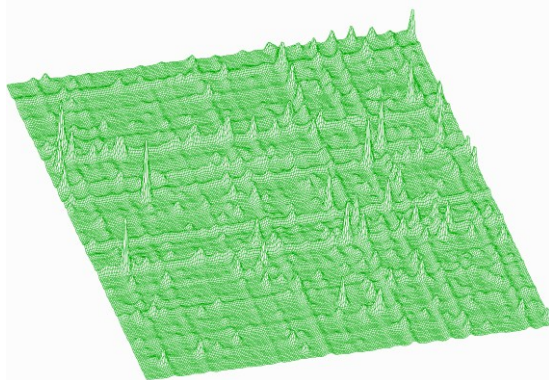
DMN team: E. Majková, M. Jergel, P. Šiffalovič, Š. Luby, K. Gmucová, J. Ivančo, V. Nádaždy, K. Végső, M. Benkovičová

Formation of a new metastable structural phase was revealed and in situ studied on a self-assembled nanoparticle array confined to the liquid/air interface by grazing-incidence small-angle X-ray scattering. The phase was analyzed as a fast transient phenomenon preceding the 2D-3D structural transformation at the surface pressure growth. To do so, a new diffraction model of 2D and 3D nanoparticle arrays based on the concept of two-dimensional hexagonal paracrystal was developed that allowed for the first time a complex structural analysis of the self-assembled nanoparticle arrays including the degree of vertical correlation between the monolayers. The results obtained were employed for preparation of new types of sensors based on self-assembled semiconducting nanoparticles for air pollution monitoring and nitrate explosives detection (gas sensors with  $\gamma$ - $\text{Fe}_2\text{O}_3$  and  $\text{CoFe}_2\text{O}_4$  nanoparticles for CO and  $\text{NO}_2$  monitoring) and water pollution monitoring (selective electrochemical sensors based on Fe-O nanoparticles). The possibility to realize both types of conductivity paves the way to extremely sensitive and selective sensors based on p-n assemblies.

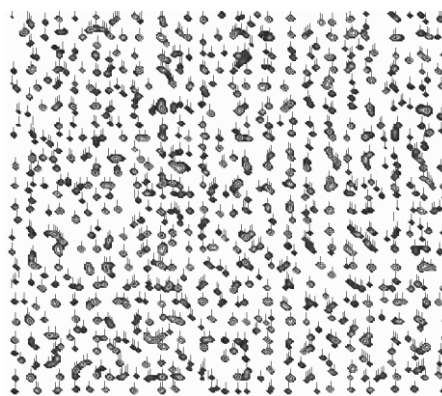


**3. miesto: Vladislav Matoušek (OJF)****Spracovanie mnohorozmerných experimentálnych dát v jadrovej fyzike**

Súbor prác je venovaný problematike spojenej so spracovaním viacrozmerných experimentálnych dát v jadrovej fyzike. V prácach sú prezentované ako rozšírenia a zovšeobecnenia konvenčných metód spracovania viacrozmerných dát, tak aj definície nových originálnych prístupov, metód a algoritmov. Prvým krokom v spracovaní dát (eventov) je ich výber alebo separácia - triedenie. Operácia sortovania je založená na "hradlách" alebo "podmienkach". Správne navrhnuté použitie metód hradíel vedie k zlepšeniu kvality spektier, najmä k zlepšeniu pomeru pík/pozadie. Jedným zo základných problémov v analýze spektier (jedno- aj mnohorozmerných) je oddelenie užitočných informácií obsiahnutých v píkoch od neužitočných (pozadie, šum). V prácach prezentujeme rozšírenia existujúcich algoritmov odhadu pozadia až do n-rozmerných spektier. Zovšeobecnil sme existujúce základné algoritmy pridaním ďalších parametrov a možností, ktoré umožňujú výrazne zlepšiť kvalitu odhadu pozadia. Jedným z najviac chýlostivých problémov každej spektrometrickej metódy sú problémy súvisiace s korektnou extrakciou informácie z častí spektier, kde vzhľadom na obmedzené rozlíšenie prístrojov sa signály prichádzajúce z rôznych zdrojov prekrývajú. Dekonvolučné metódy predstavujú účinný nástroj pre zlepšenie rozlíšenia v jadrových spektrách. Modifikovali a rozšírili sme známe iteratívne dekonvolučné algoritmy a vyvinuli nové regularizačné techniky. Kvalita analýzy jadrových spektier spočíva v správnom určení existencie píkov a následne v presnom odhade ich pozícií. Rozšírili sme konvenčné algoritmy hľadania píkov až po n-rozmerné spektrá. Taktiež sme navrhli algoritmus identifikácie valov, ktoré sa nachádzajú v spektrách jadrových multifragmentácií a vyvinuli nové algoritmy rozpoznávania objektov optimalizované na rozpoznávanie krúžkov v dvojrozmerných spektrách z RICH detektorov. Pozície nájdených píkov môžu byť použité ako počiatočný odhad do procedúr fitovania. Základným problémom fitovania mnohorozmerných  $\gamma$ -spektier je existencia veľkého počtu píkov v spektrách, a teda veľký počet fitovaných parametrov. Navrhli sme niekoľko modifikácií algoritmu fitovania bez nutnosti výpočtu inverznej matice, ktoré zvyšujú jeho efektivitu. S rastúcim počtom rozmerov histogramov (jadrových spektier) sú požiadavky na vývoj viacrozmerných techník vizualizácie skalárnych dát stále náročnejšie. Konvenčné metódy zobrazovania izoplôch, objemového vykresľovania a technika glyfov nie sú rozšíriteľné do vyšších rozmerov. Z toho dôvodu sme navrhli nový algoritmus vizualizácie hyperobjemov, ktorý je založený na vizualizácii vnorených podpriestorov a je rozšíriteľný na ľubovoľný počet rozmerov.



Príklad 2-Dimenziálneho spektra.

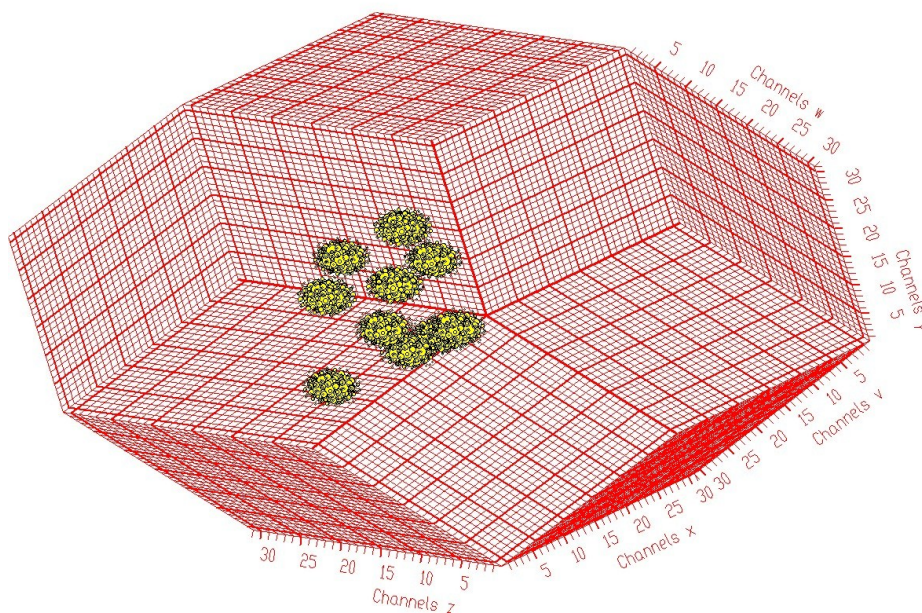


Identifikované „peaky“ v 2D spektre.

**Multidimensional Experimental Data Processing in Nuclear Physics**

The collection of works is devoted to the problems connected with the processing of multidimensional experimental data in nuclear physics. It presents the extensions and generalizations of the conventional processing methods for multidimensional data and the

definitions of new original approaches, methods and algorithms. The first step of event processing is their selection or separation - sorting. The sorting operation is based on “gates” or “conditions”. Properly proposed gating methods lead to an improvement in spectral quality, in particular, the peak-to-background ratio. One of the basic problems in the analysis of the spectra (both one-, and multidimensional) is the separation of useful information contained in peaks from the useless information (background, noise). We present an extension of the algorithms of background estimation up to n-dimensional spectra. We generalized the existing basic algorithms for additional parameters and possibilities that make it possible to improve substantially the quality of the background estimation. One of the most delicate problems of any spectrometric method is that related to the extraction of the correct information out of the spectra sections, where due to the limited resolution of the equipment, signals coming from various sources are overlapping. The deconvolution methods represent an efficient tool to improve the resolution in the nuclear spectra. We developed modifications and extensions of iterative deconvolution algorithms as well as new regularization technique. The quality of the analysis of nuclear spectra consists in the correct identification of the existence of peaks and subsequently in the good estimation of their positions. We extended the conventional algorithms up to n-dimensional spectra. We also proposed the algorithm of ridges identification used in nuclear multifragmentation spectra and a new pattern recognition algorithm optimized for the determination of rings in two-dimensional spectra from RICH detectors. The positions of found peaks can be fed as initial estimate into a fitting procedure. The basic problem of the fitting of multidimensional  $\gamma$ -ray spectra resides in the existence of a large number of peaks and thus large number of fitted parameters. We proposed several modifications of the algorithm without matrix inversion that allow increasing its efficiency. With increasing dimensionality of histograms (nuclear spectra), the requirements in developing of multidimensional scalar visualization techniques become striking. Conventional isosurfacing, volume rendering and glyph-based techniques are not extendible to higher dimensions. Therefore, we have suggested a new algorithm of hypervolume visualization that is based on visualization of embedded subspaces and is extendible to any dimension.



Example of the visualization of ten 5D Gaussians

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### 2.3.3. Medzinárodné vedecké projekty

#### 1. miesto: Martin Venhart (OJF)

##### **Predčasný nárast deformácie v neutrónovo deficitných izotopoch polónia**

In-source rezonančná laserová spektroskopia párnych izotopov polónia  $^{192-210,216,218}\text{Po}$  bola realizovaná za využitia atómového prehodu zo stavu  $6p^3 7s^5 S_2$  do stavu  $6p^3 7p^5 P_2$  ( $\lambda=843.38$  nm). Tieto merania poskytli hodnoty zmien stredného polomeru náboja atómového jadra  $\delta\langle r^2 \rangle$  v závislosti na neutrónovom čísle v rámci izotopického reťazca polónia. Tieto merania poskytujú modelovo nezávislú informáciu o deformácii jadier v základnom stave, za predpokladu, že atómové prechody sú dostatočne známe. Toto sa javí ako problematické vzhľadom na to, že polónium nemá stabilný izotop. Výrazný progres v rozvoji teórie atómového obalu, ktorý nastal v posledných dvoch desaťročiach, umožnil detailné výpočty pre atómy a ióny s neuzavretými vrstvami. Tieto výpočty poskytujú dôležité parametre potrebné na analýzu dát z laserovej spektroskopie. Avšak presnosť a spoľahlivosť týchto výpočtov musí byť pozorne posúdená, a to najmä v ťažkých systémoch. Experimentálne overenie atómových modelov je mimoriadne dôležité, keďže sú potrebné napr. pri popise atómových a chemických vlastností superťažkých jadier.

Experimenty sa konali na zariadení CERN-ISOLDE, ktoré produkuje zväzky rádioaktívnych izotopov. Jadrá polónia boli produkované spaláciou masívneho uránového terča indukovaného protónovým zväzkom s energiou 1.4 GeV, za použitia rezonančnej laserovej ionizácie. Izotopy polónia boli identifikované metódami alfa a beta spektroskopie. Systematické laserové skeny, t.j. monitorovanie výťažku polónia v závislosti na frekvencii laseru, odhalili prekvapujúco veľký a predčasný odklon od sféricity jadra počnúc izotopom  $^{194}\text{Po}$ . Kvantifikácia evolúcie deformácie základného stavu, špecificky závislosť na neutrónovom čísle, bude vyžadovať posun teórie za metódy stredného poľa. Porovnanie nameraného izotopického posunu v jadrách  $^{200-210}\text{Po}$  s predošlými meraniami umožnilo preverenie atómových výpočtov, ktoré sa ukázali ako dostatočne presne reproduktujúce experimentálne dáta.

##### **Early Onset of Ground State Deformation in Neutron Deficient Polonium Isotopes**

In-source resonant ionization laser spectroscopy of the even-A polonium isotopes  $^{192-210,216,218}\text{Po}$  has been performed using the  $6p^3 7s^5 S_2$  to  $6p^3 7p^5 P_2$  ( $\lambda=843.38$  nm) transition in the polonium atom. These measurements yield the changes in the mean-square charge radius  $\delta\langle r^2 \rangle$  as a function of neutron number within the isotopic chain. This provides model-independent insight into the ground-state deformation, with assumption that required atomic parameters are known. Since polonium does not form a stable isotope, the latter appears to be very challenging. Within past two decades, the progress in atomic structure theory has enabled large-scale calculations for open-shell atoms and ions providing the necessary input to analyze laser-spectroscopic data. However, the accuracy and reliability of such calculations has to be assessed carefully, especially in heavy systems. Experimental testing of above models is of extreme importance since they are needed to access, e.g., the atomic and chemical properties of super heavy elements.

Experiments took place at CERN-ISOLDE radioactive-ion beam facility. The Po isotopes were produced by 1.4 GeV proton-induced spallation reactions of a thick depleted  $\text{UC}_x$  target using resonant laser ion source. The polonium ions were identified by methods of alpha and beta decay spectroscopy. Systematic laser scans, i.e., monitoring of the polonium yield as a function of the



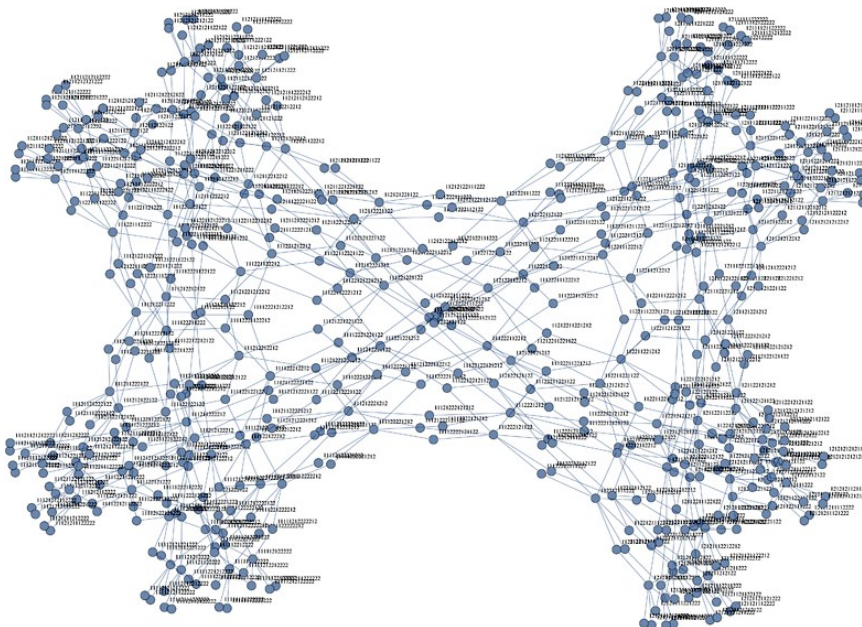
laser frequency, revealed a surprisingly large and early departure from the sphericity starting at  $^{194}\text{Po}$  isotope. The quantification of evolution of ground-state deformations, particularly their nucleon number dependence, will demand that theory moves beyond mean-field descriptions to quantify the specific nucleon number dependence. Comparison of measured isotope shifts in  $^{200-210}\text{Po}$  with previous data allowed to test large-scale atomic calculations, which appeared to reasonably well reproduce measured data.

[1] T. E. Cocolios, W. Dexters, M. D. Seliverstov, A. N. Andreyev, S. Antalic, A. E. Barzakh, B. Bastin, J. Buscher, I. G. Darby, D. V. Fedorov, V. N. Fedosseyev, K. T. Flanagan, S. Franchoo, S. Fritzsche, G. Huber, M. Huyse, M. Keupers, U. Koster, Yu. Kudryavtsev, E. Mane, B. A. Marsh, P. L. Molkanov, R. D. Page, A. M. Sjoedin, I. Stefan, J. Van de Walle, P. Van Duppen, M. Venhart, S. G. Zemlyanov, M. Bender and P.-H. Heenen, **Phys. Rev. Lett.** **106**, 052503 (2011)

## 2. miesto: Daniel Nagaj (CVKI)

### Kritikalita bez frustrácie pre reťazce spin-1 častíc

Základné stavy spinových reťazcov bez frustrácie (FF) spĺňajú požiadavku, aby základný stav minimalizoval naraz všetky členy v Hamiltoniáne. Pýtame sa, ako veľmi previazaný môže byť základný stav FF kvantového spin- $s$  reťazca pre malé hodnoty  $s$ . Zatiaľ čo o reťazcoch spinov  $1/2$  vieme, že majú nepreviazané základné stavy, táto úloha je pre  $s=1$  málo preskúmaná. Našli sme prvý príklad FF, translačne invariantného spin-1 reťazca, ktorý má nedegenerovaný, veľmi previazaný základný stav, ktorý poukazuje na niektoré vlastnosti kritických systémov. Na tento základný stav sa môžeme pozrieť ako na uniformnú superpozíciu dobre ozátvorkovaných reťazcov zložených zo zátvoriek a medzier. Entropia previazania polovice takéhoto reťazca celkovej dĺžky  $n$  rastie ako  $\log(n)/2 + O(1)$ . Ukázali sme tiež, že medzera v spektre nad základným stavom je polynomiálna v  $1/n$ . Náš dôkaz sa zakladá na zaujímavom novom výsledku o štatistike Dyckových ciest.



Hamiltonián mapovaný na poprepájaný Markovovský reťazec

### Criticality without frustration for quantum spin-1 chains

Frustration-free (FF) spin chains have a property that their ground state minimizes all individual terms in the chain Hamiltonian. We ask how entangled the ground state of a FF quantum spin- $s$  chain with nearest-neighbor interactions can be for small values of  $s$ . While FF spin- $1/2$  chains are

known to have unentangled ground states, the case  $s=1$  remains less explored. We propose the first example of a FF translation-invariant spin-1 chain that has a unique highly entangled ground state and exhibits some signatures of a critical behavior. The ground state can be viewed as the uniform superposition of balanced strings of left and right parentheses separated by empty spaces. Entanglement entropy of one half of the chain scales as  $\log(n)/2 + O(1)$ , where  $n$  is the number of spins. We prove that the energy gap above the ground state is polynomial in  $1/n$ . The proof relies on a new result concerning statistics of Dyck paths which might be of independent interest.

[1] Criticality without frustration for quantum spin-1 chains, Sergey Bravyi, Libor Caha, Ramis Movassagh, Daniel Nagaj, Peter Shor, **Phys. Rev. Lett.** **109**, 207202 (2012)

### 3. miesto: Pavol Kalinay (OKFS)

#### **Redukcia fázového priestoru Fokker-Planckovej rovnice**

Procedúru mapovania difúznej rovnice v 2D nehomogénom kanáliku sme zovšeobecniili na redukciu fázového priestoru Fokker-Planckovej rovnice. Podobne, ako je výsledkom mapovania difúzie v 2D kanáli Fick-Jacobsova rovnica s korekciami vypočítanými rekurentnou schémou, zovšeobecnená procedúra umožňuje odvodiť Smoluchovského rovnicu opravenú členmi závisiacimi od hmotnosti častice. Táto rovnica potom umožňuje zahrnúť aj zotrvačné efekty do difúzneho popisu pohybu častíc. Redukované rovnice sú potrebné pri analýze Brownovských púmp, usmernenia stochastického pohybu častíc, či stochastickej rezonancie.

#### **The phase space reduction of the Fokker-Planck equation**

The procedure mapping diffusion in a 2D non homogeneous channel was generalized to the reduction of the phase space in the Fokker-Planck equation. Similar to the mapping of diffusion in a 2D channel, giving the Fick-Jacobs equation with corrections calculated by a recurrent scheme, the generalized procedure enables us to derive the Smoluchowski equation corrected by the terms depending on the mass of the particles. This equation then involves also the inertial effects into the diffusional description of the motion of particles. Reduced equations of that kind are useful in analysis of the Brownian pumps, rectification of the stochastic motion of the particles, or modeling the stochastic resonance.

[1] P. Kalinay, J.K. Percus: Phase Space Reduction of the 1D Fokker-Planck (Kramers) Equation: J. Stat. Phys. 148, 1135 (2012).

[2] P. Kalinay, J.K. Percus: Mapping of diffusion in a channel with soft walls, Phys. Rev. E 83, 031109 (2011), a práca Phys. Rev. E 84, 011118 (2011).

**2.4. Publikačná činnosť** (úplný zoznam je uvedený v Prílohe C)

Tabuľka 2e Štatistika vybraných kategórií publikácií

<b>PUBLIKAČNÁ A EDIČNÁ ČINNOSŤ</b>	<b>A Počet v r. 2012/ doplnky z r. 2011</b>	<b>B Počet v r. 2012/ doplnky z r. 2011</b>	<b>C Počet v r. 2012/ doplnky z r. 2011</b>
<b>1. Vedecké monografie vydané v domácich vydavateľstvách</b> (AAB, ABB, CAB)	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>2. Vedecké monografie vydané v zahraničných vydavateľstvách</b> (AAA, ABA, CAA)	<b>1 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>3. Odborné monografie, vysokoškolské učebnice a učebné texty vydané v domácich vydavateľstvách</b> (BAB, ACB)	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>4. Odborné monografie a vysokoškolské učebnice a učebné texty vydané v zahraničných vydavateľstvách</b> (BAA, ACA)	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>5. Kapitoly vo vedeckých monografiách vydaných v domácich vydavateľstvách</b> (ABD, ACD)	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>6. Kapitoly vo vedeckých monografiách vydaných v zahraničných vydavateľstvách</b> (ABC, ACC)	<b>4 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>7. Kapitoly v odborných monografiách, vysokoškolských učebniciach a učebných textoch vydaných v domácich vydavateľstvách</b> (BBB, ACD)	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>8. Kapitoly v odborných monografiách, vysokoškolských učebniciach a učebných textoch vydaných v zahraničných vydavateľstvách</b> (BBA, ACC)	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>9. Vedecké a odborné práce v časopisoch evidovaných v Current Contents</b> (ADC, ADCA, ADCB, ADD, ADDA, ADDB, CDC, CDCA, CDCB, CDD, CDDA, CDDB, BDC, BDCA, BDCB, BDD, BDDA, Bddb)	<b>105 / 2</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>10. Vedecké a odborné práce v nekarentovaných časopisoch</b> (ADE, ADEA, ADEB, ADF, ADFA, ADFB, CDE, CDEA, CDEB, CDF, CDFA, CDFB, BDE, BDEA, BDEB, BDF, BDFA, BDFB)	<b>11 / 2</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>11. Vedecké a odborné práce v zborníkoch (konferenčných aj nekonferenčných, vydaných tlačou alebo na CD)</b>			
<b>a/ recenzovaných, editované</b> (AEC, AED, AFA, AFB, AFBA, AFBB, BEC, BED, CEC, CED)	<b>16 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>b/ nerecenzovaných</b> (AEE, AEF, AFC, AFD, AFDA, AFDB, BEE, BEF)	<b>35 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>

<b>12. Vydané periodiká evidované v Current Contents</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>13. Ostatné vydané periodiká</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>14. Vydané alebo editované zborníky z vedeckých podujatí (FAI)</b>	<b>2/0</b>	<b>0/0</b>	<b>0/0</b>
<b>15. Vedecké práce uverejnené na internete (GHG)</b>	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>
<b>16. Preklady vedeckých a odborných textov (EAJ)</b>	<b>0 / 0</b>	<b>0 / 0</b>	<b>0 / 0</b>

*A - pracovisko SAV je uvedené ako pracovisko (adresa) autora, alebo je súčasťou kolaborácie alebo iného združenia, ktoré je uvedené ako pracovisko (adresa) autora*

*B - pracovisko SAV nie je na publikácii uvedené, pretože prameň údaj o pracovisku autora neobsahuje, práca ale vznikla na pracovisku SAV*

*C - pracovisko SAV je uvedené ako materské pracovisko autora odlišné od pracoviska, na ktorom práca vznikla (napr. „on leave...“, „permanent address...“, „present address...“)*

Tabuľka 2f Ohlasy

<b>OHLASY</b>	<b>A</b> <b>Počet v r. 2011/ doplňky z r. 2010</b>	<b>B</b> <b>Počet v r. 2011/ doplňky z r. 2010</b>
<b>Citácie vo WOS (1.1, 2.1)</b>	2214 / 0	0 / 0
<b>Citácie v SCOPUS (1.2, 2.2)</b>	170 / 0	0 / 0
<b>Citácie v iných citačných indexoch a databázach (9, 10)</b>	0 / 0	0 / 0
<b>Citácie v publikáciách neregistrovaných v citačných indexoch (3, 4)</b>	37 / 2	0 / 0
<b>Recenzie na práce autorov z organizácie (5, 6, 7, 8)</b>	0 / 0	0 / 0

*A - pracovisko SAV je uvedené ako pracovisko (adresa) autora, alebo je súčasťou kolaborácie alebo iného združenia, ktoré je uvedené ako pracovisko (adresa) autora, alebo pracovisko SAV nie je na publikácii uvedené, pretože prameň údaj o pracovisku autora neobsahuje, práca ale vznikla na pracovisku SAV*

*B - pracovisko SAV je uvedené ako materské pracovisko autora odlišné od pracoviska, na ktorom práca vznikla (napr. „on leave...“, „permanent address...“, „present address...“)*

## 2.5. Aktívna účasť na vedeckých podujatiach

Tabuľka 2g Vedecké podujatia

<b>Prednášky a vývesky na medzinárodných vedeckých podujatiach</b>	<b>88</b>
<b>Prednášky a vývesky na domácich vedeckých podujatiach</b>	<b>28</b>

## 2.6. Vyžiadané prednášky

### 2.6.1. Vyžiadané prednášky na medzinárodných vedeckých podujatiach

1) L.Šamaj, *Wigner strong-coupling theory I: counterions near highly charged interfaces*, CECAM, New Challenges in Electrostatics of Soft and Disordered Matter, University of Toulouse III, France, 8. máj, 2012.

2) I. Štich, *Chemical Tip Fingerprinting in Scanning Probe Microscopy of Oxidized Cu(110) Surface*, Physics Meeting in Amazonia, Belem, Brazília, 25. september, 2012.

3) Michal Sedlák, *Three aspects of quantum protocols: Extremality, Memory cost and Optimality for transformation*, COQUIT workshop, Torino, Taliansko, 13.9.2012.

4) Mario Ziman, *Direct estimation of decoherence rates*, COQUIT workshop, Torino, Taliansko, 13.9.2012.

5) Vladimir Buzek, *On the Origin of temperature in Quantum Universe*, International Iranian Conference on Quantum Information, Teherán, Irán, september 2012

6) Vladimir Buzek, *On the Origin of temperature in Quantum Universe*, Pécs Workshop on Quantum Information and Quantum Optics, Pecs, Maďarsko, 28. máj 2012

7) E. Běták, *Possibilities of Statistical Pickup and Knockout in the Pre-equilibrium (exciton model) Nuclear Reactions for the Cluster Emission*, 4th International conference on Present Problems of Nuclear Physics and Atomic Energy, Kiev, 3-7. september, 2012



- 8) Daniel Nagaj, *Hamiltonian Complexity*, workshop Tensor networks and algebraic geometry, ISI Torino, Taliansko, 7.11.2012
- 9) P. Švec, *Formation, structure and properties of mono, bi and tri-layered rapidly quenched ribbons*, SURFINT-SREN III Progress in Applied Surface, Interface and Thin Film Science, 14.-18. mája 2012, Florencia, Taliansko
- 10) P. Švec ml., *Nanokompozitné kovové materiály pripravené žihaním z amorfnej fázy*, seminár "TEM v materiálovém výzkumu", VŠB-TU Ostrava, 26.-27. 1. 2012
- 11) M. Krajčí, *Electronic Structure Of Quasicrystals: DFT Studies*, Statistical Physics and Low Dimensional Systems, SPLDS, 29.5.-1.6.2012, Abbaye des Prémontrés, Pont-à-Mousson, Francúzsko
- 12) M. Mihalkovič, *Atomistic simulations of quasicrystals*, International Symposium "Quasicrystals Today", Grenoble 18.-19. október 2012
- 13) M. Hartmanová, *Polymorphism of Oxide Materials with Fluorite (F)-type Structure and its Utilization in Applications*, 10th International Symposium on "Systems with Fast Ionic Transport", 1.-4. júla 2012, Chernogolovka, Ruská federácia
- 14) M. Hartmanová, *Influence of Deposition Conditions on Electrical and Mechanical Properties of Sm<sub>2</sub>O<sub>3</sub>-Doped CeO<sub>2</sub> Thin Films Prepared by EB-PVD (+IBAD) Methods (Indentation Hardness and Effective Elastic Modulus)*, 11th International Meeting on "Fundamental Problems of Solid State Ionics", 5.-8. júla 2012, Chernogolovka, Russia
- 15) Š. Luby, *Iron oxide nanoparticle gas sensors*, 14th Joint Vacuum Conference, Dubrovnik, jún 2012.
- 16) Š. Luby, *Nanotechnology in medicine – some benefits and threats*, Int. Conf. Nanomedicine, University Zürich, november 2012
- 17) E. Majková, *Self-Assembly of Noble Metal Nanoparticles at Liquid/Air Interfaces*, XI Int. Conf. on Nanostructured Materials – NANO2012, Rhodes 2012
- 18) L. Martinovič, *A consistent solution of the Schwinger model in the covariant gauge*, Light Cone 2012 II, Delhi University, India, 12.12.2012
- 19) L. Martinovič, *New operator solution of the Schwinger model and axial anomaly*, Many manifestations of non-perturbative QCD, Caragatatuba, Brazília, 5.5.2012
- 20) E. Illeková, *Termická analýza kovov (Kryštalizácia a topenie amorfných kovových pások; rozklad, oxidácia a nitridácia zliatin hliníka)*, Setkání uživatelů TA Instruments, 22. - 23. 3. 2012, Brno, Czech Republic, pozvaná prednáška.

## 2.6.2. Vyžiadané prednášky na domácich vedeckých podujatiach

- 1) P. Švec, *Formation, structure and properties of mono, bi and tri-layered rapidly quenched*

*ribbons*, 19. konferencia slovenských fyzikov, Prešovská univerzita, Prešov, 3.-6. september 2012

2) P. Švec, *Recent developments in preparation and applications of amorphous alloys*, INNOVMAT ACADEMY – Progressive methods and technologies of preparation, processing and diagnostics of materials, MTF STU, 10. 5. 2012

3) P. Šiffalovič, *Nanoparticle self-assembly at solid/liquid interfaces*, 19. konferencia slovenských fyzikov, Prešovská univerzita, Prešov, 3.-6. september 2012

### 2.6.3. Vyžiadané prednášky na významných vedeckých inštitúciách

1) I.Štich, *Quantum Monte Carlo modeling of transition metal-benzene complexes*, Centro de Investigación e Innovación Tecnológica, Instituto Politécnico Nacional, Mexico city, 8. august 2012.

2) I.Štich, *QMC an aletrnative to DFT*, Dept. of Physics, Federal University of Pará, Belem, Brazilia, 28. september 2012

3) I.Štich, *Photoswitchable molecules: from electronic structure to optomechanical switching*, Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, 10. október 2012

4) I.Štich, *Quantum Monte Carlo Modeling of  $\pi$ -bonded Transition-metal Organometallics*, Cavendish Laboratory, University of Cambridge, 29. november 2012

5) P. Filip, *Career perspectives and funding of science in Slovakia*, Young Academy of Europe, Brussels, 8. december 2012.

6) Peter Staňo, *Measuring spin currents in mesoscopic conductors*, University of Geneva, Geneva, Switzerland, 24.1.2012

7) Daniel Nagaj, *Criticality without frustration*, IQC Colloquium, IQC Waterloo, Kanada, 25.9.2012

8) Daniel Nagaj, *Quantum computing and complexity*, Heyrovského inštitút pre fyzikálnu chémiu, Praha, ČR, 10.12.2012

9) M. Krajčí, *On the Nobel-prize in chemistry 2011 winning topic: The discovery of quasicrystals*, zasadanie UčS SAV, 14. 3. 2012, Bratislava

10) M. Mihalkovič, *Atomic structure of Mg–Zn based Frank–Kasper decagonal quasicrystals*, ETH Zurich, 14. 12. 2012

11) Ľ.Martinovič, *Light front field theory: a few non-perturbative aspects in simple terms*, ITA Sao Jose dos Campos, Brazilia, 24.4.2012

*Ak boli príspevky publikované, sú súčasťou Prílohy C, kategória (AFC, AFD, AFE, AFF, AFG, AFH)*

### 2.7. Patentová a licenčná činnosť na Slovensku a v zahraničí v roku 2012

### **2.7.1. Vynálezy, na ktoré bol udelený patent**

### **2.7.2. Prihlásené vynálezy**

Názov prihlášky patentu: Tvarovanie kovových skiel za tepla (Hot Forming of metallic glasses)

Rok prihlášky: 2012

Číslo prihlášky: PCT/SK201x/0x (Patentový úrad zatiaľ nepridelil číslo)

Mená autorov: P. Švec, D. Janičkovič, M. Halász, P. Švec ml., J. Hoško

### **2.7.3. Predané licencie**

### **2.7.4. Realizované patenty**

*Finančný prínos pre organizáciu SAV v roku 2012 a súčet za predošlé roky sa neuvádzajú, ak je zverejnenie v rozpore so zmluvou súvisiacou s realizáciou patentu.*

### **2.8. Iné informácie k vedeckej činnosti.**

Recenzie článkov v CC časopisoch: **181**

Recenzie v iných časopisoch: **4**

Editori zborníkov: **1**

J.Krištiak: Proc. of Positron and Positronium Chemistry X, in Materials Science Forum Vol.733.

Iné posudky: **1**

### 3. Doktorandské štúdium, iná pedagogická činnosť a budovanie ľudských zdrojov pre vedu a techniku

#### 3.1. Údaje o doktorandskom štúdiu

Tabuľka 3a Počet doktorandov v roku 2012

Forma	Počet k 31.12.2012				Počet ukončených doktorantúr v r. 2012					
	Doktorandi				Ukončenie z dôvodov					
	celkový počet		z toho novoprijatí		ukončenie úspešnou obhajobou		predčasné ukončenie		neúspešné ukončenie	
	M	Ž	M	Ž	M	Ž	M	Ž	M	Ž
<b>Interná zo zdrojov SAV</b>	8	3	4	0	4	1	0	0	0	0
<b>Interná z iných zdrojov</b>	0	1	0	0	0	0	0	0	0	0
<b>Externá</b>	1	0	0	0	0	0	0	0	0	0
<b>Spolu</b>	9	4	4	0	4	1	0	0	0	0

#### 3.2. Zmena formy doktorandského štúdia

Tabuľka 3b Počty preradení

Z formy	Interná z prostriedkov SAV	Interná z prostriedkov SAV	Interná z iných zdrojov	Interná z iných zdrojov	Externá	Externá
Do formy	Interná z iných zdrojov	Externá	Interná z prostriedkov SAV	Externá	Interná z prostriedkov SAV	Interná z iných zdrojov
<b>Počet</b>	0	0	0	0	0	0

#### 3.3. Zoznam doktorandov, ktorí ukončili doktorandské štúdium úspešnou obhajobou

Tabuľka 3c Menný zoznam ukončených doktorandov v roku 2012 úspešnou obhajobou

Meno doktoranda	Forma DŠ	Mesiac, rok nástupu na DŠ	Mesiac, rok obhajoby	Číslo a názov študijného odboru	Meno a organizácia školiteľa	Fakulta udeľujúca vedeckú hodnotu
Matúš Dubecký	interné štúdium hradené z prostriedkov SAV	9 / 2008	9 / 2012	4.1.3 fyzika kondenzovaných látok a akustika	prof. Ing. Ivan Štich DrSc., Fyzikálny ústav SAV	Fakulta matematiky, fyziky a informatiky UK

Danica Fidiriková	interné štúdium hradené z prostriedkov SAV	9 / 2009	8 / 2012	5.2.48 fyzikálne inžinierstvo	Ing. Ľudovít Kubičár DrSc., Fyzikálny ústav SAV	Fakulta elektrotechniky a informatiky STU
Kristián Petrík	interné štúdium hradené z prostriedkov SAV	9 / 2007	8 / 2012	4.1.5 jadrová a subjadrová fyzika	Ing. Štefan Gmuca CSc., Fyzikálny ústav SAV	Fakulta matematiky, fyziky a informatiky UK
Tomáš Rybár	interné štúdium hradené z prostriedkov SAV	9 / 2008	8 / 2012	4.1.2 všeobecná fyzika a matematická fyzika	Prof. RNDr. Vladimír Bužek DrSc., Fyzikálny ústav SAV	Fakulta matematiky, fyziky a informatiky UK
Peter Švec	interné štúdium hradené z prostriedkov SAV	9 / 2008	8 / 2012	4.1.3 fyzika kondenzovaných látok a akustika	RNDr. Marek Mihalkovič CSc., Fyzikálny ústav SAV	Fakulta matematiky, fyziky a informatiky UK

*Zoznam interných a externých doktorandov je uvedený v Prílohe A.*

### 3.4. Zoznam akreditovaných študijných odborov s uvedením VŠ

Tabuľka 3d Zoznam akreditovaných študijných odborov s uvedením univerzity/vysokej školy a fakulty, kde sa doktorandský študijný program uskutočňuje

Názov študijného odboru (ŠO)	Číslo ŠO	Doktorandské štúdium uskutočňované na: (univerzita/vysoká škola a fakulta)
Všeobecná fyzika a matematická fyzika	4.1.2	Fakulta matematiky, fyziky a informatiky UK
Fyzika kondenzovaných látok a akustika	4.1.3	Fakulta matematiky, fyziky a informatiky UK
Kvantová elektronika a optika	4.1.4	Fakulta matematiky, fyziky a informatiky UK
Jadrová a subjadrová fyzika	4.1.5	Fakulta matematiky, fyziky a informatiky UK
Elektronika	5.2.13	Fakulta elektrotechniky a informatiky STU
Fyzikálne inžinierstvo	5.2.48	Fakulta elektrotechniky a informatiky STU

Tabuľka 3e Účasť na pedagogickom procese

Menný prehľad pracovníkov, ktorí boli menovaní do odborových komisií študijných programov doktorandského štúdia	Menný prehľad pracovníkov, ktorí pôsobili ako členovia vedeckých rád univerzít, správnych rád univerzít a fakúlt	Menný prehľad pracovníkov, ktorí získali vyššiu vedeckú, pedagogickú hodnotu alebo vyšší kvalifikačný stupeň
Doc. RNDr. Emil Běták, DrSc. (teoretická fyzika a astrofyzika)	Doc. RNDr. Emil Běták, DrSc. (Filosoficko-přírodovědecká fakulta Slezské univerzity, Česká republika)	Mgr. Erik Bartoš, PhD. (IIa)
Doc. RNDr. Emil Běták, DrSc. (jadrová a subjadrová fyzika)	Prof. RNDr. Vladimír Bužek, DrSc. (Fakulta matematiky, fyziky a informatiky UK)	Mgr. Kristian Petřík, PhD. (PhD., Fakulta matematiky, fyziky a informatiky UK)
Prof. RNDr. Vladimír Bužek, DrSc. (všeobecná fyzika a matematická fyzika)	Prof. Ing. Štefan Luby, DrSc. (Trnavská univerzita v Trnave)	
Mgr. Andrej Gendiar, PhD. (všeobecná fyzika a matematická fyzika)	Prof. Ing. Štefan Luby, DrSc. (Katolícka univerzita v Ružomberku)	
Ing. Štefan Gmuca, CSc. (jadrová a subjadrová fyzika)	RNDr. Eva Majková, DrSc. (Univerzita Komenského v Bratislave)	
RNDr. Emília Illeková, DrSc. (materiály)	Ing. Vojtech Nádaždy, CSc. (Slovenský metrologický ústav, Slovensko)	
Ing. Matej Jergel, DrSc. (kvantová elektronika a optika)		
Ing. Matej Jergel, DrSc. (fyzika kondenzovaných látok a akustika)		

Ing. Jozef Krištiak, CSc. (jadrová a subjadrová fyzika)		
Ing. Štefan Lányi, DrSc. (elektronika)		
RNDr. Eva Majková, DrSc. (kvantová elektronika a optika)		
RNDr. Eva Majková, DrSc. (fyzikálne inžinierstvo)		
Ing. Vojtech Nádaždy, CSc. (elektrotechnológie a materiály)		
RNDr. Štefan Olejník, DrSc. (jadrová a subjadrová fyzika)		
RNDr. Štefan Olejník, DrSc. (všeobecná fyzika a matematická fyzika)		
Prof., RNDr. Milan Ožvold, CSc. (elektronika)		
RNDr. Martin Plesch, PhD. (teória vyučovania fyziky)		
RNDr. Ladislav Šamaj, DrSc. (všeobecná fyzika a matematická fyzika)		
Dr. Rer. Nat. Peter Šiffalovič, PhD. (kvantová elektronika a optika)		
RNDr. Anton Šurda, CSc. (všeobecná fyzika a matematická fyzika)		
Ing. Peter Švec, DrSc. (všeobecná fyzika a matematická fyzika)		
Ing. Peter Švec, DrSc. (fyzikálne inžinierstvo)		
Ing. Peter Švec, DrSc. (materiály)		
Ing. Peter Švec, DrSc. (fyzika kondenzovaných látok a akustika)		
Ing. Peter Švec, DrSc. (elektrotechnológie a materiály)		
Mgr. Martin Veselský, PhD. (jadrová a subjadrová fyzika)		

**3.5. Údaje o pedagogickej činnosti**

Tabuľka 3f Prednášky a cvičenia vedené v roku 2012

PEDAGOGICKÁ ČINNOSŤ	Prednášky		Cvičenia a semináre	
	doma	v zahraničí	doma	v zahraničí
<b>Počet prednášateľov alebo vedúcich cvičení</b>	7	4	1	4
<b>Celkový počet hodín v r. 2012</b>	180	192	13	66

*Prehľad prednášateľov predmetov a vedúcich cvičení, s uvedením názvu predmetu, úväzku, katedry, fakulty, univerzity/vysokej školy je uvedený v Prílohe D.*

Tabuľka 3g Aktivity pracovníkov na VŠ

<b>1.</b>	<b>Počet pracovníkov, ktorí pôsobili ako vedúci alebo konzultanti diplomových a bakalárskych prác</b>	<b>9</b>
<b>2.</b>	<b>Počet vedených alebo konzultovaných diplomových a bakalárskych prác</b>	<b>16</b>
<b>3.</b>	<b>Počet pracovníkov, ktorí pôsobili ako školitelia doktorandov (PhD.)</b>	<b>8</b>
<b>4.</b>	<b>Počet školených doktorandov (aj pre iné inštitúcie)</b>	<b>11</b>
<b>5.</b>	<b>Počet oponovaných dizertačných a habilitačných prác</b>	<b>15</b>
<b>6.</b>	<b>Počet pracovníkov, ktorí oponovali dizertačné a habilitačné práce</b>	<b>8</b>
<b>7.</b>	<b>Počet pracovníkov, ktorí pôsobili ako členovia komisií pre obhajoby DrSc. prác</b>	<b>0</b>
<b>8.</b>	<b>Počet pracovníkov, ktorí pôsobili ako členovia komisií pre obhajoby PhD. prác</b>	<b>7</b>
<b>9.</b>	<b>Počet pracovníkov, ktorí pôsobili ako členovia komisií, resp. oponenti v inauguračnom alebo habilitačnom konaní na vysokých školách</b>	<b>2</b>

**3.6. Iné dôležité informácie k pedagogickej činnosti**



## 4. Medzinárodná vedecká spolupráca

### 4.1. Medzinárodné vedecké podujatia

#### 4.1.1. Medzinárodné vedecké podujatia, ktoré organizácia SAV organizovala v roku 2012 alebo sa na ich organizácii podieľala, s vyhodnotením vedeckého a spoločenského prínosu podujatia

MECO37, Conference of the Middle European Cooperation in Statistical Physics, Tatranské Matliare, hotel Hutník, Vysoké Tatry, 65 účastníkov, 19.03.-21.03.2012

Konferencia MECO37, bola adresovaná všetkým fyzikom pracujúcim v oblasti štatistickej mechaniky a fyziky pevných látok. Konferencia sa uskutočnila 19. – 21. marca 2012 vo Vysokých Tatrách, v krásnej hornej oblasti severného Slovenska neďaleko poľských hraníc. Miestom konania konferencie bol hotel Hutník, v Tatranských Matliaroch, kde mali účastníci zabezpečené stravovanie aj ubytovanie. Konferencie MECO sa začali konať od roku 1975 ako podujatia pre vedcov zo strednej Európy a neskôr sa zloženie účastníkov rozšírilo. Konferencie MECO zohrali významnú úlohu v medzinárodnej komunikácii európskych fyzikov počas rokov studenej vojny.

SURFINT-SREN III 2012, Progress in Applied Surface, Interface, and Thin Film Science 2012, Florencia (Taliansko), 175 účastníkov, 14.05.-19.05.2012

Hlavným cieľom konferencie je prispieť k rozvoju poznatkov v oblasti povrchov, ultratenkých a veľmi tenkých filmov a medzivrstiev organických a anorganických materiálov priamym interaktívnym spôsobom: osobnou komunikáciou vedcov z relevantných vedeckých odborov. Rámec konferencie pokrýva rozvoj základných teoretických a chemických princípov fungovania a účinnosti tenkých filmov, povrchov a rozhraní na úrovni experimentálnych procedúr, ako aj na atomárnej škále. Tematika konferencie pokrýva aj prezentáciu principiálne nových zariadení v nasledovných oblastiach: solárne články, displeje na báze tekutých kryštálov, vysokoteplotná supravodivosť a senzorika. Pozornosť je venovaná ekologickým aspektom solárnej energie a súčasťou konferencie sú prezentácie zainteresovaných ekonomických subjektov – firiem.

CEQIP 2012 - Central European Quantum Information Processing, Smolenice, Slovensko, 66 účastníkov, 07.06.-10.06.2012

Skratka CEQIP znamená “Central European Quantum Information Processing” a podujatie je zamerané na riešenie súčasných otázok a paradigiem v oblasti spracovania kvantovej informácie. Aj keď program podujatia bol otvorený ľubovoľnej téme z teórie kvantovej informácie, v roku 2012 bolo ťažisko podujatia prenesené na kvantovú náhodnosť, nové schémy kvantovej komunikácie, kvantové previazanie a na nové algoritmy pre simuláciu kvantových systémov.

Relativistic Nuclear Physics: From Hundreds MeV to TeV, 2012, Stará Lesná, Slovensko, 38 účastníkov, 18.06.-22.06.2012

Konferencia je venovaná najnovším výsledkom vedeckého výskumu v oblasti relativistickej jadrovej fyziky v rozsahu interakčných energií od malých urýchľovačov (MeV) do oblasti energií najväčších kolajderov (TeV na LHC). Konferencia je tradične organizovaná za veľkej účasti vedeckej komunity z SÚJV v Dubne (Rusko), pričom prednášky obsahujú najnovšie výsledky dosiahnuté v rámci spolupráce slovenských vedcov s touto medzinárodnou vedeckou inštitúciou.

#### 4.1.2. Medzinárodné vedecké podujatia, ktoré usporiada organizácia SAV v roku 2013 (anglický a slovenský názov podujatia, miesto a termín konania, meno, telefónne číslo a e-mail zodpovedného pracovníka)

Conference Hadron Structure '13/Konferencia Hadron Structure '13, Tatranské Matliare, Slovensko, 30.06.-04.07.2013, (Stanislav Dubnička, [59410] 504, stanislav.dubnicka@savba.sk)

V dňoch 30. júna - 4. júla 2013 sa v Hoteli SOREA Hutník, Tatranské Matliare, uskutoční v poradí siedma spoločná medzinárodná konferencia Hadron Structure '13. Konferencia je spoluorganizovaná slovenskými fyzikálnymi inštitúciami spoločne s Petrohradským ústavom jadrovej fyziky Ruskej akadémie vied v Gatčine (Ruská federácia). Zámerom konferencie je najmä prehľad teoretických a experimentálnych výsledkov v oblasti štruktúry hadrónov, z pohľadu silných, elektromagnetických a slabých interakcií. Očakávané sú aj prezentácie venované najnovším previerkam štandardného modelu a jeho rozšíreniam, hadrónovej spektroskopii, fyzike LHC a budúcim urýchľovačom, ako aj mnohým iným súčasným fyzikálnym problémom.

Konferencia je organizovaná Fyzikálnym ústavom SAV v spolupráci s Petersburg Nuclear Physics Institute of RAS (Gatchina, Rusko), Joint Institute for Nuclear Research (Dubna, Rusko), Ústavom experimentálnej fyziky, SAV (Košice), Univerzitou Komenského (Bratislava), Univerzitou P. J. Šafárika (Košice), Slovenskou fyzikálnou spoločnosťou a MŠVVaŠ SR.

#### 4.1.3. Počet pracovníkov v programových a organizačných výboroch medzinárodných konferencií

Tabuľka 4a Programové a organizačné výbory medzinárodných konferencií

Typ výboru	Programový	Organizačný	Programový i organizačný
Počet členstiev	10	11	7

#### 4.2. Členstvo a funkcie v medzinárodných orgánoch

##### 4.2.1. Členstvo a funkcie v medzinárodných vedeckých spoločnostiach, úniách a národných komitétach SR

Doc. RNDr. Emil Běták, DrSc.

Institute of Physics (funkcia: člen Fellowship Panelu)  
Institute of Physics (funkcia: Fellow)

RNDr. Pavol Butvin, CSc.

European Physical Society (funkcia: člen)

Prof. RNDr. Vladimír Bužek, DrSc.

American Physical Society (funkcia: člen)  
Institute of Physics (funkcia: Fellow)  
Optical Society of America (funkcia: Fellow)  
Rakúska akadémia vied (funkcia: zahraničný člen)

Mgr. Peter Filip, PhD.

European Physical Society (funkcia: individuálny člen)

Mgr. Andrej Gendiar, PhD.

Americká fyzikálna spoločnosť (funkcia: člen)

Americká chemická spoločnosť (funkcia: člen)

RNDr. Mária Hartmanová, DrSc.

Material Research Community, Singapore (funkcia: člen)

RNDr. Emília Illeková, DrSc.

ICTAC - International Confederation of Thermal Analysis and Calorimetry (funkcia: member)

Ing. Ján Ivančo, PhD.

American Chemical Society (funkcia: člen)

Polish Synchrotron Radiation Society (funkcia: člen korešpondent)

Ing. Matej Jergel, DrSc.

Česko-Slovenská kryštalografická spoločnosť (funkcia: člen, 1996-2002 člen Rady)

European Academy of Sciences and Arts (funkcia: člen)

European Crystallographic Association (funkcia: individuálny člen)

RNDr. Dalibor Krupa, CSc.

American Physical Society (funkcia: member)

Bieloruská fyzikálna spoločnosť (funkcia: čestný člen)

European Physical Society (funkcia: Fellow)

Európska fyzikálna spoločnosť (funkcia: člen)

Institute of Physics (Great Britain) (funkcia: Fellow)

Nemecká fyzikálna spoločnosť (funkcia: čestný člen)

Poľská fyzikálna spoločnosť (funkcia: čestný člen)

Ruská fyzikálna spoločnosť (funkcia: čestný člen)

Science and Technology – Int. Energy Foundation (funkcia: Assistant under-Secretary)

World Innovation Foundation (funkcia: Fellow)

Ing. Štefan Lányi, DrSc.

Česká společnost pro nové materiály a technologie (funkcia: člen)

Materials Research Society (funkcia: člen)

Prof., Ing. Štefan Luby, DrSc.

All European Academies (ALLEA) (funkcia: úradujúci prezident)

All European Academies (ALLEA) (funkcia: člen Rady)

Európska akadémia vied a umení (funkcia: viceprezident)

Európska akadémia vied a umení (funkcia: senátor)

Prof., RNDr. Eva Majerníková, DrSc.

American Physical Society (funkcia: členka)

RNDr. Eva Majková, DrSc.

Academia Europea Scietiarum et Artium, (funkcia: socius ordinarius)  
ESUO Integrated Infrastructure Initiative (I3) “ELISA (funkcia: reprezentant SR)  
International Union of Vacuum Science, Technology and Applications, IUVSTA, Divízia  
tenkých vrstiev (funkcia: národný reprezentant)

RNDr. Emil Pinčík, CSc.

International Committee of Analysis in Steel and Iron Industry - ICASI (funkcia: člen  
medzinárodného výboru)

RNDr. Martin Plesch, PhD.

Medzinárodný výbor IJSO (funkcia: člen)  
Medzinárodný výbor Turnaja mladých fyzikov (funkcia: tajomník)

Ing. Mgr. Peter Staňo, PhD.

American Physical Society (funkcia: člen)

prof. Ing. Ivan Štich, DrSc.

American Physical Society (funkcia: člen)

Ing. Vladimír Štofánik, PhD.

IEEE-UFFC (funkcia: člen)  
URSI (funkcia: člen)

Ing. Peter Švec, DrSc.

Intl. Advisory Committe on Rapid Quenching (funkcia: member)  
IUPAP (funkcia: associate member, Comission C10 on Solid State Physics)

#### 4.3. Účast' expertov na hodnotení medzinárodných projektov (EÚ RP, ESF a iných)

Tabuľka 4b Experti hodnotiaci medzinárodné projekty

Meno pracovníka	Typ programu/projektu/výzvy	Počet hodnotených projektov
Bužek Vladimír	ERC Starting	8
	ERC Synergy	14
	FET CSA	11
	Grantová agentúra FCT (Portugalsko)	114
	Grantová agentúra FNRS (Belgicko)	8
	Marie Curie IAPP	5
	Marie Curie IRSES	10
	Marie Curie ITN	11
Jergel Matej	FP7-NMP-2012-SMALL-6	5
Kliman Ján	Grantová agentura ČR	1

Luby Štefan	7RP EU, PC Bezpečnosť	12
Olejník Štefan	Centrá MŠMT ČR	1
Šamaj Ladislav	Neznámy	1
Šurda Anton	Grantová agentúra ČR	1
Švec Peter	COST MPNS	22
	DOE, Division of Materials Sciences and Engineering	1

#### **4.4. Najvýznamnejšie prínosy MVTS ústavu vyplývajúce z mobility a riešenia medzinárodných projektov a iné informácie k medzinárodnej vedeckej spolupráci**

*Prehľad údajov o medzinárodnej mobilite pracovníkov organizácie je uvedený v Prílohe E.  
Prehľad a údaje o medzinárodných projektoch sú uvedené v kapitole 2 a Prílohe B.*

## **5. Vedná politika**

## **6. Spolupráca s univerzitami/vysokými školami, štátnymi a neziskovými inštitúciami okrem aktivít uvedených v kap. 2, 3, 4**

### **6.1. Spolupráca s univerzitami/VŠ (fakultami)**

**Názov univerzity/vysokej školy a fakulty:** Slovenská technická univerzita v Bratislave

**Druh spolupráce (spoločné pracovisko alebo iné):** Fakulta chemickej a potravinárskej chémie

**Začiatok spolupráce:** 2010

**Zameranie:** experimenty na charakterizáciu vlastností keramickej peny

**Zhodnotenie:** Spolupráca je v oblasti merania termofyzikálnych parametrov keramickej peny za účelom optimalizácie technológie výroby.

**Názov univerzity/vysokej školy a fakulty:** Slovenská technická univerzita v Bratislave

**Druh spolupráce (spoločné pracovisko alebo iné):** Katedra fyziky na FEI, Katedra stavebnej fyziky na SF

**Začiatok spolupráce:** 2010

**Zameranie:** experimentálne a teoretické

**Zhodnotenie:** Spolupráca je v oblasti merania termofyzikálnych parametrov stavebných materiálov. Odborným zameraním sa kolektívy navzájom dopĺňajú a tým zabezpečujú požadovanú úroveň spolupráce (kontakt na FÚ: Ľ. Kubičár).

**Názov univerzity/vysokej školy a fakulty:** Slovenská technická univerzita v Bratislave

**Druh spolupráce (spoločné pracovisko alebo iné):** Oddelenie fyziky ÚJFI FEI STU

**Začiatok spolupráce:** 2012

**Zameranie:** Grant VEGA

**Zhodnotenie:** Spoločný projekt VEGA "Rozvoj a testovanie fyzikálnych modelov pre pulznú prechodovú metódu". Projekt má za úlohu spracovať a teoreticky analyzovať spoľahlivosť jednotlivých modelov pre impulznú metódu. Analýza neistoty merania pre jednotlivé parametre modelu slúži na korekciu geometrie vzoriek a tiež korekciu režimu merania. Výsledkom je zníženie chyby určenia meraných hodnôt termofyzikálnych parametrov. (V. Boháč, V. Vretenár, D. Fidiriková)

**Názov univerzity/vysokej školy a fakulty:** Slovenská technická univerzita v Bratislave

**Druh spolupráce (spoločné pracovisko alebo iné):** VEGA Projekt (K. Gmucová, R. Durný)

**Začiatok spolupráce:** 2010

**Zameranie:** Organické materiály pre fotovoltaiiku a senzoriku

**Zhodnotenie:** Základný výskum fotovoltaiických materiálov dostupnými metodikami

**Názov univerzity/vysokej školy a fakulty:** Univerzita Komenského v Bratislave

**Druh spolupráce (spoločné pracovisko alebo iné):** Katedra inžinierskej geológie

**Začiatok spolupráce:** 2011

**Zameranie:** APVV projekt

**Zhodnotenie:** Spoločný APVV projekt "Štúdium vlastností hornín a vyšetrovanie štruktúrno-textúrnych charakteristík hornín s koreláciou na termofyzikálne a fyzikálno-mechanické vlastnosti." (V. Boháč, V. Vretenár, V. Štofanič, M. Markovič). Spolupráca je výhodná najmä z hľadiska vzájomného doplnenia experimentálnych techník pre komplexné vyšetrovanie vlastností materiálov. Odborným zameraním sa kolektívy navzájom dopĺňajú, čím sa zvyšuje odborná úroveň spolupráce.

**Názov univerzity/vysokej školy a fakulty:** České vysoké učení technické v Praze, Česká republika

**Druh spolupráce (spoločné pracovisko alebo iné):** Katedra materiálového inžinýrství a chemie /

Department of Materials Engineering and Chemistry

**Začiatok spolupráce:** 2012

**Zameranie:** Organizácia konferencie THERMOPHYSICS

**Zhodnotenie:** Konferencia THERMOPHYSICS je zameraná na problémy vyšetrovania transportu tepla a s tým súvisiacich vedných odborov v oblasti základného aj aplikovaného výskumu. Kontakt V. Boháč, Org. výbor - <http://www.fch.vutbr.cz/lectures/thermophysics/2012/index3.php>

**Názov univerzity/vysokej školy a fakulty:** Fakulta chemická, Vysoké učení technické v Brně, VUT Brno, Česko

**Druh spolupráce (spoločné pracovisko alebo iné):** Ústav fyzikální a spotřební chemie / Institute of Physical and Applied Chemistry

**Začiatok spolupráce:** 2012

**Zameranie:** Organizácia konferencie THERMOPHYSICS

**Zhodnotenie:** Konferencia THERMOPHYSICS je zameraná na problémy vyšetrovania transportu tepla a s tým súvisiacich vedných odborov v oblasti základného aj aplikovaného výskumu. Kontakt - V. Boháč, Org. výbor - <http://www.fch.vutbr.cz/lectures/thermophysics/2012/index3.php>

**Názov univerzity/vysokej školy a fakulty:** Fakulta prírodných vied Univerzity Mateja Bela v Banskej Bystrici

**Druh spolupráce (spoločné pracovisko alebo iné):** výskumný projekt APVV-0050-11

**Začiatok spolupráce:** 2012

**Zameranie:** výskum v oblasti jadrovej a subjadrovej fyziky

**Zhodnotenie:** Od 1. júla 2012 spoločne riešime projekt "Silno interagujúca hmota v extrémnych podmienkach (SIMEX)". Cieľom projektu je priniesť relevantné príspevky k chápaniu silných interakcií elementárnych častíc s dôrazom na javy, ktoré súvisia so súčasnými a budúcimi experimentmi pri vysokých excitačných energiách a vysokých hustotách jadrovej hmoty, a na vlastnosti hustej jadrovej hmoty relevantné pre zloženie a vnútornú štruktúru neutrónových hviezd. Riešiteľmi sú pracovníci z FÚ SAV, UMB v Banskej Bystrici a UEF SAV v Košiciach.

## **6.2. Významné aplikácie výsledkov výskumu v spoločenskej praxi alebo vyriešenie problému pre štátnu alebo neziskovú inštitúciu**

**Zadávateľ, odberateľ, zmluvný partner:** Arcibiskupský úrad, Bratislava

**Názov aplikácie/objekt výskumu:** Monitorovanie teplotno- vlhkosného režimu veže katedrále sv. Martina v Bratislave

**Začiatok spolupráce:** 2011

**Stručný opis aplikácie/výsledku:** Inštalovali sme monitorovacie zariadenie do veže a pripravili dlhodobý monitoring po odsúhlasení s Pamiatkovým úradom. Monitoring bude podávať obraz o degradácii muriva v dôsledku environmentálnej záťaže.

**Zhodnotenie (uviesť i finančný efekt z aplikácie v € pre organizáciu SAV):** Pripravujú sa spoločné projekty s Pamiatkovým úradom, ktoré zabezpečia finančný efekt pre FÚ a zároveň umožnia nadviazať užšie kontakty s organizáciami zaoberajúcimi sa ochranou pamiatok a majiteľmi pamiatkových objektov. (kontakt FÚ: Ľ. Kubičár)

**Zadávateľ, odberateľ, zmluvný partner:** Katedra inžinierskej geológie, Univerzita Komenského, Bratislava

**Názov aplikácie/objekt výskumu:** Monitorovanie teplotno-vlhkosného režimu pilierov kostola sv. Jakuba v Levoči

**Začiatok spolupráce:** 2012

**Stručný opis aplikácie/výsledku:** (kontaktná osoba: Ľ. Kubičár)

**Zhodnotenie (uviesť i finančný efekt z aplikácie v € pre organizáciu SAV):**



**Zadávatel', odberateľ, zmluvný partner:** Technický a skúšobný ústav stavebný, n. o. Bratislava

**Názov aplikácie/objekt výskumu:** Monitorovanie tuhnutia betónových zmesí

**Začiatok spolupráce:** 2010

**Stručný opis aplikácie/výsledku:** Zrealizovali sme prvé porovnávacie experimenty monitorovania tuhnutia betónových zmesí v akreditovanom laboratóriu. Cieľom je dobudovať metodiku monitorovania tak, aby mohla byť zaradená medzi štandardné testovacie metódy.

**Zhodnotenie (uviesť i finančný efekt z aplikácie v € pre organizáciu SAV):** Pripravujú sa spoločné projekty, ktoré zabezpečia finančný efekt pre FÚ a zároveň umožnia nadviazať užšie kontakty so stavebnými organizáciami. (kontakt FÚ: Ľ. Kubičár)

### **6.3. Iná činnosť využiteľná pre potreby spoločenskej praxe**

## **7. Spolupráca s aplikačnou a hospodárskou sférou okrem aktivít uvedených v kap. 2, 3, 4**

### **7.1. Spoločné pracoviská s aplikačnou sférou**

Názov pracoviska: Výskumné centrum svetla a svetelnej techniky

Partner(i): OMS Ltd. Dojč, STU Bratislava

Zameranie: Aplikačný projekt na výskum a vývoj pokročilých svietidiel

Rok založenia: 2010

Zhodnotenie: Začiatok realizácie projektu s objemom 939 990,- EUR je v roku 2011.

### **7.2. Kontraktový – zmluvný výskum (vrátane zahraničných kontraktov)**

Názov kontraktu: Monitorovanie tuhnutia betónových zmesí

Partner(i): *Betón Racio s.r.o. Trnava*

Začiatok spolupráce (v súlade s podpísaným kontraktom): 2011

Ukončenie spolupráce (ak ide o spoluprácu v krátkom období): trvá

Objem získaných prostriedkov v bežnom roku (€): 0

Stručný opis výstupu/výsledku: Realizovali sme demonštračný experiment monitorovania tuhnutia betónových zmesí priamo v priemyselnom akreditovanom laboratóriu. Cieľom je dobudovať metodiku monitorovania tak, aby mohla byť zaradená medzi štandardné testovacie metódy.

Zhodnotenie: Výsledky experimentu sú pozitívne a dávajú predpoklad k ďalšej užšej spolupráci na komerčnej, ako aj projektovej báze, s predpokladaným finančným efektom pre FÚ.

Názov kontraktu: Monitorovanie tuhnutia betónových zmesí

Partner(i): *Považská cementáreň a.s. Ladce*

Začiatok spolupráce (v súlade s podpísaným kontraktom): 2011

Ukončenie spolupráce (ak ide o spoluprácu v krátkom období): trvá

Objem získaných prostriedkov v bežnom roku (€): 1000

Stručný opis výstupu/výsledku: Realizovali sme demonštračný experiment priamo v teréne.

Zhodnotenie: Výsledky experimentu sú pozitívne a dávajú predpoklad ďalšej užšej spolupráci na komerčnej, ako aj projektovej báze. (kontakt FÚ: Ľ. Kubičár)

### **7.3. Iná činnosť využiteľná pre potreby hospodárskej praxe**

Dodávka a spracovanie materiálu pre ČVUT Praha (príjem 634 EUR)

## 8. Aktivity pre Národnú radu SR, vládu SR, ústredné orgány štátnej správy SR a iné organizácie

### 8.1. Členstvo v poradných zboroch vlády SR, Národnej rady SR, ministerstiev SR, orgánoch EÚ, EP, NATO a pod.

Tabuľka 8a Členstvo v poradných zboroch Národnej rady SR, vlády SR, ministerstiev SR, orgánoch EÚ, EP, NATO a pod.

Meno pracovníka	Názov orgánu	Funkcia
Doc. RNDr. Emil Běták, DrSc.	Pracovná skupina pre fyziku a vedy o Zemi a vesmíre Akreditačnej komisie	člen
RNDr. Stanislav Dubnička, DrSc.	vláda SR	Splnomocnený zástupca vlády SR v SÚJV Dubna
Ing. Štefan Gmuca, CSc.	Národný tím technických expertov pre posudzovanie tovarov a technológií dvojakého použitia a vojenského materiálu	člen
RNDr. Stanislav Hlaváč, CSc.	Rada Úradu jadrového dozoru SR	člen rady
RNDr. Dušan Janičkovič	Podporné štruktúry pre 7.RP EU	Národný kontaktný bod (NCP) pre programový smer "Nanovedy, nanomateriály, nové materiály a nové výrobné technológie" 7. RP
	Podporné štruktúry pre 7.RP EU	Národný expert pre programový smer "Nanovedy, nanomateriály, nové materiály a nové výrobné technológie" 7.RP
Prof. Ing. Štefan Luby, DrSc.	Programový výbor Bezpečnosť v 7. RP	člen
RNDr. Eva Majková, DrSc.	High Level Group of EU Member States and FP7 Associated States on Nanoscience and Nanotechnologies	reprezentant SR
	Programový výbor pre program IDEAS za SR	reprezentant SR
RNDr. Štefan Olejník, DrSc.	Komisia pre obhajoby doktorských dizertačných prác vo vednom odbore 010308 - jadrová a subjadrová fyzika	predseda
Ing. Peter Švec, DrSc.	COST Domain Committee for MPNS	člen doménového výboru
	Department of Energy, Division of Materials Sciences and Engineering, Washington, USA	posudzovateľ
Mgr. Martin Veselský, PhD.	Výbor pre spoluprácu SR s CERN (Poradný orgán MŠ SR)	člen

### 8.2. Expertízna činnosť a iné služby pre štátnu správu a samosprávu

**Názov expertízy:** hovorca Dunajskej akademickej konferencie

**Adresát expertízy:** EK

**Spracoval:** Prof. Ing. Štefan Luby, DrSc.

**Stručný opis:** organizácia činnosti AV v Dunajskej stratégii

### 8.3. Členstvo v radách štátnych programov a podprogramov ŠPVV a ŠO

Tabuľka 8b Členstvo v radách štátnych programov a podprogramov ŠPVV a ŠO

Meno pracovníka	Názov orgánu	Funkcia
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### 8.4. Prehľad aktuálnych spoločenských problémov, ktoré riešilo pracovisko v spolupráci s Kanceláriou prezidenta SR, s vládnyimi a parlamentnými orgánmi alebo pre ich potrebu

## 9. Vedecko-organizačné a popularizačné aktivity

### 9.1. Vedecko-popularizačná činnosť

#### 9.1.1. Najvýznamnejšia vedecko-popularizačná činnosť pracovníkov organizácie SAV

Tabuľka 9a Vedecko-popularizačná činnosť pracovníkov organizácie SAV

Meno	Spoluautori	Typ <sup>1</sup>	Názov	Miesto zverejnenia	Dátum alebo počet za rok
Mgr. Erik Bartoš, PhD.	P.Filip, PhD.	2xPB	Deň otvorených dverí FÚ SAV	FÚ SAV	9.11.2012
Mgr. Erik Bartoš, PhD.		TL	Polstoročie na špici výskumu	Quark	2012
RNDr. Monika Benkovičová	K.Gmucová, J.Hoško, K.Végső, J. Ivančo	5xiné	Noc výskumníka, prezentácia výskumných aktivít v OMN	Stará tržnica, Bratislava	28.9.2012
Doc. RNDr. Emil Běták, DrSc.		PB	Amerika očima českého vědce	Český spolek Bratislava	31.1.2012
Doc. RNDr. Emil Běták, DrSc.		PB	R. Bošković - muž, ktorý predbehol svoju dobu o 200 rokov	Quo Vadis, Bratislava	7.3.2012
Ing. Vlastimil Boháč, CSc.	oddelenie OFK FÚ SAV	iné	Noc výskumníka	Stará tržnica, Bratislava	28.9.2012
Ing. Vlastimil Boháč, CSc.	OFK FU	PB	Deň otvorených dverí 2012	laboratórium termofyziky	9.11.2012
RNDr. Stanislav Dubnička, DrSc.		TV	Komentár k stavu Cyklotrónového centra SR	STV	15.3.2012
Mgr. Peter Filip, PhD.		PB	Deň otvorených dverí FÚ	Bratislava, FÚ SAV	9.11.2012
Mgr. Peter Filip, PhD.		PB	Festival Fyziky 2012	Smolenický zámok	17.4.2012
Mgr. Peter Filip, PhD.	Erik Bartoš	PB	Noc výskumníkov 2012 / POSTER	Bratislava, Stará tržnica	28.9.2012
Ing. Ján Ivančo, PhD.		PB	Deň otvorených dverí (Nanočasticové plynové senzory)	FÚ SAV	9.11.2012
RNDr. Dušan Janičkovič		PB	FP7 – téma NMP: PPP projekty – výzva na rok 2013	Informačno-konzultačný deň pre MSP k posledným výzvam 7.RP, Bratislava	4.9.2012
RNDr. Dušan Janičkovič		PB	Nanomateriály a 7.RP	NANO INFO DEŇ, Svit	20.9.2012
RNDr. Dušan Janičkovič		PB	Špecifiká projektov 7.RP: Špecifický program „Spolupráca“	Seminár "Podávame projekt 7. RP, SOVVA, SvF STU Bratislava	5.9.2012
RNDr. Dušan Janičkovič		PB	Štruktúra projektu, výstupy projektu, projektové konzorcium	Seminár "Podávame projekt 7. RP, TU Košice	2.10.2012
RNDr. Dušan Janičkovič		PB	Témy výzvy NMP-2013 - klasické projekty	Slovenská poľnohospodárska univerzita v Nitre	14.6.2012

RNDr. Dalibor Krupa, CSc.		PB	Hľadanie Higgsa	Science on Stage Slovakia	15.4.2012
RNDr. Dalibor Krupa, CSc.		PB	Teória relativity a postmoderný relativizmus	FF UKF Nitra	21.6.2012
RNDr. Dalibor Krupa, CSc.		PB	Teória relativity a relativizmus	ÚSKI Bratislava	2.10.2012
RNDr. Dalibor Krupa, CSc.		PU	Tvorivý učiteľ fyziky	ISBN 978-80-970625-7-6 Košice, Internetová stránka SFS	2012
Ing. Ľudovít Kubičár, DrSc.		IN	Des capteurs thermiques innovants au Laboratoire de thermophysique de l'Académie slovaque des sciences	<a href="http://www.bulletins-electroniques.com/actualites/71063.htm">http://www.bulletins-electroniques.com/actualites/71063.htm</a>	25.9.2012
Prof. Ing. Štefan Luby, DrSc.		TL	Fyzik rieši rovnice bezpečia	Pravda, 10. 3. 2012	10.3.2012
Prof. Ing. Štefan Luby, DrSc.		TV	O Eur. akad. vied a umení	TV	8.3.2012
Prof. Ing. Štefan Luby, DrSc.		TV	Obnoviteľné zdroje energie	TA3	14.9.2012
RNDr. Eva Majková, DrSc.	P. Šiffalovič	2xiné	Noc výskumníka, prezentácia OMN výskumných aktivít	Stará tržnica, Bratislava	28.9.2012
Mgr. Daniel Nagaj, PhD.		2xPB	Aký veľký je vesmír?	Cirk. škola Narnia Gym. Ľ. Štúra Zvolen	8.3.2012 9.5.2012
Mgr. Daniel Nagaj, PhD.		PB	Aký veľký je vesmír?	Gymnázium Ľ. Štúra, Zvolen	
Mgr. Daniel Nagaj, PhD.		PB	Analógové počítanie	Gymnázium Metodova, Bratislava	12.6.2012
Mgr. Daniel Nagaj, PhD.		PB	Fyzika hudby, hudba fyziky	Gymnázium T. Vansovej, Stará Ľubovňa	23.3.2012
Mgr. Daniel Nagaj, PhD.		PB	Meranie času	Gymnázium T. Vansovej, Stará Ľubovňa	23.3.2012
Mgr. Daniel Nagaj, PhD.		PB	Od zemeplochy k veľkému tresku	Gymnázium Ľ. Stockela, Bardejov	21.5.2012
RNDr. Štefan Olejník, DrSc.		PB	Načo je nám higgsón? - populárna prednáška	Oddelenie fyziky ÚJFI FEI STU	13.4.2012
Ing. Peter Švec, DrSc.		EX	Exkurzia študentov FEI STU	FÚ SAV	28.2.2012
Ing. Peter Švec, DrSc.		iné	Noc výskumníka	Bratislava, Stará tržnica	28.9.2012
Mgr. Martin Venhart, PhD.		PB	Datalan IT forum 2012	Hotel Gate One Bratislava	30.5.2012
Mgr. Martin Venhart, PhD.		RO	Rozhovor s M. Venhartom z Fyzikálneho ústavu SAV	SRO	13.2.2012
Mgr. Martin Venhart, PhD.		TL	Veda je aj o šťastí	DATALAN News	1.11.2012
Mgr. Martin Venhart, PhD.	M. Veselský, V. Matoušek, D. Klč, M.Sedlák	iné	Noc výskumníka	Stará tržnica, Bratislava	31.10.2012

Mgr. Martin Venhart, PhD.	Martin Veselský	TL	Slováci šéfuju experimentu v CERN- e	denník SME	26.1.2012
RNDr. Martin Plesch, PhD.		PB	Fyzika očami fyzikov	www.physics.sk/fof	10
RNDr. Martin Plesch, PhD.	František Kundracik	iné	Olympiáda mladých vedcov	www.ijso.sk	4
RNDr. Martin Plesch, PhD.	František Kundracik	iné	Turnaj mladých fyzikov	www.tmfir.sk	5

<sup>1</sup> PB - prednáška/beseda, TL - tlač, TV - televízia, RO - rozhlas, IN - internet, EX - exkurzia, PU - publikácia, MM - multimédia, DO - dokumentárny film

### 9.1.2. Súhrnné počty vedecko-popularizačných činností organizácie SAV

Tabuľka 9b Súhrnné počty vedecko-popularizačných činností organizácie SAV

Typ	Počet	Typ	Počet	Typ	Počet
prednášky/besedy	31	tlač	4	TV	3
rozhlas	1	internet	1	exkurzie	2
publikácie	1	multimediálne nosiče	0	dokumentárne filmy	0
iné	16				

### 9.2. Vedecko-organizačná činnosť

Tabuľka 9c Vedecko-organizačná činnosť

Názov podujatia	Domáca/ medzinárodná	Miesto	Dátum konania	Počet účastníkov
Festival fyziky 2012, Tvorivý učiteľ fyziky	domáca	Smolenice	15.04.-18.04.2012	82
Fyzika a Etika VII	domáca	Univerzita Konštantína Filozofa, Nitra	21.06.-22.06.2012	56
Letná škola Matematickej Fyziky VI.	domáca	Stará Lesná, Slovensko	20.08.-26.08.2012	28
19. konferencia slovenských fyzikov	domáca	Prešov	03.09.-06.09.2012	93
THERMOPHYSICS 2012	domáca	Guesthouse Adam, Podkylava, Slovakia	31.10.-02.11.2012	45
Prínos spolupráce s nadnárodnými vedeckými spoločnosťami 2012	domáca	Bratislava	09.11.-09.11.2012	48
MECO37, Conference of the Middle European Cooperation in Statistical Physics	medzinárodná	Tatranské Matliare, hotel Hutník, Vysoké Tatry	19.03.-21.03.2012	65
SURFINT-SREN III 2012, Progress in Applied Surface, Interface, and Thin Film Science 2012	medzinárodná	Florencia (Taliansko)	14.05.-19.05.2012	175
CEQIP 2012 - Central	medzinárodná	Smolenice,	07.06.-10.06.2012	66

European Quantum Information Processing		Slovensko		
Relativistic Nuclear Physics: From Hundreds MeV to TeV, 2012	medzinárodná	Stará Lesná, Slovensko	18.06.-22.06.2012	38

### 9.3. Účasť na výstavách

Názov výstavy: Noc výskumníkov 2012, Festival vedy

Miesto konania: Bratislava, Stará tržnica

Dátum: 9.11.2012

Zhodnotenie účasti: Veľmi vydarená akcia pre FÚ SAV, prezentovalo sa 5(+1) oddelení, v 6 samostatných stánkoch.

### 9.4. Účasť v programových a organizačných výboroch národných konferencií

Tabuľka 9d Programové a organizačné výbory národných konferencií

Typ výboru	Programový	Organizačný	Programový i organizačný
Počet členstiev	0	3	5

### 9.5. Členstvo v redakčných radách časopisov

Prof. RNDr. Vladimír Bužek, DrSc.

Acta Physica Slovaca (funkcia: editor)

European Physical Journal D (funkcia: editor)

Journal of Modern Optics (funkcia: člen redakčnej rady)

RNDr. Stanislav Dubnička, DrSc.

MEDICUS (funkcia: člen red. rady)

Mgr. Andrej Gendiar, PhD.

Acta Physica Slovaca (funkcia: manag. editor)

RNDr. Dalibor Krupa, CSc.

Obzory matematiky, fyziky a informatiky (funkcia: člen)

Ing. Štefan Lányi, DrSc.

Československý časopis pro fyziku (funkcia: člen RR)

Prof., Ing. Štefan Luby, DrSc.

Contemporary Materials (funkcia: člen red. rady)

J. Electrical Engn. (funkcia: člen red. rady)

prof. Ing. Ivan Štich, DrSc.



Acta Physica Slovaca (funkcia: člen edičnej rady)

Ing. Peter Švec, DrSc.

Journal of Materials Science and Technology (funkcia: člen redakčnej rady)

Kovové materiály - Metallic Materials (funkcia: člen redakčnej rady)

## **9.6. Činnosť v domácich vedeckých spoločnostiach**

RNDr. Juraj Boháčik, CSc.

SFS (funkcia: hospodár)

RNDr. Beata Butvinová, CSc.

Slovenská magnetická spoločnosť (funkcia: člen riadiaceho výboru)

Prof. RNDr. Vladimír Bužek, DrSc.

Učená spoločnosť SAV (funkcia: predseda)

Mgr. Peter Filip, PhD.

Slovenská fyzikálna spoločnosť (funkcia: člen výboru)

Ing. Štefan Gmuca, CSc.

Slovenská fyzikálna spoločnosť (funkcia: revízna komisia)

Ing. Matej Jergel, DrSc.

Odborná skupina chémie a fyziky tuhých látok (funkcia: člen)

RNDr. Dalibor Krupa, CSc.

Národný komitét IUPAP (funkcia: člen)

Rada slovenských vedeckých spoločností (funkcia: predseda)

Slovenská fyzikálna spoločnosť (funkcia: vedecký tajomník)

RNDr. Martin Plesch, PhD.

Odborná komisia Turnaja mladých fyzikov (funkcia: člen)

RNDr. Daniel Reitzner, PhD.

Club of Individualities, Intenda Foundation (funkcia: Member)

Ing. Peter Švec, DrSc.

Národný komitét IUPAP (funkcia: člen)

Pracovníci FÚ SAV sú tiež členmi (konkrétne mená tu neuvádzame):

Slovenskej magnetickej spoločnosti pri SVTS,  
Slovenskej vákovej spoločnosti,  
Slovenskej chemickej spoločnosti,  
Jednoty slovenských matematikov a fyzikov (JSMF)

Učená spoločnosť SAV

(funkcia: riadny člen):

RNDr. E. Majková, DrSc.  
RNDr. Štefan Olejník, DrSc.  
prof. Ing. Ivan Štich, DrSc.  
Ing. Peter Švec, DrSc.

(funkcia: emeritný člen):

prof. Ing. Štefan Luby, DrSc.

#### **9.7. Iné dôležité informácie o vedecko-organizačných a popularizačných aktivitách**

## 10. Činnosť knižnično-informačného pracoviska

### 10.1. Knižničný fond

Tabuľka 10a Knižničný fond

<b>Knižničné jednotky spolu</b>		10417
z toho	knihy a zviazané periodiká	10417
	audiovizuálne dokumenty	
	elektronické dokumenty (vrátane digitálnych)	
	mikroformy	
	iné špeciálne dokumenty - dizertácie, výskumné správy	154
Počet titulov dochádzajúcich periodík		28
z toho zahraničné periodiká		25
Ročný prírastok knižničných jednotiek		45
v tom	kúpou	42
	darom	3
	výmenou	
	bezodplatným prevodom	
Úbytky knižničných jednotiek		
Knižničné jednotky spracované automatizovane		1235

### 10.2. Výpožičky a služby

Tabuľka 10b Výpožičky a služby

<b>Výpožičky spolu</b>		860
z toho	odborná literatúra pre dospelých	
	výpožičky periodík	360
	prezenčné výpožičky	500
MVS iným knižniciam		38
MVS z iných knižníc		410
MMVS iným knižniciam		
MMVS z iných knižníc		
Počet vypracovaných bibliografií		
Počet vypracovaných rešerší		2

### 10.3. Používatelia

Tabuľka 10c Užívatelia

Registrovaní používatelia	82
Návštevníci knižnice spolu (bez návštevníkov podujatí)	110

#### 10.4. Iné údaje

Tabuľka 10d Iné údaje

On-line katalóg knižnice na internete ( 1=áno, 0=nie)	1
Náklady na nákup knižničného fondu v €	1995,25

#### 10.5. Iné informácie o knižničnej činnosti

## **11. Aktivity v orgánoch SAV**

### **11.1. Členstvo vo Výbore Snemu SAV**

### **11.2. Členstvo v Predsedníctve SAV a vo Vedeckej rade SAV**

RNDr. Eva Majková, DrSc.

- člen Vedeckej rady SAV
- podpredseda pre vedu a výskum

### **11.3. Členstvo vo vedeckých kolégiách SAV**

Ing. Matej Jergel, DrSc.

- VK SAV pre matematiku, fyziku a informatiku (člen)

RNDr. Marián Krajčí, DrSc.

- VK SAV pre matematiku, fyziku a informatiku (člen)

Ing. Štefan Lányi, DrSc.

- VK SAV pre elektroniku, materiálový výskum a technológie (predseda)

RNDr. Ladislav Šamaj, DrSc.

- VK SAV pre matematiku, fyziku a informatiku (člen)

### **11.4. Členstvo v komisiách SAV**

Mgr. Andrej Gendiar, PhD.

- Edičná rada SAV (člen)

RNDr. Marián Krajčí, DrSc.

- Komisia SAV pre vyhodnocovanie medzinárodných projektov (člen)

Prof., Ing. Štefan Luby, DrSc.

- Porota pre udeľovanie Medzinárodnej ceny SAV (člen)

RNDr. Eva Majková, DrSc.

- Komisia SAV pre vednú politiku a prognózy vývoja vedy a spoločnosti (predseda)
- Rada programu centier excelentnosti SAV (člen)
- Rada SAV pre vzdelávanie a doktorandské štúdium (člen)

RNDr. Štefan Olejník, DrSc.

- Komisia SAV pre informačné a komunikačné technológie (člen)

### **11.5. Členstvo v orgánoch VEGA**

Ing. Ján Ivančo, PhD.

- Komisia VEGA č.5 pre elektrotechniku, automatizáciu a riadiace systémy a príbuzné odbory informačných a komunikačných technológií (člen)

Ing. Matej Jergel, DrSc.

- Komisia č.7 pre strojárstvo a príbuzné odbory informačných a komunikačných technológií a materiálové inžinierstvo (člen)

RNDr. Marián Krajčí, DrSc.

- Komisia č. 1 (člen)

Ing. Peter Švec, DrSc.

- komisia VEGA č. 1 (člen)

Mgr. Martin Veselský, PhD.

- komisia VEGA č. 1 (člen)

## 12. Hospodárenie organizácie

### 12.1. Náklady PO SAV

Tabuľka 12a Náklady PO SAV (v €)

Kategória	Plán na rok 2012 (posl. uprav.)	Skutočnosť k 31.12.2012 celkom	z toho:	
			z príspevku	z vlastných zdrojov
<b>Kapitálové výdavky</b>	209104	253519	209104	44415
<b>Náklady spolu:</b>	1631466	3660834	1631466	2029369
z toho:				
- mzdové náklady (účet 521)	898920	1224393	898920	325473
- odvody do poisťovní a NÚP (účet 524-525)	310128	403203	310128	93075
- vedecká výchova	72851	108707	72851	35856
- náklady na projekty (VEGA, APVT, APVV, ŠPVV, MVTP, ESF a i.)	282983		282983	
- náklady na vydávanie periodickej tlače	11199	11199	11199	11199

### 12.2. Tržby PO SAV

Tabuľka 12b Tržby PO SAV (v €)

Kategória	Plán na rok 2012	Plnenie k 31.12.2012
<b>Výnosy spolu:</b>	1676466	3493902
z toho:		
- príspevok na prevádzku (účet 691)	1631466	1631466
- vlastné tržby spolu:	45000	105043
z toho:		
- tržby za nájomné	32000	14999
- tržby za riešenie projektov (tuzemských + zahraničných, z účtu 64)	13000	31502

### **13. Nadácie a fondy pri organizácii SAV**

Názov: Fond na podporu mladých pracovníkov FÚ

Zameranie: Prostriedky 9.812,54 Eur určené na podporu mladých vedeckých pracovníkov

Opis: Vytvorený na oddelení CVKI z daru občianskeho združenia Quniverse.



## **14. Iné významné činnosti organizácie SAV**

## **15. Vyznamenania, ocenenia a ceny udelené pracovníkom organizácie v roku 2012**

### **15.1. Domáce ocenenia**

#### **15.1.1. Ocenenia SAV**

##### **Hlaváč Stanislav**

Čestná plaketa SAV Dionýza Ilkoviča za zásluhy vo fyzikálno-chemických vedách

*Oceňovateľ: SAV*

##### **Švec Peter**

Cena SAV

*Oceňovateľ: Vedecká rada SAV*

#### **15.1.2. Iné domáce ocenenia**

##### **Luby Štefan**

Ocenenie pri výročí JSMF

*Oceňovateľ: minister školstva*

*Opis: minister školstva*

##### **Luby Štefan**

Ocenenie pri výročí STU

*Oceňovateľ: rektor STU*

*Opis: rektor STU*

### **15.2. Medzinárodné ocenenia**

##### **Hartmanová Mária**

Certificate of Appreciation (ACS)

*Oceňovateľ: American Chemical Society*

*Opis: San Diego, 25. Marec*

##### **Illeková Emília**

The scientific bibliographical profile of E. Illeková in the "Who's Who in the World"

*Oceňovateľ: Marquis Who's Who*

**16. Poskytovanie informácií v súlade so zákonom č. 211/2000 Z. z. o slobodnom prístupe k informáciám v znení neskorších predpisov (Zákon o slobode informácií)**

## **17. Problémy a podnety pre činnosť SAV**

**Správu o činnosti organizácie SAV spracoval(i):**

**Riaditeľ organizácie SAV:**

.....  
RNDr. Stanislav Hlaváč, CSc.

**Vedecký tajomník FÚ:**

.....  
Mgr. Peter Filip, PhD.

**Schválené Vedeckou radou FÚ SAV, 30. januára 2013**

.....  
Doc. RNDr. Emil Běťák, DrSc.  
predseda VR

**Príloha A****Zoznam zamestnancov a doktorandov organizácie k 31.12.2012****Zoznam zamestnancov podľa štruktúry (nadväzne na údaje v Tabuľke 1a)**

	<b>Meno s titulmi</b>	<b>Úväzok (v %)</b>	<b>Ročný prepočítaný úväzok</b>
<b>Vedúci vedeckí pracovníci DrSc.</b>			
1.	Doc. RNDr. Emil Běták, DrSc.	100	1.00
2.	prof. RNDr. Vladimír Bužek, DrSc.	100	1.00
3.	RNDr. Stanislav Dubnička, DrSc.	75	0.75
4.	RNDr. Mária Hartmanová, DrSc.	15	0.24
5.	RNDr. Emília Illeková, DrSc.	100	1.00
6.	Ing. Matej Jergel, DrSc.	100	1.00
7.	Ing. Ján Kliman, DrSc.	100	1.00
8.	RNDr. Marián Krajčí, DrSc.	100	1.00
9.	Ing. Ľudovít Kubičár, DrSc.	75	0.75
10.	Ing. Štefan Lányi, DrSc.	100	1.00
11.	prof. Ing. Štefan Luby, DrSc.	100	1.00
12.	prof. RNDr. Eva Majerníková, DrSc.	5	0.05
13.	RNDr. Eva Majková, DrSc.	60	0.60
14.	RNDr. Miroslav Nagy, DrSc.	100	0.00
15.	RNDr. Štefan Olejník, DrSc.	100	1.00
16.	RNDr. Ladislav Šamaj, DrSc.	100	1.00
17.	prof. Ing. Ivan Štich, DrSc.	100	1.00
18.	Ing. Peter Švec, DrSc.	100	1.00
<b>Vedúci vedeckí pracovníci CSc., PhD.</b>			
1.	RNDr. Stanislav Hlaváč, CSc.	100	1.00
2.	RNDr. Dalibor Krupa, CSc.	50	0.50
3.	RNDr. Peter Mraňko, CSc.	25	0.31
4.	RNDr. Anton Šurda, CSc.	50	0.50
5.	RNDr. Gabriel Vlasák, CSc.	35	0.35
<b>Samostatní vedeckí pracovníci</b>			
1.	Mgr. Erik Bartoš, PhD.	100	1.00
2.	Ing. Vlastimil Boháč, CSc.	100	1.00
3.	RNDr. Juraj Boháčik, CSc.	50	0.50
4.	RNDr. Pavol Butvin, CSc.	100	1.00
5.	RNDr. Beata Butvinová, CSc.	100	1.00

6.	Mgr. Andrej Gendiar, PhD.	100	1.00
7.	Ing. Štefan Gmuca, CSc.	100	1.00
8.	RNDr. Katarína Gmucová, CSc.	100	1.00
9.	Doc. RNDr. Miroslav Grajcar, DrSc.	25	0.18
10.	Ing. Ján Ivančo, PhD.	100	1.00
11.	RNDr. Pavol Kalinay, CSc.	100	1.00
12.	RNDr. Lubomir Martinovič, CSc.	100	0.00
13.	RNDr. Igor Maťko, CSc.	100	1.00
14.	Ing. Vladislav Matoušek, CSc.	100	1.00
15.	RNDr. Marek Mihalkovič, CSc.	100	0.75
16.	Ing. Vojtech Nádaždy, CSc.	100	1.00
17.	Mgr. Daniel Nagaj, PhD.	100	0.66
18.	RNDr. Emil Pinčík, CSc.	100	1.00
19.	RNDr. Martin Plesch, PhD.	100	0.66
20.	Ing. Mgr. Peter Staňo, PhD.	100	0.08
21.	RNDr. Ondrej Šauša, CSc.	100	1.00
22.	Dr. Rer. Nat. Peter Šiffalovič, PhD.	100	1.00
23.	Ing. Igor Travěnek, CSc.	100	1.00
24.	Ing. Ivan Turzo, CSc.	30	0.30
25.	Mgr. Martin Venhart, PhD.	100	1.00
26.	Mgr. Martin Veselský, PhD.	100	1.00
27.	Doc. Mgr. Mário Ziman, PhD	100	0.42
<b>Vedeckí pracovníci</b>			
1.	Mgr. Cyril Adamuščin, PhD.	100	1.00
2.	Mgr. Ján Brndiar, PhD.	100	1.00
3.	RNDr. Róbert Brunner, CSc.	100	1.00
4.	RNDr. René Derian, PhD.	100	1.00
5.	Ing. Danica Fidríková, PhD.	100	0.28
6.	Mgr. Peter Filip, PhD.	100	1.00
7.	Ing. Yuriy Halahovets, PhD.	100	1.00
8.	Ing. Teodóra Kocsisová, PhD.	20	0.20
9.	Mgr. Roman Krčmár, PhD.	100	0.00
10.	Mgr. Lubos Krupa, PhD.	100	0.00
11.	Dr. Ing. Mgr. Andrej Liptaj, PhD.	100	1.00
12.	Mgr. Viktor Majerník, PhD.	20	0.20

13.	Mgr. Kristian Petrík, PhD.	70	0.73
14.	Mgr. Gabriela Pleschová, PhD.	83	0.69
15.	Mgr. Peter Rapčan, PhD.	100	1.00
16.	RNDr. Daniel Reitzner, PhD.	100	0.00
17.	Ing. Jaroslav Rusnák, PhD.	100	1.00
18.	Mgr. Tomáš Rybár, PhD.	100	0.05
19.	Mgr. Michal Sedlák, PhD.	100	1.00
20.	PhD. Eszter Simon, PhD.	4	0.04
21.	Ing. Vladimír Štofanič, PhD.	25	0.37
22.	Ing. Peter Švec, Jr., PhD.	100	0.37
23.	Dr. Lukas Theussl, PhD.	100	1.00
24.	RNDr. Robert Turanský, PhD.	100	1.00
25.	Ing. Viliam Vretenár, PhD.	100	1.00
<b>Odborní pracovníci s VŠ vzdelaním</b>			
1.	RNDr. Monika Benkovičová	5	0.05
2.	Bc. Zuzana Branická	100	0.12
3.	Mgr. Michal Daniška	5	0.05
4.	Mgr. Lenka Duffalová	78	0.78
5.	Ing. Aneta Fecková	58	0.33
6.	Mgr. Jozef Genzor	5	0.02
7.	Mgr. Martin Hodas	5	0.02
8.	Ing. Lucia Horváthová	5	0.05
9.	Ing. Jozef Hoško	5	0.05
10.	RNDr. Dušan Janičkovič	100	1.00
11.	Ing. Irena Janotová	5	0.05
12.	Mgr. Ursula Juhássová	55	0.23
13.	Ing. Mária Jusková	35	0.35
14.	Ing. Mário Kotlár	31	0.23
15.	Ing. Jana Kováčová	100	1.00
16.	Mgr. Lucia Kuchtová	100	1.00
17.	Mgr. Martina Miklošovičová	5	0.00
18.	Ing. Rudolf Senderák, Piešťany	100	1.00
19.	Mgr. Ivan Siváček	5	0.05
20.	Prom. knih. Božena Številová	50	0.50
21.	Mgr. Karol Végső	5	0.05



22.	Ing. Erika Verešová	29	0.06
23.	Mgr. Andrej Vojtko	5	0.02
24.	Ing. Martina Zemanová	100	0.94
25.	Ing. Marta Zofčáková	65	0.65
<b>Odborní pracovníci ÚSV</b>			
1.	Marta Bubničová	100	1.00
2.	Ľubomír Dostál	50	0.50
3.	Dana Haasová	100	1.00
4.	Michal Halász	100	1.00
5.	Emília Hoffmanová	100	1.00
6.	Alena Janičinová	100	1.00
7.	Lenka Kabátová	100	1.00
8.	Jana Koláriková	100	1.00
9.	Štefan Lučanský, dielňa	100	1.00
10.	Marian Markovič	100	1.00
11.	Jana Nekanovičová	100	0.08
12.	Vladimir Palanský, dielňa	100	1.00
13.	Ružena Palovská	100	0.42
14.	Gustáv Pomšár, ved. dielne, technik	100	1.00
15.	Miroslav Popelák, Piešťany	50	0.50
16.	Mária Reháková	100	0.00
17.	Ivan Sabo	60	0.25
18.	Peter Zitto	100	1.00
19.	Jana Zvončeková, Piešťany	100	1.00

**Zoznam zamestnancov, ktorí odišli v priebehu roka**

	<b>Meno s titulmi</b>	<b>Dátum odchodu</b>	<b>Ročný prepočítaný úväzok</b>
<b>Vedúci vedeckí pracovníci CSc., PhD.</b>			
1.	Ing. Jozef Krištiak, CSc.	23.11.2012	0.75
<b>Vedeckí pracovníci</b>			
1.	Stefano Facchini, PhD.	30.4.2012	0.33
2.	Ing. Marko Fulop, CSc.	31.8.2012	0.17
3.	Ing. Martin Weis, PhD.	30.6.2012	0.16
<b>Odborní pracovníci s VŠ vzdelaním</b>			
1.	Mgr. Maksym Demydenko, PhD.	30.10.2012	0.42

2.	Ing. Matúš Dubecký	28.9.2012	0.09
3.	Bc. Marek Krúpa	29.2.2012	0.16
4.	Mgr. Barbora Sláviková	31.5.2012	0.02
5.	RNDr. Pavol Surovec	30.9.2012	0.75
6.	Mgr. Dmitro Vorobiov	4.5.2012	0.08
<b>Odborní pracovníci ÚSV</b>			
1.	Ľubomír Dudáš	11.12.2012	0.95

**Zoznam doktorandov**

	<b>Meno s titulmi</b>	<b>Škola/fakulta</b>	<b>Študijný odbor</b>
<b>Interní doktorandi hrazení z prostředků SAV</b>			
1.	RNDr. Monika Benkovičová	Fakulta elektrotechniky a informatiky STU	5.2.48 fyzikálne inžinierstvo
2.	Mgr. Libor Caha	Fakulta matematiky, fyziky a informatiky UK	4.1.2 všeobecná fyzika a matematická fyzika
3.	Mgr. Michal Daniška	Fakulta matematiky, fyziky a informatiky UK	4.1.2 všeobecná fyzika a matematická fyzika
4.	Mgr. Jozef Genzor	Fakulta matematiky, fyziky a informatiky UK	4.1.2 všeobecná fyzika a matematická fyzika
5.	Mgr. Martin Hodas	Fakulta matematiky, fyziky a informatiky UK	4.1.4 kvantová elektronika a optika
6.	Ing. Jozef Hoško	Fakulta elektrotechniky a informatiky STU	5.2.48 fyzikálne inžinierstvo
7.	Ing. Irena Janotová	Fakulta elektrotechniky a informatiky STU	5.2.48 fyzikálne inžinierstvo
8.	Mgr. Martina Miklošovičová *MD	Fakulta matematiky, fyziky a informatiky UK	4.1.5 jadrová a subjadrová fyzika
9.	Mgr. Ivan Siváček	Fakulta matematiky, fyziky a informatiky UK	4.1.5 jadrová a subjadrová fyzika
10.	Mgr. Karol Végső	Fakulta matematiky, fyziky a informatiky UK	4.1.4 kvantová elektronika a optika
11.	Mgr. Andrej Vojtko	Fakulta matematiky, fyziky a informatiky UK	4.1.3 fyzika kondenzovaných látok a akustika
<b>Interní doktorandi hrazení z jiných zdrojov</b>			
1.	Ing. Lucia Horváthová	Fakulta matematiky, fyziky a informatiky UK	4.1.3 fyzika kondenzovaných látok a akustika
<b>Externí doktorandi</b>			
1.	Mgr. Jozef Leja	Fakulta matematiky, fyziky a informatiky UK	4.1.5 jadrová a subjadrová fyzika

\*MD = materská dovolenka

## **Príloha B**

### **Projekty riešené v organizácii**

#### **Medzinárodné projekty**

#### **Programy: Medziakademická dohoda (MAD)**

##### **1.) Štruktúra vákua a mechanizmus uväznenia v $SU(N)$ škálovacích teóriách** (*Vacuum structure and confinement mechanism in $SU(N)$ gauge theories*)

**Zodpovedný riešiteľ:** Juraj Boháčik  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Oleg Borisenko, Bogolyubov Institute for Theoretical Physics  
**Počet spoluriešiteľských inštitúcií:** 1x Ukrajina  
**Čerpané financie:**

Podpora medzinárodnej spolupráce z národných zdrojov: 200 €

##### Dosiahnuté výsledky:

Pokračovali sme v analytických výpočtoch uväznenia kvarkov pomocou plaketovej formulácie pre mriežkové škálovacie modely. Model pre popis uväznenia pomocou monopólov je v štádiu dokončovania.

##### **2.) Doménová štruktúra a magnetoelastické javy v magneticky mäkkých amorfných a nanokryštalických zliatinách** (*Domain Structure and magnetoelastic effects in soft-magnetic amorphous and nanocrystalline alloys*)

**Zodpovedný riešiteľ:** Gabriel Vlasák  
**Trvanie projektu:** 1.1.2010 / 31.12.2012  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 2 - Poľsko: 1, Slovensko: 1  
**Čerpané financie:** 0

##### Dosiahnuté výsledky:

Pri vyšetřovaní doménovej štruktúry (DŠ) materiálov typu Finemet sme na štandardnom zložení identifikovali primárne povrchové domény, ktoré sú rôzne orientované voči pozdĺžnej osi pásy na jej lesklej a matnej strane. Rôznosť DŠ na oboch povrchoch pásy bola prisúdená mechanickým napätiam pôsobiacim počas nanokryštalizácie (vzniká creepom indukovaná anizotropia), avšak u Finemetov s nízkym obsahom Si (s o rád vyššou magnetostrikciou) hlavný vplyv na výslednú magnetickú anizotropiu má magnetoelastická interakcia. Pri dlhodobom inertnom žíhaní bola na povrchu pozorovaná DŠ patriaca magneticky tvrdej vrstve pochádzajúcej od kyslíčnikov železa. Na Co kovových sklách žíhaných v priečnom magnetickom poli sme pomocou sledovania DŠ zistili

značné zmeny magnetickej anizotropie pri ohýbaní pások do tvaru toroidu. Tieto poznatky boli ďalej využité pri konštrukcii jadier pre magnetické senzory.

Publikácie: 2 CC články, 1 v konf. zborníku, 1 poster

### **3.) Magnetické nanotvarovanie multivrstvových štruktúr** (*Magnetic, lateral nano-patterning of multilayer structures, IPSAS and IMP PAS project*)

**Zodpovedný riešiteľ:** Eva Majková  
**Trvanie projektu:** 1.1.2010 / 31.12.2012  
**Evidenčné číslo projektu:** project-PAS-SAS  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 0

#### Dosiahnuté výsledky:

Vedecké výstupy neboli v čase uzávierky k dispozícii.

### **4.) Magneticky mäkké objemové kovové sklá a nanokompozity ako prekurzory pre senzory a aktuátory** (*Soft magnetic bulk metallic glasses and nanocomposites, precursors for sensors and actuators*)

**Zodpovedný riešiteľ:** Peter Švec  
**Trvanie projektu:** 1.1.2011 / 31.12.2012  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 2 - Nemecko: 2, Slovensko: 0  
**Čerpané financie:** U SAV: 372 €

#### Dosiahnuté výsledky:

Spolu s partnerom (IFW Dresden) sme pripravili unikátne dvojvrstvy na báze LaFeSi cielené pre dosiahnutie zvýšenia magnetokalorického javu v oblasti izbových teplôt. Počas pobytu mladých slovenských vedcov na pracovisku partnera sme pomocou vysokorozlišovacích elektrónomikroskopických metód stanovili usporiadanie v objemových kovových sklách a rýchloochladených magneticky mäkkých páskach (Appl. Surf. Sci. a J. Supercond. Nov. Magn.).

### **Programy: Medziústavná dohoda**

### **5.) Relativistická jadrová fyzika** (*Experimental Physics of Relativistic Heavy and Light Ions*)

**Zodpovedný riešiteľ:** Ján Kliman

**Trvanie projektu:** 1.1.2009 / 15.8.2013  
**Evidenčné číslo projektu:** 3983-1-09/11  
**Organizácia je** nie  
**koordinátorom projektu:**  
**Koordinátor:** Malachov A.I., Prof., DrSc.  
**Počet spoluriešiteľských** 0  
**inštitúcií:**  
**Čerpané financie:** Medzivládna dohoda: 28076 €

Dosiahnuté výsledky:

Bolo ukončené budovanie mnohokanálového spektrometrického zariadenia, pracujúceho na úplnej digitalizácii vstupných experimentálnych dát. Zariadenie zabezpečuje akumuláciu, triedenie, spracovanie a štatistické vyhodnotenie vysokých tokov experimentálnych dát bolo vybudované pre zber údajov z univerzálneho detekčného zariadenia projektu NICA.

**6.) SPIDER: nový prístroj pre meranie výťažku štiepnej reakcie** (*SPIDER: a new instrument for fission yield measurement*)

**Zodpovedný riešiteľ:** Ján Kliman  
**Trvanie projektu:** 1.6.2012 / 31.12.2015  
**Evidenčné číslo projektu:** LANL # 188558  
**Organizácia je** nie  
**koordinátorom projektu:**  
**Koordinátor:** Los Alamos National Laboratory  
**Počet spoluriešiteľských** 5 - Slovensko: 1, USA: 4  
**inštitúcií:**  
**Čerpané financie:** 0

Dosiahnuté výsledky:

Boli vyhotovené, otestované a koordinátorovi dodané dva páry superrýchlych koordinátnych detektorov spektrometra hmotnosti pracujúceho na princípe merania času prieletu fragmentov štiepenia konštantnou vzdialenosťou. Detektory, pracujúce s mikrokanálovými doštičkami dosahujú rekordné časové rozlíšenie ~100 ps.

**Programy: Medzivládna dohoda**

**7.) Syntéza a vlastnosti jadier na hranici stability** (*Synthesis and Properties of Nuclei at the Stability Line*)

**Zodpovedný riešiteľ:** Ján Kliman  
**Trvanie projektu:** 1.1.2010 / 1.1.2014  
**Evidenčné číslo projektu:**  
**Organizácia je** nie  
**koordinátorom projektu:**  
**Koordinátor:** Itkis M.G. Prof., DrSc.  
**Počet spoluriešiteľských** 0  
**inštitúcií:**  
**Čerpané financie:** 0

Dosiahnuté výsledky:

Bol vykonaný prvý experiment mass-spektrometrického určenia produktov jadrovej reakcie  $^{48}\text{Ca} + ^{238}\text{U}$ , supert ťažkého prvku  $Z=112$  – Copernicium. Boli vykonané tiež experimenty týkajúce sa účinnosti hmotnostného spektrometra "Masha". Bol ukončený projekt konštrukcie rotačného terča, ktorý umožní pracovať s vyšším výkonovým zaťažením.

**8.) Vytvorenie elektronickej aparatury pre experimenty v relativistickej fyzike ťažkých a ľahkých iónov na urýchľovači Nuklotrón** (*Creation of electronic equipment for experiments in relativistic nuclear physics of heavy and light ions at the Nuclotron accelerator*)

<b>Zodpovedný riešiteľ:</b>	Vladislav Matoušek
<b>Trvanie projektu:</b>	1.1.2012 / 31.12.2013
<b>Evidenčné číslo projektu:</b>	08626319/1020103-7400000000
<b>Organizácia je</b>	áno
<b>koordinátorom projektu:</b>	
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Rusko: 1
<b>Čerpané financie:</b>	JINR: 26000 €

Dosiahnuté výsledky:

V tomto sme roku zrealizovali modernizáciu časti hardvéru a softvéru stanice vnútorných terčov Nuklotrónu. Tieto časti boli skompletované na FÚ SAV. Hardvér tvorí priemyselný počítač s kontrolérom krokového motora, čítačov, ADC, DAC a číslicových vstupno-výstupných brán. Ďalej pozostáva z krokového motoru do vakuu s enkodérom polohy, príslušnej elektroniky a nastavovacieho softvéru.

Softvérovú časť tvorí program WinTarget, určený na riadenie pohybu terčov v profile zväzku, zberovej časti na zber dát z detektorov a grafického užívateľského rozhrania.

Pohyb terčov vo zväzku je možné presne zadať a synchronizuje sa s periódami pulzov urýchľovača. Pohyb sa automaticky koriguje v súlade s údajmi získanými z enkodéra, čím je zaistený presne definovaný pohyb terčov s presnosťou 0.2 mm.

Výsledky boli prezentované na konferencii RNP2012 v Starej Lesnej a v JINR Dubna.

**Prednášky:**

V. Matoušek, A.V.Afanasiev, I. Turzo: Recent status in hardware and software upgrade of the internal targets station of Nuclotron, RNP 2012, Stará Lesná, Slovensko, 2012.

V. Matoušek, A.V. Afanasiev, I. Turzo: Status of hardware and software upgrade of the internal targets station of Nuclotron and its possibilities", VBLHEP, Dubna, Ruská federácia, 2012.

**Programy: COST**

**9.) Pokročilá roentgenová priestorová a časová metrológia** (*Advanced X-ray spatial and temporal metrology*)

<b>Zodpovedný riešiteľ:</b>	Matej Jergel
<b>Trvanie projektu:</b>	16.11.2012 / 15.11.2016

**Evidenčné číslo projektu:** MP1203  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Dr Philippe ZEITOUN, CNRS LOA, ENSTA, Chemin de la Hunier, 91671 Palaiseau  
**Počet spoluriešiteľských inštitúcií:** 24 - Nemecko: 1, Dánsko: 1, Španielsko: 2, Estónsko: 1, Fínsko: 1, Francúzsko: 2, Veľká Británia: 4, Grécko: 1, Maďarsko: 1, Švajčiarsko: 1, Írsko: 2, Taliansko: 3, Poľsko: 1, Portugalsko: 1, Rumunsko: 1, Slovinsko: 1  
**Čerpané financie:** SAV: 1333 €

Dosiahnuté výsledky:

Memorandum o porozumení, ktoré vstúpilo oficiálne do platnosti 16.7.2012, podpísalo 17 krajín. Následne sa sformoval Riadiaci výbor Akcie, kde má každá krajina 2 zástupcov. Otvárací míting sa konal 16.11.2012 v Bruseli. Bolo vytvorených 5 pracovných skupín, kde bol prediskutovaný a navrhnutý pracovný plán Akcie a rozpočet na r. 2013. Odznala prehľadová prednáška o využití laserov a rtg žiarenia.

Pracovné skupiny:

1. Priestorová metrológia rtg optiky
2. Priestorová a časová metrológia rtg zdrojov
3. Diagnostika rtg koherentným a nekoherentným zobrazovaním
4. Poškodenie rtg optiky
5. Vysoko intenzívne a koherentné rtg zdroje pre priestorovú a časovú metrológiu

FÚ SAV sa zapojí do prac. skupiny 1. a 4.

- Začali sme s návrhom V-tvarovaných kanálikových kompresorov rtg zväzku pre malouhlový rtg rozptyl. Výpočty metódou ray tracing ukázali, že kompresný pomer možno zvýšiť laterálnou zmenou koncentrácie prímеси, rozdielnou teplotou alebo rôznym stupňom asymetrie difraktorov. To nám umožní zvýšiť rozlíšenie v priamom a recipročnom priestore, čo je osobitne dôležité pre štúdium nanoštruktúr.

- V rámci vývoja technológie finalizácie povrchov rtg monochromátorov sme ukázali výhody metódy jednobodového diamantového frézovania (single point diamond turning) oproti chemickému leptaniu na základe komplexnej charakterizácie na rôznych rozmerových škálach. To je dôležité pre minimalizáciu parazitného difúzneho rozptylu.

Výstupy:

D. Korytár, P. Vagovič, K. Végső, P. Šiffalovič, E. Dobročka, W. Jark, V. Áč, Z. Zápražný, C. Ferrari, A. Cecilia, E. Hamann, P. Mikulík, T. Baumbach, M. Fiederle: X-ray beam conditioning and imaging using higher asymmetry V-channel monochromators, J. Applied Crystallography (podané).

## 10.) Fundamentálne problémy kvantovej fyziky (*Fundamental Problems in Quantum Physics*)

**Zodpovedný riešiteľ:** Mário Ziman  
**Trvanie projektu:** 11.4.2011 / 10.4.2015  
**Evidenčné číslo projektu:** oc-2010-1-7320  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Dr. Angelo Bassi, Department of Physics, University of Trieste, Italy

**Počet spoluriešiteľských inštitúcií:** 7 - Rakúsko: 1, Nemecko: 1, Španielsko: 1, Veľká Británia: 1, Švajčiarsko: 1, Írsko: 1, Portugalsko: 1  
**Čerpané financie:**

Podpora medzinárodnej spolupráce z národných zdrojov: 4000 €

Dosiahnuté výsledky:

Postupnosť kontrolovaných zrážok medzi kvantovým systémom a prostredím (zloženým z množiny kvantových objektov) prirodzene simuluje (s ľubovoľnou presnosťou) ľubovoľnú Markovovskú kvantovú dynamiku uvažovaného systému. V tomto článku navrhujeme a študujeme problém simulácie ľubovoľného kvantového kanála prostredníctvom zrážkových modelov. Ukazujeme, že korelované prostredie umožňuje simulovať ne-Markovovský vývoj vedúci k ľubovoľnému nerozložiteľnému qubitovému kanálu. Predovšetkým odvodíme zodpovedajúcu "master equation" generujúcu ne-Markovovskú dynamiku v spojitom čase implementovaním univerzálneho NOT hradla, ktoré je príkladom naj-ne-Markovovskejších kanálov.

Publikácia ADCA74: (J. Phys. B: At. Mol. Opt. Phys. 45, r. 2012) je uvedená v Prílohe C.

**Programy: CERN/MŠ**

**11.) CERN - ISOLDE (CERN - ISOLDE)**

**Zodpovedný riešiteľ:** Martin Veselský  
**Trvanie projektu:** 1.1.2009 / 31.12.2015  
**Evidenčné číslo projektu:** CERN - ISOLDE  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 4 - Švajčiarsko: 2, Slovensko: 2  
**Čerpané financie:** MŠ SR: 5000 €

Dosiahnuté výsledky:

V roku 2012 bola publikovaná práca M. Veselský, M. Venhart et al., s názvom Fission-barrier heights of neutron-deficient mercury nuclei, vo Physical Review C (pozri ADCA107 v Prílohe C), kde boli určené štiepne bariéry neutrónovo-ochudobnených jadier  $^{178,180}\text{Hg}$  a bol ukázaný ich nesúlad s teoretickými predpoveďami. V roku 2012 bol v rámci zasadania komisie INTC (ISOLDE and n-TOF Committee) predložený návrh experimentu (Proposal) pre štúdium štiepenia ťažkých rádioaktívnych zväzkov na budovanom komplexe HIE-ISOLDE (M. Veselský et al., (d,p)-induced fission of heavy radioactive beams) s využitím aktívneho terča ACTAR. Zámer bol posúdený komisiou a odporučený ako časť fyzikálneho programu pre HIE-ISOLDE. Celkovo boli publikované 2 články v CC časopisoch.

**Programy: 7RP**

**12.) (Quantum Information Entanglement-Enabled Technologies)**

**Zodpovedný riešiteľ:** Vladimír Bužek  
**Trvanie projektu:** 1.2.2010 / 31.7.2013  
**Evidenčné číslo projektu:**



<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	6 - Nemecko: 1, Francúzsko: 1, Veľká Británia: 1, Švajčiarsko: 1, Taliansko: 2
<b>Čerpané financie:</b>	Európska komisia: 82240 €

Podpora medzinárodnej spolupráce z národných zdrojov: 15773 €

Dosiahnuté výsledky:

Projekt si kladie za cieľ posilniť európsku spoluprácu v oblasti výskumu, viditeľnosti a dosahu kvantovej informácie. V tomto roku sme aktualizovali databázy konferencií, voľných miest a hlavných noviniek.

Zoznam aktivít za rok 2012:

1) QUIE2T prezentácie na FET Info Day

Informačný deň - FP7-Call-9 sa konal dňa 18.januára 2012 v Bruseli a zúčastnilo asi 250 ľudí. Diapozitívy z prezentácie sú k dispozícii na stiahnutie z agendy Info dňa:  
[http://cordis.europa.eu/fp7/ict/fet-proactive/ie-jan12-ag\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/ie-jan12-ag_en.html)

2) QUIE2T sponzoroval ICAP'12 okrúhly stôl

Okrúhly stôl sa koná v priebehu ICAP 2012 konferencie (<http://www-lpl.univ-paris13.fr/ICAP2012/>), a je jedným z vrcholov niekoľkých špeciálnych akcií. Táto verejná udalosť je sponzorovaná programom koordinačnej akcie QUIE2T "Quantum Envoy" .

3) QIPC 2013

Po QIPC2009 v Ríme a QIPC2011 v Zürichu máme to potešenie oznámiť ďalší ročník konferencie QIPC2013 (QUANTUM INFORMATION PROCESSING AND COMPUTING 2013). Tentoraz sa bude konať vo Florencii od 30. júna - 5. júla 2013:  
<http://www.cqstar.eu/QIPC/index.html>

4) TheQubitLab na Facebooku

QubitLab má teraz samostatnú stránku na Facebooku:  
<https://www.facebook.com/TheQubitLab>

5) Záverečná správa s prezentáciou zozbieraných dát

Ako hlavný výstup z projektu, bola databáza QUROPE štatisticky analyzovaná a vyhodnotená:  
<http://qurope.eu/db>

6) Aktualizácia QIPC Stretegickej správy a Quantum Information Classification Scheme.

<http://qurope.eu/content/Roadmap>  
<http://qurope.eu/content/qics-book>

7) Na úrovni riadenia bolo vynegociované no-cost predĺženie projektu na dobu ďalších 6 mesiacov a do konzorcia bol pridaný nový partner (Florencia), ktorý bude mať na starosti organizáciu konferencie QIPC.

**13.) (Hybrid Information Processing)**

**Zodpovedný riešiteľ:** Vladimír Bužek

**Trvanie projektu:** 1.11.2008 / 30.4.2012  
**Evidenčné číslo projektu:** EU STREP 221889  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Prof. Fabrizio Illuminati (Universita Degli Studi Di Salerno)  
**Počet spoluriešiteľských inštitúcií:** 7 - Austrália: 1, Nemecko: 1, Veľká Británia: 2, Taliansko: 2, Japonsko: 1  
**Čerpané financie:** Európska komisia: 8667 €  
APVV: 12909 €

Dosiahnuté výsledky:

Projekt bol zameraný na spracovanie informácie v hybridných spojito-diskrétnych kvantových systémoch. Našou primárnou úlohou v posledných dvoch rokoch projektu bolo vyvinúť program na estimáciu kvantových procesov z nameraných experimentálnych dát. Tento program sa nachádza na stránke <http://www.quniverse.sk/processmaxlik/> a v posledných mesiacoch riešenia, za ktoré sa predkladá táto správa, bol použitý na odhadovanie experimentálnych dát z teleportačného experimentu skupiny v Heidelbergu. Pôvodná predstava o širokom aplikovaní vyvinutého softvéru sa nenaplnila v dobe trvania projektu, pretože plánované experimentálne ciele zaostali za pôvodnými očakávaniami, resp. museli byť predefinované.

Na ostatné 4 mesiace projektu bol zamestnaný postdoktorand zo zahraničia, ktorého úlohou bolo vymyslieť teoretický návrh tzv. čiastočnej teleportácie, pri ktorej cieľom nie je teleportovať celý objekt, ale iba niektoré jeho vlastnosti. Išlo o úlohu, ktorá nebola medzi pôvodným teoretickými cieľmi projektu, ale zapadá do ideového rámca projektu. Boli dosiahnuté veľmi čiastočné výsledky, ktoré budú predmetom ďalšieho výskumu. Konkrétne sa podarilo kvantifikovať minimálne zdroje (v zmysle potrebného kvantového previazania) potrebné na zrealizovanie čiastočnej teleportácie. Materiál nie je zatiaľ dostatočný na samotnú publikáciu, ale vo výskume budeme pokračovať a v budúcnosti očakávame výstup aj v tomto smere.

**14.)** (*Quantum Interfaces, Sensors and Communication based on Entanglement*)

**Zodpovedný riešiteľ:** Mário Ziman  
**Trvanie projektu:** 1.2.2010 / 31.1.2013  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Institute of Theoretical Physics, University of Warsaw  
**Počet spoluriešiteľských inštitúcií:** 16 - Austrália: 1, Rakúsko: 0, Nemecko: 6, Dánsko: 1, Španielsko: 1, Veľká Británia: 4, Švajčiarsko: 0, Taliansko: 0, Holandsko: 1, Poľsko: 2  
**Čerpané financie:** Európska komisia: 62857 €  
APVV: 8237 €  
Podpora medzinárodnej spolupráce z národných zdrojov: 4000 €

Dosiahnuté výsledky:

ADCA63 [Phys. Rev. B 86, 201408(R) (2012)] Vzájomné pôsobenie uväznenia a Coulombovských interakcií v kvantových bodkách môže viesť na silne korelované fázy kvalitatívne odlišné od správania sa Fermiho kvapaliny. Skúmame, ako prítomnosť magnetických nečistôt v kvantových bodkách môže poskytnúť ďalšie možnosti pre štúdium korelačných efektov a výsledného usporiadania v nosných a prímiesových spinov. Využitím exaktnej diagonalizácie odhaľujeme, že zdanlivo jednoduché dvojnásné kvantové bodky vedú na pestrý fázový diagram. Navrhujeme

experimenty na potvrdenie našich predpovedí. Zvlášť diskutujeme o medzipásových optických prechodoch ako funkcii teploty a magnetického poľa.

ADCA09 [Phys. Rev. Lett. 109, 207202 (2012)] Nefrustrované spinové reťaze majú vlastnosť, že ich základný stav minimalizuje všetky individuálne členy v reťazovom Hamiltoniáne. Pýtame sa ako entanglovaný môže byť základný stav nefrustrovaných kvantových spinových reťazí s interakciami medzi najbližšími susedmi pre malé hodnoty  $s$ . Zatiaľ čo o nefrustrovaných reťaziach spinov  $1/2$  je známe, že majú neentanglované základné stavy, prípad  $s=1$  ostáva menej preskúmaný. Navrhujeme prvý príklad nefrustrovanej translačne invariantnej reťaze spinov  $1$ , ktorá má jednoznačný vysoko entanglovaný základný stav a vykazuje niektoré známky kritického správania. Základný stav možno považovať za uniformnú superpozíciu vyrovnaných reťazcov ľavých a pravých zátvoriek oddelených prázdny miestom. Entropia entanglovania jednej polovice reťaze sa škáluje ako  $1/2 \log(n) + O(1)$ , kde  $n$  je počet spinov. Dokazujeme, že energetická medzera nad základným stavom je polynomiálna v  $1/n$ . Dôkaz sa opiera o nové výsledky týkajúce sa štatistiky Dyck-ových dráh.

### Programy: Multilaterálne - iné

#### 15.) Optimization of plasmonic nano-templates for enhanced light trapping in novel photovoltaic devices (*Optimization of plasmonic nano-templates for enhanced light trapping in novel photovoltaic devices*)

**Zodpovedný riešiteľ:** Eva Majková  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:** II-20100246 EC  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 4000 €

#### Dosiahnuté výsledky:

Metódou GISAXS sme preskúmali správanie sa 2D a 3D súborov plazmonických nanočastíc pod vplyvom UV žiarenia s cieľom modifikovať surfaktant nanočastíc a sledovať zmeny usporiadania. Vypracovali sme nový difrakčný model, ktorý je schopný analyzovať kvalitatívne aj kvantitatívne experimentálne GISAXS spektrá a umožňuje plne charakterizovať reálnu štruktúru nanočasticového kryštálu.

### Programy: Bilaterálne - iné

#### 16.) Kovové pásy pre magnetické senzory (*Metallic ribbons for magnetic sensors*)

**Zodpovedný riešiteľ:** Pavol Butvin  
**Trvanie projektu:** 1.1.2012 / 31.12.2013  
**Evidenčné číslo projektu:** SK-CZ-0078-11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 1 - Česko: 1

**inštitúcií:**

**Čerpané financie:** 1633 €

Dosiahnuté výsledky:

Vnútorne mechanické napätie vyvolané ohybom (aj spracovanej, relaxovanej) pásky pri navíjaní toroidného jadra sa ukázalo byť podstatným dôvodom horšieho šumu jadier s malým oproti väčším priemerom. Efekt je zjavný aj pri materiáloch s koeficientom magnetostrikcie v ráde 0.1 ppm. Metóda vyhnúť sa ohybu a zároveň zlepšiť demagnetizačný faktor v senzore meranom poli formou vyleptaný plochý "racetrack" (ovál) naráža podľa našich zistení na dve významné prekážky: Nesymetria v budiacom poli indukuje v častiach magnetického obvodu nekoherentnú rotáciu magnetizácie (zdroj šumu) a realistické rozmery obvodu vyžadujú vyleptanie zo širšej pásky často vykazujúcej priečnu nehomogenitu. Uprednostnili sme preto toroidné jadrá navinuté z genericky úzkej pásky kovového skla a vyžili hotovú (zapuzdrenú) sondu senzora v axiálnom magnetickom poli. S takýmto senzorom sme štandardne dosiahli šum do 7 pT/sqrtHz, najlepšie obvody 5 pT/sqrtHz. Prieskum literatúry i mienka špecialistov ukazuje, že ide pre rok 2012 o svetový rekord nízkeho šumu na 12 mm malom senzore typu "fluxgate".

Publikácie: 1 CC článok, 2 prednášky a 1 poster na konferenciách

**17.) Fyzika kvantových kráčaní (*Physics of quantum walks*)**

**Zodpovedný riešiteľ:** Daniel Reitzner  
**Trvanie projektu:** 1.4.2011 / 31.12.2012  
**Evidenčné číslo projektu:** SK-PT-0008-10  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 3 - Portugalsko: 3  
**Čerpané financie:** APVV: 361 €

Dosiahnuté výsledky:

V rámci projektu APVV medzinárodnej spolupráce medzi Slovenskom a Portugalskom s názvom Fyzika kvantových kráčaní (SK-PT-0008-10) sme za rok 2012 vykonali jedinú pracovnú návštevu, počas ktorej sme rozpracovali výsledky z predchádzajúceho roku v oblasti kvantových kráčaní s viacerými chodcami (obzvlášť ich analytickým popisom). Vzhľadom na nevyužitie plného potenciálu projektu sme však dosiahli len rozšírenie draftu, nie však publikáciu. V spolupráci s Danielom Nagajom sme sa pokúsili pozrieť aj na (v čase) spojené kvantové kráčania, kde sa však ukázalo, že takýto popis je značne zložitejší, než v diskretných náprotivkoch a zatiaľ nie je jasné, nakoľko môže byť tento popis užitočný.

**18.) Mikroštruktúra zliatin na báze Fe-Al (*Microstructure of Fe-Al based alloys*)**

**Zodpovedný riešiteľ:** Igor Matko  
**Trvanie projektu:** 1.1.2012 / 31.12.2013  
**Evidenčné číslo projektu:** SK-CZ-0096-11  
**Organizácia je** áno

**koordinátorom projektu:**

**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 2 - Česko: 2  
**Čerpané financie:** APVV: 628 €

Dosiahnuté výsledky:

Riešenie projektu bolo v 1. roku zamerané hlavne na podrobné štúdium hrubozrnných zliatin Fe-Al. Na FÚ SAV boli k tomu účelu pripravené oblúkovým tavením ingoty zliatin s nominálnym obsahom 18 až 35 % Al a vykonaná ich chemická analýza. Z nich boli následne pripravené menšie vzorky vhodné pre ďalšie plánované analýzy. Časť vzoriek bola podrobená žihaniu vo vákuu pri 1000 °C / 1 h s rýchlym resp. pomalým ochladením, s cieľom získať vzorky s rôznym obsahom vakancií a dislokácií. To následne umožnilo sledovať vzájomnú súvislosť medzi koncentráciou vakancií a koncentraciou Al a lokálnym usporiadaním atómov Fe a Al v štruktúre.

Na pracovisku hlavného riešiteľa (MFF UK Praha) bola potom mikroštruktúra vzoriek charakterizovaná technikami konvenčnej pozitronovej anihilačnej spektroskopie (meranie doby života pozitronov a Dopplerovho rozšírenia spektier anihilačných fotónov v koincidenčnom režime) v kombinácii s mikrotvrdosťou a s meraniami na zväzku pomalých pozitronov s laditeľnou energiou. Bolo tak určené, že koncentrácia zakalených vakancií v zliatinách rastie s obsahom Al. Pri viac než 27 at. % Al je koncentrácia vakancií tak vysoká, že spôsobuje významné vytvrdenie materiálu.

Na ÚFM AV ČR Brno sa uskutočnili merania mössbauerovských spektier, jednak v usporiadaní na odraz pomocou  $\gamma$ -žiarenia s hĺbkovou citlivosťou 30  $\mu\text{m}$ , taktiež pomocou konverzných elektrónov s hĺbkovou citlivosťou 200 nm s cieľom sledovať vplyv koncentrácie Al na lokálne usporiadanie atómov v zliatine, a to ako v objeme vzorky, tak i na jej povrchu. Mikroštruktúra vzoriek, veľkosť zŕn a chemické zloženie boli preštudované pomocou rastrovacej elektrónovej mikroskopie. V rámci spolupráce boli merané povrchové magnetické vlastnosti využitím Kerrovho javu. Podarilo sa tak na vzorkách zliatiny Fe-18at.%Al identifikovať jednu alebo dve magneticky rozdielne fázy v podpovrchovej oblasti, čo je veľmi dobre podporované teoretickými simuláciami mössbauerovských spektier konverzných elektrónov.

Publikačné výstupy z projektu sú: ADCA14 (pozri Príloha C) a do tlače sú zaslané práce:

- [1] F. Lukáč, J. Čížek, I. Procházka, Y. Jirásková, D. Janičkovič, W. Anwand, G. Brauer: Vacancy induced hardening in Fe-Al alloys, Journ. Phys.: Conf. Ser. (2012)  
[2] Y. Jirásková, A. Hendrych, O. Životský, J. Buršík, T. Žák, I. Procházka a D. Janičkovič: Surface magneto-optical and Mössbauer observations of Fe-Al, Applied Surface Science (2012)

**19.) Nepresné merania spinových systémov** (*Coarse grained measurements on spin systems*)

**Zodpovedný riešiteľ:** Martin Plesch  
**Trvanie projektu:** 1.1.2011 / 31.12.2012  
**Evidenčné číslo projektu:** SK-AT-015-10  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 1 - Rakúsko: 1  
**Čerpané financie:** APVV: 1340 €

Dosiahnuté výsledky:

V rámci projektu boli vykonané dve návštevy z partnerského pracoviska na FÚ SAV - Fabio Costa a Magdalena Zych sa zúčastnili na konferencii CEQIP 2012, organizovanej FÚ SAV v Smoleniciach. Dr. Plesch absolvoval dve pracovné cesty na partnerské pracovisko vo Viedni. Výstupom projektu je spracovaný rukopis článku o tom, ako slabé merania v priebehu unitárnych procesov môžu navodiť zdanie klasického vývoja aj pre čisto kvantové Hamiltoniány.

**20.) Príprava a štúdie nanočasticových súborov pre plazmonické aplikácie** (*Preparation and studies of nanoparticle arrays for plasmonic applications*)

<b>Zodpovedný riešiteľ:</b>	Eva Majková
<b>Trvanie projektu:</b>	1.1.2012 / 31.12.2014
<b>Evidenčné číslo projektu:</b>	SAS-NSC JRP 2011/05
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	0

Dosiahnuté výsledky:

V rámci projektu sme preskúmali nanočasticové systémy plazmonických nanočastíc v as deposited stave a po fotodisociácii surfaktantu UV žiarením. K tomu sme použili synchrotron v Hsin Chu a použili sme zariadenie GISAXS. Výsledky analyzujeme.

## Projekty národných agentúr

### Programy: VEGA

#### 1.) Jadrové reakcie od MeV ku hviezdám (*Nuclear reactions from MeV to stars*)

**Zodpovedný riešiteľ:** Emil Běták  
**Trvanie projektu:** 1.1.2010 / 31.12.2013  
**Evidenčné číslo projektu:** 2/0029/10  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 5737 €

##### Dosiahnuté výsledky:

Výpočty vlastností deformovaných rotujúcich neutrónových hviezd použitím DBHF (2x AEC + 1x subm. AEC + 1 príspevok na medzinárodnej konferencii)

Predrovnovážna emisia klastrov s uvažovaním spinových premenných v rámci modelu Iwamotu a Haradu (2x AEC + 1 prednáška na medzinárodnej konferencii)

Výpočty jadrových reakcií záchytu pre produkciu terapeutických rádionuklidov (1x AEE)

#### 2.) Rozvoj a testovanie fyzikálnych modelov pre pulznú prechodovú metódu (*Development and testing of physical models for the pulse transient method*)

**Zodpovedný riešiteľ:** Vlastimil Boháč  
**Zodpovedný riešiteľ v organizácii SAV:** Vlastimil Boháč  
**Trvanie projektu:** 1.1.2012 / 31.12.2012  
**Evidenčné číslo projektu:** 2/0182/12  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 1 - Slovensko: 1  
**Čerpané financie:** VEGA: 1721 €

##### Dosiahnuté výsledky:

Projekt riešil problém analýzy modelov pre impulznú prechodovú metódu. Pre vzorky v tvare hranola so štvorcovou podstavou bol analyzovaný tzv. cubboid model zohľadňujúci tepelné straty tepla z povrchu vzorky. Tepelné straty boli riešené pomocou koeficientu prestupu tepla medzi povrchom vzorky a okolím. Pre problém vyžaduje 3-rozmerné riešenie. Pre 3D model bola vykonaná analýza neurčitosti pre voľné parametre modelu. Pri fitovaní existuje vždy istá hranica pre nejednoznačnosť určenia hľadaných parametrov. Pomocou analýzy neurčitostí sa určila výška neistôt v percentuálnom vyhodnotení. Analýza modelu bola aplikovaná na merania pieskovca a určila, ako sa dá zlepšiť presnosť meraní. Výsledky sa použili aj v riešení úloh ďalšieho grantu

APVV a boli spoločne publikované vo forme prednášky na medzinárodnej konferencii a v recenzovanom zborníku z konferencie.

#### Publikácie FÚ SAV

1 príspevok a 2 prednášky (THERMOPHYSICS)

Vlastimil Boháč, Peter Dieška, Viliam Vretenár, The measurement of thermophysical properties of sandstone by pulse transient method using model for cuboid form samples and influence of heat loss effect, Thermophysics 2012 - Conference Proceedings, 17th International Meeting of Thermophysical Society, 31st October to 2th November 2012, Podkylava, Slovak Republic, org. Institute of Physics, Slovak Academy of Science in Bratislava, Printed by: Brno University of Technology, Faculty of Chemistry, 2012, ISBN: 978-80-214-4599-4, p.23-32

Prednáška a abstrakt v zborníku (článok zatiaľ nevyšiel) (THERMOSYMPOSIUM)

Vlastimil Boháč, Peter Dieška, Viliam Vretenár, Investigation of porous stone material by pulse transient method using model for cuboid form samples, EIGHTEENTH SYMPOSIUM ON THERMOPHYSICAL PROPERTIES, Boulder, CO, USA, June 24 - 29, 2012  
[http://thermosymposium.nist.gov/pdf/Abstract\\_1517.pdf](http://thermosymposium.nist.gov/pdf/Abstract_1517.pdf)

### 3.) Faktory obmedzujúce ciele ovplyvnenie magneticky mäkkých vlastností kovových pásov (Factors that limit the possibilities to tailor the soft-magnetic properties of metallic ribbons)

<b>Zodpovedný riešiteľ:</b>	Pavol Butvin
<b>Trvanie projektu:</b>	1.1.2011 / 31.12.2013
<b>Evidenčné číslo projektu:</b>	2/0056/11
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	VEGA: 1834 €

#### Dosiahnuté výsledky:

Magnetické experimenty po jednostrannom odstránení pôvodného povrchu (len lesklý alebo len matný) širokých ( $>5$  mm) pásov nanokryštalického Si-bohatého Finemetu ( $\text{FeNbCuBSi} - 12\div 14$  at% Si) a porovnanie s analogickými experimentmi s as-cast amorfným stavom viedli k ďalšiemu argumentu v prospech tvrdenia, že naprieč hrúbkou heterogénna lokálne jednoosová magnetická anizotropia vzniká až počas nanokryštalizačného tepelného spracovania a má prevažne iný ako magnetoelastický pôvod. Na rozdiel od širších, úzke pásy ( $1\div 4$  mm) Si-bohatého Finemetu nevykazujú výraznú tzv. priečnu heterogenitu - doménová štruktúra každého povrchu je relatívne homogénna, hoci lesklý a matný povrch sa odlišujú orientáciou ľahkého smeru magnetovania. Priečna zložka anizotropie je podstatne slabšia ako pri širokých páskach. Zároveň silnejšia tendencia k viskóznemu tečeniu pri namáhaní ťahom a teplote nad  $400^\circ\text{C}$  ukazuje na rozhodujúci vplyv heterogenity aspoň na procesy relaxácie. Vo všeobecnosti ostávajú v heterogénnom materiáli lokálne napätia nenulové po akejkoľvek relaxácii. Náhrada časti B fosforom v Si-chudobných (at.% Si  $< 10$ ) Finemetoch nasledovaná vyšetrením ich magnetických vlastností poukázala na ešte nevyčerpaný potenciál týchto materiálov s vyššou indukciou v nasýtení ( $B_s$ ). V určitom rozsahu zložení možno magnetickú mäkkosť ešte zlepšiť bez závažnej redukcie  $B_s$ .

Publikácie: 3 CC články, 2 príspevky v zborníkoch a 1 poster



#### 4.) Vplyv zmien povrchových charakteristík na magnetické vlastnosti tenkých kovových pásov (*Influence of changes of surface features on magnetic properties of thin metallic ribbons*)

**Zodpovedný riešiteľ:** Beata Butvinová  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** 02/0056/12  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 966 €

##### Dosiahnuté výsledky:

Materiály typu Finemet s nižším obsahom Si a s vyšším obsahom Nb oproti klasickému Finemetu sa správajú pri štandardnom (cielenom na monokryštalizáciu) žihaní v inertnej atmosfére tak, že ich výsledné magnetické vlastnosti prostredníctvom magnetoelastickej interakcie odrážajú mechanický vplyv povrchov. Zistili sme, že pri dlhodobom žihaní vznikajú na povrchu pásky kyslíčníky železa  $\text{Fe}_2\text{O}_3$ , ktoré spôsobujú magnetické tvrdnutie čiastočne odstrániteľné odleptaním povrchov pásky. Pomocou Ramanovej spektroskopie bol na povrchu identifikovaný aj dvojpík grafitického uhlíka, ktorého pôvod a korelácia s kyslíčníkmi na povrchu sa ďalej skúma. Vyšetrovali sme aj vplyv substitúcie P (3 at. %) za B v nízko-kremíkových Finemetoch na ich magnetické vlastnosti a makroskopické povrchové efekty. Zistili sme významný pokles koercivity a zlepšenie magneticky mäkkých vlastností u Finemetu s 5 at. % Si, zvýšenie  $B_s$  pre 10 at. % Si, a pre obe zloženia redukciu efektu makroskopickej heterogenity po  $500^\circ\text{C}$  žihaní v inertnej atmosfére.

Publikácie: 1 prednáška, 1 poster a 2 články v zborníkoch z medzinárodných konferencií.

#### 5.) Mezonová spektroskopia a overenie štandardného modelu presnejším vyhodnotením $\text{Alfa}(M_Z)$ a miónovej $g-2$ anomálie (*Meson spectroscopy and Standard Model verification by a more precise evaluation of $\text{Alfa}(M_Z)$ and the muon $g-2$ anomaly*)

**Zodpovedný riešiteľ:** Stanislav Dubnička  
**Trvanie projektu:** 1.1.2010 / 31.12.2013  
**Evidenčné číslo projektu:** 2/0009/10  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 5 - Francúzsko: 2, Taliansko: 2, Rusko: 1  
**Čerpané financie:** VEGA: 8606 €

##### Dosiahnuté výsledky:

Novou analýzou všetkých existujúcich experimentálnych údajov o nukleónových elektromagnetických formfaktorech pomocou 9 rezonančného sofistikovaného unitárneho a analytického modelu, rešpektujúceho ale  $\text{SU}(3)$  symetriu, sme našli nábojový protónový rms rádius, ktorý je konzistentný s hodnotou určenou v spektroskopii miónového vodíkového atómu. Použijúc nami rozpracovaný unitárny a analytický model na interpoláciu a extrapoláciu existujúcich údajov o prechodových formfaktorech pseudoskalárnych mezonov, určili sme príspevky

neutrálneho piónu, eta a eta' mezónov k anomálnemu magnetickému momentu miónu a šírky rozpadov týchto častíc na dva fotóny. Využitím univerzálneho unitárneho a analytického modelu sa podarilo prvýkrát popísať elektromagnetickú štruktúru kompletného nonetu pseudoskalárnych mezónov v priestoropodobnej aj časopodobnej oblasti súčasne.

## 6.) Analýza mnohočasticových korelácií v ultrarelativistických zrážkach ťažkých iónov (*Analysis of multi-particle correlations in ultra-relativistic heavy ion collisions*)

**Zodpovedný riešiteľ:** Peter Filip  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:** 1/0171/11  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 1721 €

### Dosiahnuté výsledky:

V rámci osobnej účasti pri meraní údajov na experimentálnom zariadení STAR/RHIC sa realizovali zrážky U+U (238+238) pri energii zväzkov 193 GeV/n, ktorých cieľom bolo zvýšenie hustoty energie interagujúcej jadrovej hmoty. Hľadanie kritického bodu fázového prechodu hadrónovej hmoty do partónovej plazmy pokračovalo analýzou údajov z interakcií Au+Au (197+197) pri energiách zrážok 62.4, 39.0, 27.0, 19.6, 11.5 a 7.7 GeV/n. Boli pozorované príznaky poklesu príspevku partónovej fázy v produkcii častíc, avšak jasný signál kritického bodu alebo fázového prechodu nebol nájdený. Na 2 zahraničných konferenciách (Ruská Federácia a USA) boli prezentované vlastné výsledky ohľadom vplyvu statickej a dynamickej deformácie jadier Au, a U na eliptický tok (azimutálna korelácia hadrónov) v centrálnych zrážkach. Vplyv silných magnetických polí vznikajúcich pri zrážke ťažkých iónov na vlastnosti mezónov bol preskúmaný na základe analógie s viazanými stavmi pozitronia a muónia, výsledok bol prezentovaný na medzinárodnej konferencii SPIN 2012. Príspevky do zborníkov z týchto 3 konferencií aj z 1 konferencie (RNP2012 konanej na Slovensku) boli zaslané k opublikovaniu. V rámci popularizačnej aktivity bola tematika projektu prezentovaná na Festivale fyziky 2012 v Smoleniciach (zborník je publikovaný: AFDB01), tiež počas akcie Noc výskumníkov (poster) a vo forme prednášky v Deň otvorených dverí FÚ SAV. Analýza existujúcich údajov zo zrážok p+p, Cu+Cu a Au+Au viedla v roku 2012 k publikáciám: 4x Phys. Rev. D (ADCA89,88,87,84), 5x Phys. Rev. C (ADCA79,80,82,83,86), 3x Phys. Rev. Lett. (ADCA85,81,78) v rámci kolaborácie STAR. V článku ADCA83: Phys. Rev. C86, 014904 (2012) je umiestnené poďakovanie grantovej agentúry VEGA.

## 7.) Vývoj algoritmov pre klasifikáciu fázových prechodov (*Development of algorithms for classification of phase transitions*)

**Zodpovedný riešiteľ:** Andrej Gendiar  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** 2/0074/12  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0

**inštitúcií:**

**Čerpané financie:** VEGA: 2754 €

Dosiahnuté výsledky:

V prvom roku riešenia projektu VEGA-DARG sme publikovali dva CC články:

[1] ADCA24: A. Gendiar, M. Daniška et al., s názvom "Weak correlation effects in the Ising model on triangular-tiled hyperbolic lattices".

[2] ADCA110: A. Gendiar, et al. s názvom "Capillary condensation in a square geometry with surface fields"

V prvej etape riešenia projektu sme vytvorili nový algoritmus založený na procedúre renormalizačnej grupy pre Hilbertove podpriestory popísané nehermitovskými redukovanými maticami hustoty. Pomocou tohto algoritmu sme analyzovali vlastnosti fázových prechodov spinových systémov na nekonečne veľkých zakrivených povrchoch s konštantnou negatívnou gaussovskou krivosťou. Tieto hyperbolické geometrie boli vytvorené mozaikovaním povrchov s identickými rovnostrannými trojuholníkmi, pričom sme menili koordinačné číslo v intervale od 6 do 10 miliónov. Zistili sme, že korelačné funkcie klesajú exponenciálne rýchlo aj v bodoch fázového prechodu, čím sme potvrdili neexistenciu kritických vlastností v bodoch fázového prechodu. Tieto vlastnosti sú dôsledkom strednopolovej triedy univerzality, ktorá je indukovaná len krivosťou priestoru, v ktorom je Hausdorfova dimenzia nekonečná. Nedivergujúca korelačná dĺžka aj kvantová entropia entanglovania tiež podporujú tieto závery. Presne sme kvantifikovali potlačenie veľkosti korelačnej dĺžky do nuly vo fázovom prechode s narastajúcou veľkosťou koordinačného čísla, resp. s divergenciou gaussovskej krivosti, a sú spolu inverzne previazané [1].

V druhej časti projektu sme vytvorili nový variačný algoritmus pre metódu Corner Transfer Matrix Renormalization Group (CTMRG), tzv. "sweepovanie", pomocou ktorého sme boli schopní vypočítať magnetizačné a energetické profily spinových systémov vo štvorcovej geometrii. Tieto systémy popisujú vlastnosti fázových prechodov kvapalina-plyn umiestnených v malých štvorcových nádobách. Podľa vlastností kvapaliny môže na rozhraní medzi kvapalinou a okrajom nádoby vznikáť kapilárny efekt a vytvárať tak zmáčavú alebo nezmáčavú kvapalinu. Vplyv zmáčavosti sme študovali na kapilárnej kondenzácii pre jednoduchú kvapalinu vo štvorcovej geometrii s okrajovými magnetickými poliami, pričom sme za referenčný systém zobrali nekonečne dlhý pás. Zovšeobecnilí a rozšírili sme CTMRG metódu pre dvojrozmerný Isingov model v  $L \times L$  geometrii s rovnakými krajovými poliami. Naše výsledky potvrdili, že posun prechodu koexistencie fáz v oboch geometriách sa riadi podľa rovnakých mocnín v škálovacom vzťahu voľnej energie, pričom sa líšia len prefaktormi v týchto rozvoch [2].

**8.) Štiepenie supert ťažkých zložených jadier (*Fission of superheavy compound nuclei*)**

**Zodpovedný riešiteľ:** Štefan Gmuca  
**Trvanie projektu:** 1.1.2010 / 31.12.2012  
**Evidenčné číslo projektu:** 2/0177/10  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 0  
**inštitúcií:**  
**Čerpané financie:** VEGA: 9179 €

Dosiahnuté výsledky:

Boli urobené testovacie experimenty na hmotnostnom spektrometri MASHA, určenom na identifikáciu supert ťažkých prvkov. Experimenty boli vykonané na zväzkoch ťažkých iónov v SÚJV Dubna. Bola stanovená celková účinnosť a rýchlosť transportu v uzle catcher-ECR iónový zdroj.

Boli odvodené nové hustotné závislosti väzbových konštánt relativistického prístupu založené na mapovaní výmenných členov Dirac-Hartree-Fock modelu. Tento bezparametrický prístup predstavuje významný posun pri formulácii relativistického efektívneho funkcionálu hustoty vhodného pre popis širokej triedy jadrových procesov vrátane štruktúry supert ťažkých jadier. Boli študované aj niektoré implikácie pre štruktúru kompaktných hviezd.

**9.) Organické materiály pre fotovoltaiiku a senzoriku** (*Organic materials for photovoltaics and sensorics*)

**Zodpovedný riešiteľ:** Katarína Gmucová  
**Trvanie projektu:** 1.1.2010 / 31.12.2012  
**Evidenčné číslo projektu:** 2/0093/10  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 1 - Slovensko: 1  
**inštitúcií:**  
**Čerpané financie:** VEGA: 3059 €

Dosiahnuté výsledky:

Ako účinný nástroj v senzorike sme diskutovali anomálny prenos náboja na mikroštrukturovanom povrchu elektródy so zónami odlišnej elektródovej aktivity. Študovali sme reakciu medi na elektróde pokrytej kompozitnou štruktúrou pozostávajúcou z LB vrstvou P3HT pokrytých superparamagnetických nanočasticových membrán s otvormi vymodelovanými v magnetickom poli. Získaná ostrosť voltametrických a volcoulometrických odoziev sa ukazuje byť zaujímavá pre selektívnu senzoriku na environmentálne dôležitých vzorkách.

Interakcia cytochrómu c s kalix[6]arénom zabudovaným do podporených lipidových membrán zložených z dimyristoylphosphatidylcholínu bola študovaná rozličnými elektrickými a elektrochemickými metódami. Pre cytochróm c bol dosiahnutý detekčný limit 30 nM.

Použitím komplementárnych elektrochemických metód sme získali informácie o architektúre zakázaného pásu organických polovodičov (pentacén, P3HT a H2T26N). Identifikovali sme väzbové miesta defektov súvisiacich s molekulami vody.

2 x CC, 1 x kapitola v knihe, 1 x non CC, 3 x konferenčný zborník

**10.) Binárne a ternárne tuhé oxidové elektrolyty na báze CeO<sub>2</sub> a ZrO<sub>2</sub>, ich príprava, štruktúra a vybrané vlastnosti** (*Binary and ternary solid oxide electrolytes based on CeO<sub>2</sub> and ZrO<sub>2</sub>. their preparation, structure and chosen properties*)

**Zodpovedný riešiteľ:** Mária Hartmanová  
**Trvanie projektu:** 1.1.2010 / 31.12.2012  
**Evidenčné číslo projektu:** 2/0053/10  
**Organizácia je** áno  
**koordinátorom projektu:**

**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 574 €

Dosiahnuté výsledky:

Vyšetrovala sa mechanická mikro(tvrdosť)  $H$  a elastický modul  $Y$  polykryštalických tenkých filmov  $\text{CeO}_2\text{-x.Sm}_2\text{O}_3$  ( $x = 0, 10.9 - 15.9$  mol%) pripravených odparovaním e-lúčom (EB-PVD) a súčasne bombardovaním  $\text{Ar}^+$  iónami na Si podložkách v závislosti od depozičných podmienok, ako sú zloženie systému (množstvo dopantu  $\text{Sm}_2\text{O}_3$ ,  $x$ ), depozičná teplota  $T_{\text{dep}}$  a bombardovanie  $\text{Ar}^+$  iónami (IBAD). Vyšetrovanie sa robilo metódou hĺbkovej indentácie (DSI) ako funkcia relatívnej hĺbkovej indentácie,  $h_{\text{rel}} = h_{\text{max}}/t$  ( $h_{\text{max}}$ -maximálna hĺbka indentácie,  $t$ -hrúbka filmu). Indentačná mikro(tvrdosť)  $H_{\text{pl}}$ , elastický modul  $Y$ , podobne ako klasická Vickersova tvrdosť  $HV$  boli invariantné vzhľadom na zloženie filmu, ale závislé na jeho mikroštruktúre, záťaži  $L$  aplikovanej na indentor a na  $\text{Ar}^+$  iónovom bombardovaní. Získané hodnoty  $H_{\text{pl}}$ ,  $Y$  ako i  $HV$  sú v súlade s literatúrou, vždy vzhľadom na formu vyšetrovaného materiálu, objemovú alebo ako tenkého filmu. Určitý rozdiel medzi hodnotami  $H_{\text{pl}}$  a  $HV$  je dôsledkom odlišnosti princípov oboch metód ich merania.  $H_{\text{pl}}$  sa určuje z indentačnej hĺbkovej, zatiaľ čo  $HV$  je určená z optického merania dĺžky diagonály indentačného odtlačku. U tenkého filmu nanoseného na podložku, indentačné vyšetrovanie vlastností filmu závisí na indentačnej hĺbke a na hrúbke filmu v dôsledku kombinovanej odozvy filmu aj podložky. V prípade nášho systému  $\text{CeO}_2\text{-Sm}_2\text{O}_3$  sa tento kombinovaný efekt na meranie zloženej tvrdosti,  $H_c$  a zdanlivého modulu,  $Y$  modeloval použitím funkcií Battcharay-a a Nix-a. Fitovanie týchto funkcií k nameraným údajom sa robilo Marquart-Levenbergovým algoritmom na určenie neznámych parametrov modelu. Závislosť na indentačnej hĺbke sa použila na vizualizáciu rastúceho vplyvu podložky na vznik prasklín, odlupovanie filmu okolo indentačného odtlačku alebo až prieniku indentora cez rozhranie film/podložka. Všetky tieto vyšetrovania sú už hotové a teraz sa získané výsledky dávajú do tvaru publikácie.

**11.) Vplyv expozičných podmienok na vývoj binárnych a ternárnych fáz v komplexných kovových zliatinách na báze hliníka** (*Influence of exposure conditions on evolution of binary and ternary phases in aluminium-based complex metallic alloys*)

**Zodpovedný riešiteľ:** Emília Illeková  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** 1/0143/12  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Materiálovotechnologická fakulta STU v Trnave  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** Fyzikálny ústav SAV: 3274 €

Dosiahnuté výsledky:

V rámci projektu boli študované fázové premeny v systémoch  $\text{Al-Co-Cu}$  a  $\text{Al-Pd-Co}$  za rovnovážnych aj nerovnovážnych podmienok. Pozornosť bola venovaná charakterizácii dekadonálnej kvázikryštalickej fázy a viacerých fáz zo skupiny epsilon. Výstupom riešenia projektu boli upresnené izotermické rezy pre príslušné ternárne fázové diagramy pri zvolených teplotách, ako aj teplotné sekvencie vývoja štruktúrne komplexných fáz za nerovnovážnych podmienok.

## 12.) Senzorické vlastnosti usporiadaných nanočasticových vrstiev (*Sensing properties of layers based on ordered nanoparticle arrays*)

**Zodpovedný riešiteľ:** Ján Ivančo  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 8798 €

### Dosiahnuté výsledky:

V rámci prvého roku riešenia projektu VEGA boli riešené nasledujúce úlohy:

- Charakterizácia usporiadania a chemických vlastností aktívnych nanočasticových vrstiev na báze  $\text{Fe}_2\text{O}_3$  a  $\text{CoFe}_2\text{O}_4$  pomocou SEM, SAXS, DLS a XANES;
- Realizácia vzoriek senzorov stopových koncentrácií plynov na báze usporiadaných nanočasticových vrstiev  $\text{Fe}_2\text{O}_3$  a  $\text{CoFe}_2\text{O}_4$  so zameraním na optimalizáciu počtu nanočasticových monovrstiev v intervale 1 - 10;
- Charakterizácia statickej aj dynamickej odozvy senzorov na stopové koncentrácie CO a  $\text{NO}_2$  v suchom vzduchu (na partnerskom pracovisku CNR Lecce, Taliansko): Pozorovaná prúdová odozva 1/38 na 500 ppb  $\text{NO}_2$  pre senzory na báze  $\text{Fe}_2\text{O}_3$  nanočastíc pri  $350^\circ\text{C}$  patrí medzi najlepšie publikované hodnoty  $\text{NO}_2$  senzorov na báze oxidových polovodičov a je veľmi sľubnou hodnotou dovoľujúcou očakávať vyššie citlivosti;
- Preskúmanie elektrického transportu  $\text{Fe}_2\text{O}_3$  a  $\text{CoFe}_2\text{O}_4$  nanočasticových vrstiev v intervale teplôt  $250^\circ\text{C}$  až  $500^\circ\text{C}$  a stanovenie aktivačnej energie vodivosti v modeli excitácie nosičov cez energetickú medzeru, ktorej stredné hodnoty pre  $\text{Fe}_2\text{O}_3$  a  $\text{CoFe}_2\text{O}_4$  sú 0,65 eV a 0,85 eV.
- Konštrukcia vákuovej aparatury na testovanie senzorov stopových koncentrácií plynov. Doterajší rozpočet umožnil vybavenie/dokončenie aparatury na úroveň asi 80%.

Prezentované resp. publikované výsledky:

S. Luby et al.: Iron oxide nanoparticle gas sensors, 14th Joint Vacuum Conf., Dubrovnik, June 2012 (invited).

S. Luby et al.: "Gas sensing properties and electrical resistance of Langmuir-Blodgett iron oxide nanoparticle arrays" (AFBA06 v prílohe C)

S. Luby et al.: "Nanoparticle LB arrays for sensing of CO and  $\text{NO}_2$  gases", (ADEB08 v prílohe C)

## 13.) Pokročilé fotovoltické štruktúry s efektom plazmónovej excitácie na kovových nanočasticiach (*Advanced photovoltaic structures with the effect of plasmonic excitation on metallic nanoparticles*)

**Zodpovedný riešiteľ:** Matej Jergel  
**Trvanie projektu:** 1.1.2011 / 31.12.2014  
**Evidenčné číslo projektu:** 2/0041/11  
**Organizácia je koordinátorom projektu:** Áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0

**Čerpané financie:** SAV: 12859 €

Dosiahnuté výsledky:

- Metódou malouhlového rtg rozptylu pri šikmom dopade (GISAXS) boli študované súbory plazmonických Ag nanočastíc do solárnych článkov pripravené metódou Langmuir-Blodgettovej. Boli podrobne analyzované jednotlivé kompresné štádiá a bola nájdená nová metastabilná fáza predchádzajúca kolapsu monovrstvy. Bol vypracovaný nový difrakčný model pre analýzu 3D nanočasticových súborov (kryštálov) založený na parakryštalickom koncepte.

- Metódou SEM a meraním absorpcie vo viditeľnej oblasti bol analyzovaný vplyv redukcie surfaktantu pomocou UV žiarenia na súbory plazmonických Ag nanočastíc. Zistili sme aglomeráciu nanočastíc sprevádzanú postupným zánikom plazmonického efektu, ale s čiastočnou regeneráciou. Proces aglomerácie sme zistili aj bez UV žiarenia po dlhšom skladovaní vzoriek. Tieto efekty vyžadujú ďalšie štúdium.

- Metódami GISAXS, XRD a DSC bola ďalej optimalizovaná príprava polymérnej zmesi P3HT/PCBM do aktívnej vrstvy solárneho článku, jej štruktúra a depozícia na substrát ITO ako prednú elektródu. Bol testovaný vplyv medzivrstvy PSS-PEDOT na ITO a optimalizovaná štruktúra zadného kontaktu (Ag s prímiesou Ca). Bola dosiahnutá konverzná účinnosť článkov 2,5% a plniaci faktor 0,6.

- Boli vykonané prvé pokusy zabudovania plazmonických Ag nanočastíc do solárnych článkov, a to priamo do aktívnej vrstvy alebo na prednú ITO elektródu. Ako alternatíva boli pripravené aj nanočastice získané žihaním tenkých Ag a Au vrstiev na ITO. V ďalšom bude treba optimalizovať koncentráciu nanočastíc a žihacie resp. UV procedúry.

- Bol analyzovaný vplyv výstupnej práce na elektrické vlastnosti organických polovodičov rozšírením klasického modelu používaného pre rozhrania tvorené anorganickými elektrickými aktívnymi materiálmi.

- Bolo ukázané, že izotermálna spektroskopia prechodového náboja a elektrochemická impedančná spektroskopia sú účinné techniky pre detekciu defektných stavov v organických polovodičoch.

Články CC, WOS (pozri príloha C): ADCA105, ADCA104, ADCA103

Zborníky z konferencií (pozri príloha C): AFBA01, AFHB01 a do tlače je zaslané: "Nanoparticle Self-Assembly at Solid/Liquid Interfaces, Proc. "19th Conf. of Slovak Physicists", Prešov 2012.

**14.) Výskum kvark-gluónových stavov hadrónov v dynamike ich rozptylu** (*Research of quark-gluon states of hadrons within dynamics of diffraction*)

**Zodpovedný riešiteľ:** Dalibor Krupa  
**Trvanie projektu:** 1.1.2011 / 1.1.2013  
**Evidenčné číslo projektu:** 2 / 0137 / 11  
**Organizácia je koordinátorom projektu:** Áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 584 €

Dosiahnuté výsledky:

Bol vypracovaný postup novej aplikácie mnoho-kanálovej interakčnej schémy elementárnych častíc, na analýzu ich vlastností a ich vnútornej kvarkovej a gluónovej štruktúry priamo z nameraných účinných prierezov rozptylu meraných pri ich vysoko energetických zrážkach, ktorý obchádza doterajšie problémy spojené s nejednoznačnosťou určenia rozptylových fáz určených metódou fázovej analýzy.

**15.) Kombinovaný rastrovací tranzientový mikroskop** (*Combined Scanning Transient Microscope*)

**Zodpovedný riešiteľ:** Štefan Lányi  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:** 2/0063/11  
**Organizácia je koordinátorom projektu:** Áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 2060 €

Dosiahnuté výsledky:

Pokračoval vývoj elektroniky mikroskopu. Problém, ktorý bolo treba riešiť je eliminácia vplyvu impulzov nulujúcich vstupný integrátor na činnosť obvodu riadiaceho vzdialenosť sondy od povrchu.

**16.) Spracovanie mnohorozmerných experimentálnych dát v jadrovej fyzike** (*Multidimensional experimental data processing in nuclear physics*)

**Zodpovedný riešiteľ:** Vladislav Matoušek  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** 2/0071/12  
**Organizácia je koordinátorom projektu:** Áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 3672 €

Dosiahnuté výsledky:

Základným cieľom projektu je vývoj efektívnych numerických metód a algoritmov zberu, spracovania a vizualizácie experimentálnych dát a ich implementácia v oblasti jadrovej spektroskopie:

1. V oblasti efektívneho zberu, sortovania a uchovávanía mnohoparametrických koincidenčných dát sme navrhli sofistikovaný algoritmus zberu v on-line režime so simultánnou kompresiou mnohorozmerných histogramov.
2. V oblasti eliminácie pozadia v mnohorozmerných spektrách sme zlepšili už existujúci algoritmus odhadu zložitých tvarov pozadia založený na "Sensitive Non-linear Iterative Peak Clipping Algorithm (SNIP)" o možnosť zahrnutia nelineárnych valov špecifických tvarov do pozadia.



Je žiadúce, aby najnovšie vyvinuté algoritmy implementované do programového balíka Daqprovis, boli dostupné aj v iných systémoch. Prispôsobili sme tento balík pre možné použitie v iných OS a predovšetkým v balíku ROOT, ktorý je široko využívaný v oblasti experimentálnej jadrovej fyziky.

Všetky vyvinuté sofistikované algoritmy boli publikované v kapitole vo vedeckej monografii ABC02:

M. Morháč, V. Matoušek: Multidimensional Experimental Data Processing in Nuclear Physics, in book: Computer Physics, pp. 1-236, 2012.

**17.) Štúdium elektricky aktívnych defektov v systémoch s organickými polovodičmi pre fotovoltiku** (*Study of electrically active defects in systems with organic semiconductors for photovoltaics*)

<b>Zodpovedný riešiteľ:</b>	Vojtech Nádaždy
<b>Trvanie projektu:</b>	1.1.2012 / 31.12.2015
<b>Evidenčné číslo projektu:</b>	2/0157/12
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	FU SAV: 1834 €

Dosiahnuté výsledky:

V zmysle vytýčených úloh sme zvládli prípravu tenkých vrstiev organických polovodičov metódou rotačného nanášania v inertnej atmosfére v glovebox-e . Vykonali sme základnú charakterizáciu štruktúry vrstiev poly(3-hexylthiophenu) (P3HT), derivátu fullerénu (PCBM) a ich zmesi metódami XRD, AFM a optických vlastností týchto vrstiev metódou UV Vis spektroskopie. Optimalizovali sme postup prípravy a technického riešenia elektrochemickej komôrky s tenkou vrstvou organického polovodiča a polysilanov (PMPSi) pre určovanie energetických pásov a vyšetrovanie defektných stavov v týchto materiáloch metódami cyklickej voltametrie a voltcoulometrie.

**18.) Štruktúra vákua a neporuchové javy v kalibračných teóriách** (*Vacuum Structure and Non-perturbative Effects in Gauge Theories*)

<b>Zodpovedný riešiteľ:</b>	Štefan Olejník
<b>Trvanie projektu:</b>	1.1.2009 / 31.12.2012
<b>Evidenčné číslo projektu:</b>	VEGA 2/0070/09
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	VEGA: 4590 €

Dosiahnuté výsledky:

Preskúmali sme vlastnosti viacerých modelov v dvoch časopriestorových dimenziách s nehmotnými a hmotnými fermiónmi v hamiltonovskej formulácii v konvenčnej teórii poľa a na svetelnom fronte modifikovanou kánonickou procedúrou, ktorá zohľadňuje riešenia operátorových rovníc polí. Pokračovali sme v numerických testoch nedávno navrhnutého vlnového funkcionálu základného stavu QCD. Vznikla publikácia s názvom: "Exactly solvable models and spontaneous symmetry breaking (ADCA57 v prílohe C) a príspevok do zborníka z konferencie (Confinement X): J. Greensite, Š. Olejník: "Testing the Yang–Mills vacuum wave functional Ansatz in 3+1 dimensions" v Proceedings of Science je zaslaný do tlače.

**19.) Výskum interakcie vodného HCN roztoku s viacerými druhmi kremíkových štruktúr**

**Zodpovedný riešiteľ:** Emil Pinčík  
**Trvanie projektu:** 2.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** VEGA 2/0076/12  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 1 - Japonsko: 1  
**Čerpané financie:** 6091 €

Dosiahnuté výsledky:

a) Bola určená hustota stavov rozhraní štruktúr veľmi tenký SiO<sub>2</sub>/Si stanovením jej teoretickej kapacity z odpovedajúceho kvantovomechanického modelu. Vlastnosti nábojových stavov štruktúr Al/veľmi tenký SiO<sub>2</sub>/Si boli analyzované riešením Schrödingerovej a Poissonovej rovnice, pričom výsledky boli použité pri zostavení teoretického kvantovomechanického modelu stanovenia kapacity odpovedajúcej MOS štruktúry so započítaním stavov rozhrania oxid/polovodič.  
 b) Spektrálnou elipsometriou, nábojovou DLTS, C-V, FTIR, AFM a fotoluminiscenciou boli definované viaceré základné parametre štruktúr na báze Si a 6H-SiC po ich pasivácii v roztokoch HCN a KCN. Bolo preukázané, že pomocou takýchto pasivačných technologických krokov je možné dosiahnuť hustotu stavov rozhraní štruktúr oxid/polovodič 5x10<sup>10</sup> eV<sup>-1</sup>cm<sup>-2</sup>.

O.i. aj tieto výsledky sú obsiahnuté v 4 CC publikáciách, ktoré vyšli v roku 2012, a v ktorých je minimálne jeden zamestnanec FÚ SAV buď hlavným autorom alebo spoluautorom.

**20.) Lokálne vlastnosti komplexných spinových systémov (*Local properties of complex spin systems*)**

**Zodpovedný riešiteľ:** Martin Plesch  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** 2/0072/12  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** P SAV: 1147 €

Dosiahnuté výsledky:

Práce na projekte boli zamerané na dve základné oblasti: v spolupráci s Viedenskou univerzitou sme pracovali na problematike "klasickosti" pre nepresných meraniach a vývoji v spinových systémoch a v spolupráci s Masarikovou univerzitou v Brne na bezpečnosti pri použití komplexných spinových systémov na komunikáciu. V rámci projektu boli publikované tri práce a vznikli dva rukopisy pripravené na zaslanie na posudzovanie.

**21.) Štatistická fyzika priestorovo ohraničených systémov** (*Statistical physics of confined systems*)

<b>Zodpovedný riešiteľ:</b>	Ladislav Šamaj
<b>Trvanie projektu:</b>	1.1.2012 / 31.12.2014
<b>Evidenčné číslo projektu:</b>	2/0049/12
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	VEGA: 9179 €

Dosiahnuté výsledky:

Pre systém dvoch makro-nábojov ponorených v plazme bola odvodená ich efektívna interakcia v limite nízkych teplôt. Odvodenie bolo založené na koncepcii kvadratických odchýliek nábojov plazmy okolo základného stavu - 2D Wignerovho kryštálu. Teoretické výsledky sú v pozoruhodnej zhode s Monte-Carlo simuláciami a určujú podmienky priťahovania sa rovnakých makro-nábojov v plazme.

Algoritmus dimenzionálnej redukcie, formulovaný na probléme difúzie v nehomogénnom 2D/3D kanáliku, sme zovšeobecnil na redukciu fázového priestoru vo Fokker-Planckovej (FP) rovnici. Pre najjednoduchší prípad, 1D FP-Kramersovu rovnicu, je výsledkom dimenzionálnej redukcie Smoluchowského rovnica rozšírená o korekcie závislé od hmotnosti častice. Táto rovnica umožňuje popísať pohyb častice s nenulovou hmotnosťou vo viskóznom prostredí zjednodušene, ako difúzny pohyb, a zároveň uvážiť aj efekty inercie, ktoré sú zahrnuté do efektívneho difúzneho koeficientu.

Pre Rabiho model interakcie dvojstavového atómu s fotónom bolo v roku 2011 Braakom publikované kvázi-presné riešenie. V rámci projektu bol analogicky vyriešený príbuzný systém - dvojfotónový Rabiho model, kde atóm interaguje vždy s dvomi fotónovými kvantami súčasne.

**22.) Dynamika uväznených molekulárnych systémov v nanometrových póroch** (*Dynamics of confined molecular systems within nanoscale pores*)

<b>Zodpovedný riešiteľ:</b>	Ondrej Šauša
<b>Trvanie projektu:</b>	1.1.2010 / 31.12.2013
<b>Evidenčné číslo projektu:</b>	2/0099/10
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV

**Počet spoluriešiteľských inštitúcií:** 0

**Čerpané financie:** Fyzikálny ústav SAV: 7343 €

Dosiahnuté výsledky:

Dokončili sa merania PALS a DSC na systéme silikagél-hexadekán. Sledovala sa kinetika tuhnutia a topenia hexadekánu. Zdá sa, že topenie a tuhnutie závisí len od priemernej veľkosti pórov a je v súlade s Gibbs-Thompson vzťahom.

Urobili sa merania PALS a DSC na vzorkách CPG-hexadekán pre rôzne množstvá hexadekánu v póroch matrice pre dve rôzne priemerné veľkosti pórov 22 a 12 nm. DSC merania ukazujú, že u CPG skiel sa objavujú v cykle chladenia 2 kryštalizačné píky (pre silikagély iba jeden pík) spojené s uväznením hexadekánu v póroch a jeden kryštalizačný pík spojený s bulkovým hexadekánom. PALS merania umožňujú stanoviť mieru zaplnenia pórov matrice.

Boli nájdené korelácie dôb života a  $S$  parametra s procesom gelácie  $\text{TiO}_2$  gélu, ktorý je jedným z medziproduktov pri príprave poréznych matric pre uväznené systémy. Tri rôzne rýchlosti zmien sledovaných parametrov v čase odpovedajú procesom gelácie, postgelačným procesom a chemicky stabilnej vzorke. Bol nájdený súvis množstva pridanej vody do reakčnej zmesi s rýchlosťou gelácie. Tento experiment ukázal vhodnosť PAS na sledovanie priebehu chemickej reakcie in-situ.

Študovali sa možnosti stanovenia veľkosti mikropórov foriem oxidu titaničitého metódou PALS. V tomto prípade sa však o-Ps tvorí v materiáloch minimálne a odhad veľkosti pórov je možný len z dôb života pozitronov ( $t_2$  komponenta) aj to len pre malé póry.

Urobila sa kombinovaná štúdia 14 sklovitých polymérov a nízkomolekulových látok pomocou PALS a ESR. Bolo nájdené, že prechod (z pomalého do rýchleho režimu) pri T50G sa odohráva pri skoro rovnakej dobe života o-Ps  $t_3(\text{T50G})=2,17\pm0,15$  ns. Teda tento prechod je spojený s výskytom voľnoobjemovej diery priemernej veľkosti  $V_h=114\pm15$  Å<sup>3</sup>.

Publikácie (pozri príloha C): ADCA99, ADCA37, ADCA05 a AFC08.

Príspevky na konferenciách:

O. Šauša, E. Illeková, J. Krištiak, D. Berek and E. Macová

PALS and DSC study of partially filled nanopores by hexadecane

16 th International Conference on Positron Annihilation ICPA 16, Conference Book, P.53, 19-24 August, 2012, University of Bristol, UK

O.Šauša, K. Jesenák, D. Nýblová

Výsledky stanovenia veľkosti mikropórov fotokatalyticky aktívnych foriem oxidu titaničitého metódou pozitronovej anihilačnej spektroskopie

Sborník příspěvku, 14. ročník Konference o speciálních anorganických pigmentech a práškových materiálech, 20.září 2012, Pardubice ČR

**23.) NANOCOMPSYM: Počítačové simulácie na nanoškále** (*NANOCOMPSYM: Computer modeling on the nanoscale*)

**Zodpovedný riešiteľ:** Ivan Štich

**Trvanie projektu:** 1.1.2012 / 31.12.2014

**Evidenčné číslo projektu:** 2/0007/12

**Organizácia je** áno

**koordinátorom projektu:**

**Koordinátor:** Fyzikálny ústav SAV

**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 14 916 €

Dosiahnuté výsledky:

Venovali sme sa najmä NC-AFM (Non-Contact Atomic Force Microscopy) zobrazovaniu a nanomanipulácii a ultra presným výpočtom organometalických systémov na báze prechodových kovov. V prvej oblasti sme študovali procesy zobrazovania a nanomanipulácie na zoxidovanom povrchu Cu(110)-O (c(6x2) a p(2x1)). Ukázali sme, že tento povrch môže slúžiť ako modelový povrch pre experimentálnu identifikáciu apexu hrotu. Objasnili sme mechanizmus manipulácie Cu atómov na povrchu p(2x1) a ukázali, že sa jedná o komplikovaný viackrokový mechanizmus. Tieto výsledky sú priamo naviazané na experimenty, ktoré previedol náš partner na Osaka University. Súčasťou projektu bolo tiež testovanie metód na popis van der Waalových interakcií metódami DFT-vdW. Pri popise organometalických systémov sme používali DFT metódy v štandardných aproximáciách a ultra presné metódy Kvantového Mote Carla (QMC). Ukázali sme, že tieto korelované systémy nie je možné konzistentne popísať metódami DFT. Ukázali sme tiež, že metódy QMC umožňujú spočítať niektoré veličiny presnejšie, ako je ich možné merať experimentálne, napr. disociačné energie neutrálnych polosandvičov.

Opublikovali sme výsledky v Phys. Rev. B (pozri ADCA04 v Prílohe C) a do tlače je zaslaný článok s názvom, "Quantum Monte Carlo Study of  $\pi$ -bonded Transition-metals Organometallics: Neutral and Cationic Vanadium-benzene and Cobalt-benzene Half-sandwiches" (publik. r. 2013).

**24.) Kovové materiály s komplexnou štruktúrou** (*Metallic materials with complex structure*)

**Zodpovedný riešiteľ:** Peter Švec  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:** VEGA 2/0111/11  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 23329 €

Dosiahnuté výsledky:

Pomocou DFT metódy a vypracovaného štruktúrneho modelu sme identifikovali v intermetalickom B20 systéme AlPd povrchové reakčné centrá pre selektívnu hydrogenáciu acetylénu. Ukázali sme, že (210)-povrch AlPd s pseudopäťnásobnou symetriou, podobne ako predtým študovaný (100)-povrch Al<sub>13</sub>Co<sub>4</sub> má vyhovujúcu charakteristiku pre takúto reakciu. Analýzu katalytických vlastností povrchov intermetalických zliatin sme rozšírili aj na systém GaPd (publikácie v J. Phys. Chem. C a J. of Catalysis).

Pomocou prvoprincípových výpočtov a na základe empirických potenciálov sme ukázali možnosť predpovedať optimálnu nízкотеплотnú štruktúru v systéme Al-Cu-Sc a možnosť rozšírenia tohto postupu aj na systémy na báze Al obsahujúce Zn a Mg (Phys. Rev. B).

Podobným spôsobom sme preskúmali aj stabilitu fáz Al<sub>2</sub>Fe a Al<sub>5</sub>Fe<sub>2</sub> a predpovedali sme dosiaľ nepozorovanú nízкотеплотnú fázu s fyzikálne nezvyčajnými vlastnosťami v zliatine Al-Fe (Phys. Rev. B).

V sérii publikácií sme ukázali na význam využitia termickej analýzy pre pochopenie vlastností a stability mikro-, nano- a nekryštalických materiálov a ich transformácií (dve kapitoly v monografiách, päť publikácií napr. v J. Non-Cryst. Solids, J. Therm. Anal. Calorim., atď.), kde sme pomocou fundamentálnej fenomenologickej kinetickej analýzy získali detailné informácie o fázových prechodoch v širokej škále sledovaných systémov.

Kinetiku in-situ nanokryštalizácie v systéme Fe-Zr-B sme preskúmali aj pomocou dopredného rozptylu synchrotrónového žiarenia, kde sme potvrdili existenciu interfaciálnej fázy ležiacej na hranici medzi amorfnou maticou a vznikajúcimi nanozrnami a nezávisle sme kvantifikovali jej vývoj (Phys. Rev. B).

## **25.) Energia symetrie pri super-saturačnej hustote** (*Symmetry energy at spuer-saturation density*)

**Zodpovedný riešiteľ:** Martin Veselský  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:** VEGA-2/0105/11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 5250 €

### Dosiahnuté výsledky:

Skupina z OJF FÚ SAV sa sa zúčastnila analýzy experimentu S394 v rámci spolupráce ASY-EOS, zameranej na experimentálne určenie energie symetrie pri supersaturačnej hustote. Energetické závislosti parametrov funkcie odozvy pre monoenergetické neutróny boli použité pri dekonvolúcii reálnych dát z experimentu.

Pre fyzikálnu analýzu bol vyvinutý rozšírený model BUU, kde sa in-medium nukleón-nukleónové účinné prierezy odhadujú zo stavovej rovnice po transformácii na Van der Waalsovu stavovú rovnicu.

Skupina z OJF FÚ SAV v spolupráci s Univerzitou v Liverpoole vykonala experiment na štúdium vzbudených hladín jadier  $^{177,179}\text{Au}$  na urýchľovačovom komplexe Univerzity v Jyväskylä (Fínsko). Bolo vykonané štúdium gama žiarenia emitovaného spomínanými izotopmi, detekovaného sférou gama detektorov Jurogam2. Boli pozorované viaceré nové jadrové prechody.

Celkovo bolo publikovaných 6 článkov v CC časopisoch.

## **26.) Vývoj termofyzikálnych senzorov na monitorovanie tuhnutia betónových zmesí** (*Thermophysical sensors development for monitoring of concrete setting*)

**Zodpovedný riešiteľ:** Viliam Vretenár  
**Zodpovedný riešiteľ v organizácii SAV:** Viliam Vretenár  
**Trvanie projektu:** 1.1.2012 / 31.12.2014  
**Evidenčné číslo projektu:** 2/0190/12  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV

**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 4920 €

Dosiahnuté výsledky:

V rámci riešenia projektu boli dosiahnuté nasledovné výsledky:

- bola zrealizovaná prvotná numerická analýza reálneho termofyzikálneho senzoru založenom na princípe horúcej guľičky, vyšetrujúca konkrétne vplyv reálnej štruktúry senzora na jeho citlivosť a merací rozsah,
- bol vykonaný set termofyzikálnych meraní na komerčne dostupnom betóne "Hobby beton", v ktorom sa úspešne otestovala funkčnosť termofyzikálneho senzora horúcej guľičky. Namerané časové priebehy korelovali s charakteristickými fázami tuhnutia betónových zmesí.
- v spolupráci s Technickým a skúšobným ústavom stavebným, n.o. a súkromnou spoločnosťou Betón Racio, s.r.o. sme realizovali sériu meraní na štandardných cementových kašiach, za použitia 2 rozdielnych cementov (obsah C3A fázy). Termofyzikálne merania budú korelované s normovanými skúškami na cementovými trámčekoch, t. j. pevnosť v tlaku a v ohybe, dynamický modul pružnosti, Vikatov test atď.

Publikácie sú uvedené v prílohe C: AFDA13, ADCA52, AFDA04, AFDA10)

**27.) Testovanie kvantových prístrojov (*Testing quantum devices*)**

**Zodpovedný riešiteľ:** Mário Ziman  
**Trvanie projektu:** 1.1.2011 / 31.12.2013  
**Evidenčné číslo projektu:** 2/0127/11  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** VEGA: 11700 €

Dosiahnuté výsledky:

Zaoberali sme sa nasledovným problémom porovnávania stavov: Je možné navrhnúť experiment, ktorý by nám umožňoval jednoznačne rozhodnúť (na základe pozorovanej štatistiky výsledkov) o totožnosti alebo rozdielnosti dvoch neznámych príprav stavov bez odhalenia úplnej informácie o týchto stavoch? Zistili sme, že tvrdenie "sú rovnaké" nemožno nikdy uzavrieť bez pochybností, okrem prípadu, keď informácia je úplná. Navyše dokazujeme, že univerzálne porovnanie (ktoré dokonale odlíši všetky stavy) tiež vyžaduje úplnú informáciu o stavoch. Predsa však pre niektoré merania pravdepodobnostné rozdelenie výsledkov umožňuje vyvodiť jednoznačný záver ohľadom rozdielnosti týchto 2 stavov dokonca aj v prípade neúplnej informácie. Analyzujeme efektívnosť takéhoto merania quditových stavov, keď je založené na SWAP meraní. Pri qubitových stavoch sa detailne zaoberáme výkonnosťou špeciálnych rodín 2-hodnotových meraní, ktoré nám umožňujú úspešne porovnať najviac polovicu z dvojíc stavov. Nakoniec zavádzame takmer univerzálne porovnávacie merania, ktoré dokážu rozlíšiť takmer všetky neidentické stavy (až na množinu miery 0). Explicitná podoba takýchto meraní s 2 alebo viac výsledkami bola nájdená pre ľubovoľnú dimenziu. Publikácia ADCA22 je uvedená v prílohe C: [Phys. Rev. A 85, 062301 (2012) ]

Uvažovali sme úlohu minimalizácie ancilárnych systémov potrebných na uskutočnenie ľubovoľnej stratégie kvantového protokolu pri použití klasickej pamäte. Pre tento účel zavádzame pojem pamäťových nákladov stratégie na zmeranie potrebných zdrojov v zmysle ancilárnej dimenzie. Poskytujeme podmienku pre to, aby sa náklady rovnali danej hodnote a tento výsledok používame na vyčíslenie nákladov v špeciálnych prípadoch. Napr. ukazujeme, že ľubovoľný kovariantný protokol pre klonovanie unitárnej transformácie vyžaduje nanajvýš 1 ancilárny qubit. Tiež dokazujeme, že pamäťové náklady musia byť stanovené globálne a nemôžu byť vypočítané optimalizáciou zdrojov nezávisle v každom kroku stratégie. Publikácia ADCA06 je uvedená v prílohe C: [Phys. Rev. A 85, 032333 (2012)]

## Programy: APVV

**28.) Štúdium vlastností hornín a vyšetrovanie štruktúrno-textúrnych charakteristík hornín s koreláciou na termofyzikálne a fyzikálno-mechanické vlastnosti** (*Study of rocks properties and investigation of structural and textural characteristic in correlation with thermophysical and physico-mechanical properties*)

<b>Zodpovedný riešiteľ:</b>	Vlastimil Boháč
<b>Trvanie projektu:</b>	1.5.2011 / 31.10.2014
<b>Evidenčné číslo projektu:</b>	APVV-0641-10
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	APVV: 31238 €

### Dosiahnuté výsledky:

V druhom roku riešenia projektu APVV boli vyšetrované porézne typy kameňov. Pre vyšetrovanie termofyzikálnych vlastností pieskovca pomocou impulznej prechodovej metódy bola vypracovaná analýza vyhodnocovania pomocou nového modelu zohľadňujúceho tepelné straty z povrchu vzorky pomocou koeficientu prestupu tepla medzi povrchom vzorky a okolím. Model bol odvodený pre vzorky v tvare hranola. Pre tento 3D model bola odvodená analýza neurčitosti pri vyhodnocovaní parametrov z modelu pomocou fitovacích procedúr. Pre koeficient teplotnej vodivosti a tepelnej vodivosti sú chyby vyplývajúce z analýzy malé a ich hodnota je menšia ako 1.5%. Pre koeficient prestupu tepla je táto neurčitosť vyššia a pre bežné doby registrácie teplotnej odozvy dosahuje 50 a viac %. Analýza ukázala, že predĺžením doby skenovania a použitím väčších hrúbok vzoriek túto neurčitosť môžeme znížiť pod 25%. Výsledky boli publikované vo forme 2 prednášok na medzinárodných konferenciách a v recenzovanom zborníku z konferencie.

V ďalšej oblasti výskumu, ktorá sa týka monitorovania stavu masívu skalných obydlií v Brhlovciach sme osadili sondu, ktorá monitorovala stav vlhkosti a teploty v masíve. Sonda bola osadená v hĺbke 10 cm pod povrchom v decembri r. 2011. Pre danú lokalitu boli testované ďalšie sondy na monitorovanie v hĺbke 30 a 50 cm. Proces testovania a kalibrácie bol vykonaný v laboratórnych podmienkach pre suchý a vodou nasýtený stav tufových teliesok použitých na výrobu senzorov vlhkosti. Pre oba stavy boli vyšetrené teplotné závislosti v rozsahu teplôt od -20 do 25°C v krokoch po 5°C. Tým sme upresnili rozsah maximálnych a minimálnych hodnôt, ktoré budú merané priamo v lokalite. Porovnaním teplotnej závislosti kalibrovaných senzorov s dátami nameranými na lokalite sme zistili, že doposiaľ namerané dáta počas jedného roka sú v rozsahu teplotnej závislosti vlhkostí kalibrovaných v suchom a saturovanom stave. Práca bola prezentovaná formou prednášky a príspevku v recenzovanom zborníku na medzinárodnej konferencii



THERMOPHYSICS. Ďalšia analýza meraní bude prednesená na konferencii ISSMGE budúci rok, kde bol už zaslaný plný text príspevku. Výsledky dlhodobého monitorovania budú použité pre výpočty a analýzu deterioračných faktorov a možných mechanicko-fyzikálnych zmien v masíve. Počas riešenia projektu bola dokončená nová modifikovaná meracia komora, ktorá umožňuje flexibilne meniť prúdenie kvapaliny v termostatovanom okruhu buď v rámci jedného okruhu výmenníkov tepla alebo separátne, čím sa umožňuje vykonať merania pri nastavenom gradiente teplôt na vzorke medzi pomocou oddeleného systému výmenníkov tepla.

Publikácie za FÚ SAV: AFDA01 a AFDA13 (pozri prílohu C)  
a taktiež Prednáška a abstrakt v zborníku konferencie 18th Symposium on Thermophysical Properties (THERMOSYMPIUM) Boulder, CO, USA, June 24 - 29, 2012.  
[http://thermosymposium.nist.gov/pdf/Abstract\\_1517.pdf](http://thermosymposium.nist.gov/pdf/Abstract_1517.pdf)

Patricia Ekkertová, Ivana Šimková, Martin Brček, Tatiana Durmeková, Vlastimil Boháč, Influences of temperature change and moisture content on the thermal conductivity of rocks, Thermophysics 2012 - Conference Proceedings, 17th International Meeting of Thermophysical Society, 31st October to 2th November 2012, Podkylava, Slovak Republic, org. Institute of Physics, Slovak Academy of Science in Bratislava, Printed by: Brno University of Technology, Faculty of Chemistry, 2012, ISBN: 978-80-214-4599-4, p.33-40

## 29.) Kryštálové prvky rtg optiky pre kompresiu a expanziu zväzku (*Crystal elements of X-ray optics for beam compression and expansion*)

<b>Zodpovedný riešiteľ:</b>	Matej Jergel
<b>Trvanie projektu:</b>	1.7.2012 / 31.12.2015
<b>Evidenčné číslo projektu:</b>	APVV-0308-11
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	APVV: 19315 €

### Dosiahnuté výsledky:

Metódou "ray tracing" boli navrhnuté asymetrické kanálikové dvojdrázové Ge(220)kompresory rtg zväzku so zvýšeným kompresným pomerom väčším ako 10, kedy dochádza v dôsledku refrakcie k vzájomnému posuvu difrakčných kriviek difraktorov a zníženiu výstupnej intenzity. Pri kompresnom pomere 21 sme vypočítali posuv Ge 220 kriviek 15 uhlových sekúnd, čo vedie k 3,5-násobnému zníženiu intenzity. Simulácie ukázali, že toto možno kompenzovať laterálnou zmenou mriežkového parametra cez zmenu koncentrácie prímеси alebo rôznou teplotou difraktorov. Zistili sme, že pri použití Si ako prímеси je potrebný celkový koncentračný gradient na úrovni 0,3% alebo celkový teplotný rozdiel 30 K. Tieto výsledky overíme experimentálne. Takisto overíme rôzne asymetrie difraktorov, čo môže podľa teoretických výpočtov tiež zvýšiť intenzitu na výstupe.

Ďalej sme sa zamerali na komplexnú charakterizáciu finalizovaných povrchov rtg monochromátorov na rôznych rozmerových škálach v mikrometrovej a nanometrovej oblasti ako spätnej väzby pre vývoj technológie. Testovali sme monokryštály Ge(220), FZSi (100) a Cu (111), pričom sme porovnávali chemické leštenie a novú progresívnu metódu jednobodového diamantového frézovania (single point diamond turning - SPDT). Kombinovali sme metódy silovej

mikroskopie (AFM), dotykovej profilometrie, optického rozptylu, malouhlového rozptylu pri šikmom dopade (GISAXS) a vysokorozlišovacej rtg difraktometrie (HRXRD). Kým lokálna drsnosť na nanometrovej laterálnej škále bola pre obe metódy finalizácie povrchov porovnateľná, metóda SPDT ukázala podstatne lepšiu rovinnosť, a to v rámci niekoľko nm na mikrometrovej škále. Najlepšie výsledky sme dosiahli s Ge(220), kde rovinnosť bola plus/mínus 2nm na ploche 50x50 mikrometrov a lokálna drsnosť bola len 0.7nm. Na tento materiál sa zameriame v ďalšom.

Výstupy:

D. Korytár, P. Vagovič, K. Végső, P. Šiffalovič, E. Dobročka, W.Jark, V. Áč, Z. Zápražný, C. Ferrari, A. Cecilia, E. Hamann, P. Mikulík, T. Baumbach, M. Fiederle: X-ray beam conditioning and imaging using higher asymmetry V-channel monochromators  
- prednáška na konferencii X-TOP 2012, September 15-20, 2012, Saint-Petersburg  
- článok poslaný do J. Applied Crystallography

### 30.) Úloha vody v poréznych štruktúrach (*Role of water in porous structures*)

<b>Zodpovedný riešiteľ:</b>	Ľudovít Kubičár
<b>Trvanie projektu:</b>	1.9.2009 / 31.8.2012
<b>Evidenčné číslo projektu:</b>	LPP-0422-09
<b>Organizácia je</b>	áno
<b>koordinátorom projektu:</b>	
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských</b>	0
<b>inštitúcií:</b>	
<b>Čerpané financie:</b>	APVV - LPP: 17058 €

#### Dosiahnuté výsledky:

V projekte sme sa sústredili na difúziu vody v troch druhoch pieskovca s porozitami 0.3%, 17% a 21%. Mechanizmus difúzie je podstatne ovplyvnený porozitou. Ďalej sme venovali pozornosť šíreniu frontov mrznutia a topenia u vodou nasýtených pieskovcov. Podľa očakávania efekty spojené s mrznutím a topením úzko súvisia s porozitou. Difúzia vody a premrzavanie sú základné mechanizmy spôsobujúce deštrukciu stavebných objektov vplyvom spodných vôd a meteorologickými podmienkami. Paralelne s experimentmi v laboratóriu realizujeme monitoring tepelno – vlhkostného režimu historických objektov, kde sa namerané dáta interpretujú v rámci vyššie spomínaných efektov. Monitorovanie sa sústredilo na skalný masív Spišského hradu, pilierov kostola sv. Jakuba v Levoči a veže katedrály sv. Martina v Bratislave.

### 31.) Samousporiadanie nanočastíc a molekúl na rozhraní kvapalina/vzduch

<b>Zodpovedný riešiteľ:</b>	Eva Majková
<b>Trvanie projektu:</b>	1.9.2009 / 31.8.2012
<b>Evidenčné číslo projektu:</b>	APVV LPP -0175-09
<b>Organizácia je</b>	áno
<b>koordinátorom projektu:</b>	
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských</b>	0
<b>inštitúcií:</b>	
<b>Čerpané financie:</b>	11 092 €

Dosiahnuté výsledky:

Identifikovali sme principiálne fázy tvorby nanočasticových vrstiev na rozhraní voda/vzduch s použitím in situ rtg malouhlového rozptylu pri malom uhle dopadu, Brewster angle mikroskopie a zobrazovacej elipsometrie. Na rozhraní voda/vzduch vznikne vrstva koalescenciou voľných samousporiadaných nanočasticových ostrovčekov. Usporiadanie v rámci ostrovčekov už na začiatku stláčania je hexagonálne tesné usporiadanie, ako ukázala simulácia výsledkov GISAXS. Pôvodné usporiadanie nanočastíc sa zachová až do prechodného stlačenia hexagonálnej mriežky krátko predtým, než monovrstva skolabuje. Táto stlačená fáza nebola doteraz pozorovaná a môže byť pozorovaná len v dynamickom režime. Kolaps sa realizuje vytlačením nanočastíc a tvorbou druhej nanočasticovej vstvy. Expanzia Langmuirovskej vrstvy je ireverzibilná, vytvorí sa ostrovčeky, pričom usporiadanie v ostrovčekoch sa zachová.

**32.) Úloha defektov v organických polovodičoch pre slnečné články** (*Role of defects in organic semiconductors for solar cells*)

**Zodpovedný riešiteľ:** Vojtech Nádaždy  
**Trvanie projektu:** 1.7.2012 / 31.12.2015  
**Evidenčné číslo projektu:** APVV-0096-11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 2 - Slovensko: 2  
**inštitúcií:**  
**Čerpané financie:** FU SAV: 24360 €

Dosiahnuté výsledky:

V prvom polroku riešenia projektu sme sa zamerali na zvládnutie technológie prípravy štandardného organického slnečného článku metódou rotačného nanášania zo zmesi poly(3-hexylthiophenu) (P3HT) a derivátu fullerénu (PCBM). Podarilo sa nám pripraviť laboratórny slnečný článok, ktorého účinnosť premeny slnečného žiarenia na elektrickú energiu dosahuje 2,5 %.

**33.) Silno interagujúca hmota v extrémnych podmienkach** (*Strongly Interacting Matter under Extreme Conditions*)

**Zodpovedný riešiteľ:** Štefan Olejník  
**Trvanie projektu:** 1.7.2012 / 31.12.2015  
**Evidenčné číslo projektu:** APVV-0050-11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 2 - Slovensko: 2  
**inštitúcií:**  
**Čerpané financie:** APVV: 3572 €

Dosiahnuté výsledky:

Projekt je riešený v spolupráci s pracovníkmi Univerzity Mateja Bela v Banskej Bystrici a Ústavu experimentálnej fyziky SAV v Košiciach od 1.7.2012. Na FÚ SAV uskutočňujeme testy

približného tvaru vlnového funkcionálu vákua (VFV) Yangovej-Millsovej kalibračnej teórie (kvantovej chromodynamiky bez dynamických kvarkov) v numerických simuláciách na mriežke. Tento tvar je dobrým priblížením k presnému VFV v (2+1)-rozmernom časopriestore. V tomto roku dosiahnuté predbežné výsledky sú sľubné aj v prípade (3+1) rozmerov. Výsledky boli uverejnené zatiaľ iba v konferenčnom príspevku:

J. Greensite, Š. Olejník: Testing the Yang–Mills vacuum wave functional Ansatz in 3+1 dimensions, Proceedings of Science, PoS (Confinement X)054 (2012).

### **34.) Výskum nových pasivačných procesov štruktúr na báze kremíka** (*Research of New Passivation Processes of Si-based Structures*)

<b>Zodpovedný riešiteľ:</b>	Emil Pinčík
<b>Trvanie projektu:</b>	1.7.2012 / 30.6.2015
<b>Evidenčné číslo projektu:</b>	APVVV-0888-11
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	2 - Nemecko: 1, Japonsko: 1
<b>Čerpané financie:</b>	APVV: 23685 € ISIR Osaka University Japonsko: 1500 €

#### Dosiahnuté výsledky:

Projekt začal od 1. júla 2012. V jeho rámci boli čiastočne upravované a modifikované priestory riešenia projektu na FÚ SAV na Patrónke tak, aby bolo možné realizovať viacero nevyhnutných chemicko-technologických operácií, ktoré majú prispieť k úspešnému riešeniu jeho úloh.

Boli definované úlohy pre viacerých spolupracujúcich kolegov a aj študentov (bakalárske práce, diplomové práce, PhD témy) na spoluriešiteľskom pracovisku IAS Žilinskej Univerzity v Liptovskom Mikuláši, ako aj v samotnej Žiline.

Boli nadviazané dve nutné kooperácie s univerzitami v Českej republike. Bol nadviazaný neformálny kontakt s jedným podnikateľským subjektom, atď. V októbri 2012 úspešne prebehla konferencia ALER 2013 v Liptovskom Jáne. Recenzovaný zborník je k dispozícii. V rámci predbežných testov bolo preukázané, že pasivačnými procedúrami je možné zvýšiť konverznú účinnosť solárnych článkov pn typu na polykrystalickom kremíku o viac ako 20%. To isté číslo je možné uviesť aj pre vhodne pasivované solárne články pin typu pripravené na báze amorfného kremíka. Otázna je stabilita pasivačných procedúr. Úspešne boli pripravené a čiastočne aj vyhodnotené viaceré série vzoriek s  $\text{HfO}_2/\text{SiO}_2/\text{Si}$ . Navyše (neplánovane) boli úspešne pripravené aj tzv. „black silicon“ vzorky. Obe posledne menované typy štruktúr majú byť aplikované pri formovaní solárnych článkov, ktoré sú predmetom tohto projektu a majú predstavovať aj bázu vzoriek pre základný experimentálny, ako aj teoretický výskum takýchto štruktúr.

V rámci tohto projektu sú prijaté do tlače dva CC články a viaceré ďalšie boli prezentované na domácich ako aj zahraničných konferenciách a už sú publikované v recenzovaných zborníkoch.

### **35.) Fyzika očami fyzikov** (*Physics by Physicists*)

<b>Zodpovedný riešiteľ:</b>	Martin Plesch
<b>Trvanie projektu:</b>	1.9.2009 / 30.8.2012
<b>Evidenčné číslo projektu:</b>	
<b>Organizácia je</b>	áno

**koordinátorom projektu:**

**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 12576 €

Dosiahnuté výsledky:

V rámci projektu sa uskutočnilo 24 prednášok a diskusií na stredných školách (resp. v malej časti na pôde univerzít alebo SAV, ak bola prednáška určená viacerým školám). Projekt sme prezentovali v rámci Noci výskumníkov a na konferencii Vanovičove dni.

Celkovo sa aktivít projektu zúčastnilo viac ako 1000 študentov, pričom väčšina prednášok je vo forme prezentácií k dispozícii aj na stránke projektu <http://www.physics.sk/fof>.

**36.) Zvyšovanie tuhosti ľahkých konštrukčných prvkov aplikáciu nových kovových materiálov** (*Application of advanced metallic materials for stiffness enhancement of lightweight structural components*)

**Zodpovedný riešiteľ:** František Simančík  
**Zodpovedný riešiteľ v organizácii SAV:** Peter Švec  
**Trvanie projektu:** 1.5.2011 / 31.10.2014  
**Evidenčné číslo projektu:** APVV-0647-10  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:**  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 29742 €

Dosiahnuté výsledky:

Na základe spoločných predikcií z prvoprincípových výpočtov (Phys. Rev. B) a experimentálnych analýz sme pripravili systémy na báze Al-Cr-Fe rýchlym ochladením taveniny a atomizáciou v dusíkovej atmosfére. Jemným nastavením množstva legujúcich prvkov Fe a Si sme dosiahli vhodnú východiskovú štruktúru pre úspešnú prípravu kompaktovej pomociou pretlačania za tepla bez podstatného nárastu rozmerov spevňujúcich fáz Al<sub>7</sub>Cr a nanokvázikryštalického Al<sub>84,6</sub>Cr<sub>15,4</sub>. Použitá technológia, východisková štruktúra a tepelné režimy spracovania stanovené na základe kinetických a termodynamických analýz umožnili aj prípravu valcových kompaktovej z oboch typov východiskových materiálov s priemerom až 40mm. Kompakty v dôsledku prítomnosti ľahkých vysokomodulových fáz vykazovali vysoké pevnosti a moduly pružnosti v rozsahu teplôt až do 300°C (Mat. Sci. Engn. A).

**37.) nanoQMC: Kvantové Monte-Carlo pre nanočastice a transport** (*nanoQMC: Quantum Monte-carlo for nanoparticles and transport*)

**Zodpovedný riešiteľ:** Ivan Štich  
**Trvanie projektu:** 1.9.2009 / 21.8.2013  
**Evidenčné číslo projektu:** LPP-0392-09

**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 2 - Taliansko: 1, USA: 1  
**inštitúcií:**  
**Čerpané financie:** FU SAV: 20429 €

Dosiahnuté výsledky:

S doktorandkou (projekt APVV-LPP) sme modelovali magnetické nanoštruktúry (polosandviče) organometalických systémov na báze prechodových kovov, vanád-benzén a cobalt-benzén v neutrálnom a kationickom stave. Používali sme DFT metódy v štandardných aproximáciách a ultra presné metódy Kvantového Mote Carla (QMC). Ukázali sme, že tieto korelované systémy nie je možné konzistentne popísať metódami DFT. Ukázali sme tiež, že metódy QMC umožňujú spočítať niektoré veličiny presnejšie, ako je ich možné merať experimentálne, napr. disociačné energie neutrálnych polosandvičov. Výsledky sme opublikovali v prestížnom časopise Phys. Rev. Lett. (pozri ADCA32 v Prílohe C) a ďalší článok, ktorý sme zaslali do časopisu Jour. Chem. Theor. Comput. bude opublikovaný v r. 2013.

**38.) NANOTIP: SPM procesy indukované hrotom: zobrazovanie a nanomanipulácia**  
(*NANOTIP: Tip-induced SPM processes: Imaging and nanomanipulation*)

**Zodpovedný riešiteľ:** Ivan Štich  
**Trvanie projektu:** 1.7.2012 / 31.12.2015  
**Evidenčné číslo projektu:** APVV-0207-11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 0  
**inštitúcií:**  
**Čerpané financie:** FU SAV: 25525 €

Dosiahnuté výsledky:

V roku 2012 sme sa venovali najmä NC-AFM (Non-Contact Atomic Force Microscopy) zobrazovaniu a nanomanipulácii na zoxidovanom povrchu Cu(110)-O (c(6x2) a p(2x1)). Ukázali sme, že tento povrch môže slúžiť ako modelový povrch pre experimentálnu identifikáciu apexu hrotu. Objasnili sme mechanizmus manipulácie Cu atómov na povrchu p(2x1) a ukázali, že ide o komplikovaný viackrokový mechanizmus. Tieto výsledky sú priamo naviazané na experimenty, ktoré uskutočnil náš partner na Osaka University. Súčasťou projektu bolo tiež testovanie metód na popis van der Waalsových interakcií metódami DFT-vdW a testovanie DFT funkcionálov. Publikácie ADCA04 a ADCA32 sú uvedené v Prílohe C, ďalší článok je zaslaný do tlače.

**39.) Nanokryštalické a kvázikryštalické kovové systémy s cielene modifikovanou štruktúrou a morfológiou**  
(*Nanocrystalline and quasicrystalline metallic systems with tailored structure and morphology*)

**Zodpovedný riešiteľ:** Peter Švec

**Trvanie projektu:** 1.7.2012 / 31.12.2015  
**Evidenčné číslo projektu:** APVV-0492-11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských** 0  
**inštitúcií:**  
**Čerpané financie:** FÚ SAV: 30000 €  
ÚEF SAV: 10816 €

*Dosiahnuté výsledky:*

Na základe detailného preskúmania systému Fe-Ni-Nb-B sme vhodným spracovaním a naladením pomeru Fe a Ni voči B pripravili unikátnu monofázovú vzorku obsahujúcu komplexnú fázu typu Fe<sub>23</sub>B<sub>6</sub>, spravili sme prvé pozorovania s atomárnym rozlíšením na stanovenie obsadenia jednotlivých kryštalografických pozícií konkrétnymi atómami.

Úspešne sme rozpracovali prípravu objemových kovových skiel a pseudoobjemových viacvrstvových rýchlochladených pások (prihláška patentu), preskúmali sme ich vlastnosti, štruktúru a stabilitu (J. Supercond. Nov. Magn.) a charakterizovali sme rozhranie medzi vrstvami takýchto pások v amorfnom stave a v rôznych stupňoch kryštalinity (dve pozvané prednášky). Metodicky sme zhodnotili spôsoby určovania kinetiky sklenia a kryštalizácie skiel, kriticky sme zhodnotili bežne sa vyskytujúce omyly iných autorov (J. Non. Cryst. Sol. – pozvaný článok a dve kapitoly v knihách, pozvaná prednáška). Popisované metodiky sme spolu s detailnou štruktúrnou analýzou použili na stanovenie charakteru javov pri chladení a ohreve širokého spektra skúmaných systémov (kovové sklá rôznych geometrií, nanokryštalické a nanoporózne systémy, novovyvinuté systémy spájok a pod. – pozvané prednášky, publikácie Phys. Rev. B, Applied Surf. Sci, atď.). V systémoch Al-Mo a Al-Mn sme vyšetrili možné exotermické reakcie pri transformácii kvázikryštalických fáz.

**40.) Štúdium kryštálovej štruktúry a termodynamických vlastností komplexných kovových zliatin na báze hliníka respektíve zinku** (*Study of crystal structure and thermodynamic properties of aluminum-base and zinc-base complex metallic alloys*)

**Zodpovedný riešiteľ:** Peter Švec  
**Trvanie projektu:** 1.7.2012 / 31.12.2015  
**Evidenčné číslo projektu:** APVV-0076-11  
**Organizácia je** nie  
**koordinátorom projektu:**  
**Koordinátor:** Materiálovotechnologická fakulta STU v Trnave  
**Počet spoluriešiteľských** 0  
**inštitúcií:**  
**Čerpané financie:** APVV: 13000 €

*Dosiahnuté výsledky:*

Preskúmali sme energetické podmienky vzniku a stability fáz Al<sub>2</sub>Fe a Al<sub>5</sub>Fe<sub>2</sub> a ich transformáciu pri znížení teploty. Stanovili sme štruktúru, usporiadanie a orientačné interakcie v systéme Ca-Cd, ktorý vykazuje kvázikryštálu-podobnú štruktúru na báze ikosahedrálnej klastrov a jeho stabilitu v nízkoteplotnej oblasti. Pomocou DFT sme detailne popísali atomárnu štruktúru dekadonálneho kvázikryštálu ZnMgDy. Výsledky sme prezentovali o. i. na pozvaných prednáškach na sympóziu

Quasicrystals Today (Grenoble) a na ETH Zurich. Pripravili sme viaceré systémy na báze Al obsahujúce komplexné fázy a určili sme ich štruktúru.

#### 41.) Energia symetrie v štruktúre jadrovej hmoty (*Energy of Symetry in Structure of Nuclear Matter*)

**Zodpovedný riešiteľ:** Martin Venhart  
**Trvanie projektu:** 1.7.2012 / 31.12.2015  
**Evidenčné číslo projektu:** APVV-0177-11  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 33624 €

##### Dosiahnuté výsledky:

Vzbudené stavy izotopu  $^{177}\text{Au}$  boli študované na Univerzite v Jyväskylä (Fínsko) za použitia sféry Jurogam2. Analýza dát stále prebieha. Doteraz boli jednoznačne identifikované tri nové rotačné pásy spolu s ich kotviacimi prechodmi. V SÚJV Dubna pokračoval vývoj hmotnostného spektrometra MASHA. Realizovaný bol experiment, ktorý mal za cieľ študovať jadrovú reakciu  $^{48}\text{Ca} + ^{238}\text{U}$  s produkciou izotopu  $^{283}\text{Cn}$ . Počas ožarovania terča nebol pozorovaný ani jeden jednoznačný prípad pozorovania rozpadu izotopu  $^{283}\text{Cn}$ . Po výrazných úpravách zariadenia bude experiment pokračovať v roku 2013. V GSI Darmstadt bol vykonaný experiment so zrážkami  $\text{Au} + \text{Au}$  pri energii 1,4 GeV na nukleón. Na výročnej schôdzi HADES kolaborácie bol výskumný tím z FÚ SAV prijatý za riadnych členov. V rámci kolaborácie sa skupina z FÚ SAV zaoberá analýzou dát so zameraním na pión-piónové korelácie. Potrebný software je vo vývoji a je už čiastočne spustený na počítačovom klastri v GSI Darmstadt. Pre fyzikálnu analýzu bol vyvinutý rozšírený model BUU, kde sa in-medium nukleón-nukleónové účinné prierezy odhadujú zo stavovej rovnice po transformácii na Van der Waalovu stavovú rovnicu.

Iwamoto-Haradov model emisie klastrov v predrovnovážnych jadrových reakciách bol zovšeobecnený uvažovaním možného vplyvu spinových premenných na tvar energetického spektra emitovaných častíc.

Celkovo boli publikované 3 články v CC časopisoch a bolo prednesených 5 pozvaných prednášok na medzinárodných konferenciách.

#### 42.) Komplexnosť kvantovej informácie (*Complexity of quantum information*)

**Zodpovedný riešiteľ:** Mário Ziman  
**Zodpovedný riešiteľ v organizácii SAV:** Mário Ziman  
**Trvanie projektu:** 1.5.2011 / 30.4.2014  
**Evidenčné číslo projektu:** APVV-0646-10  
**Organizácia je** áno  
**koordinátorom projektu:**  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 39242 €



Dosiahnuté výsledky:

ADCA75 [Phys. Rev. Lett. 109, 050501 (2012)] Študujeme problém zlepených stromov od A. M. Childs, R. Cleve, E. Deotto, E. Farhi, S. Gutmann, a D. Spielman, in Proceedings of the 35th Annual ACM Symposium on Theory of Computing (ACM, San Diego, CA, 2003), s. 59., v adiabatickom modeli kvantového počítania a poskytujeme postup žihania pre exponenciálne rýchlejšie riešenie orákulového problému než je klasicky možné. Hamiltoniány zahrnuté v kvantovom žihaní nie sú citlivé na tzv. znamienkový problém. Na rozdiel od typického scenára, náš postup je efektívny aj v prípade, že minimálny rozdiel energetických hladín Hamiltoniánu je exponenciálne malou funkciou veľkosti problému. Rozoberáme zovšeobecnenia založené na znáhodnení počiatočného stavu s cieľom vyhnúť sa spomaleniu v adiabatickom kvantovom počítaní v dôsledku malých rozdielov hladín.

ADCA110 [Phys. Rev. E 86, 062104 (2012)] Zovšeobecnil sme numerický algoritmus CTMRG pre výpočet voľnej energie a profilov pre spontánnu magnetizáciu na štvorcovej mriežkovej geometrii. Algoritmus je založený na pozične závislom tenzorovom súčinovom stave. Porovnaním štvorcovej a nekonečne dlhej pásovej geometrie sme potvrdili, že škálovacie parametre sú identické v termodynamickej limite, zatiaľ čo konečnorozmerné efekty sú veľmi silné a ovplyvňujú len prefaktory v škálovanom vzťahu pre voľnú energiu.

**43.) Kvantové kráčania a zložitosť** (*Quantum Walks and Complexity*)

<b>Zodpovedný riešiteľ:</b>	Mário Ziman
<b>Trvanie projektu:</b>	1.9.2009 / 31.8.2012
<b>Evidenčné číslo projektu:</b>	APVV-LPP-0430-09
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Fyzikálny ústav SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	APVV: 11045 €

Dosiahnuté výsledky:

Najvýznamnejším výsledkom záverečného obdobia projektu je ďalšie pokračovanie publikácie s názvom "Quantum Walks on Necklaces and Mixing" (M. Kieferová, D. Nagaj) v International Journal of Quantum Information (pozri ADCA46 v prílohe C). Preložili sme kvantovo-kráčací algoritmus na prechod zlepenými stromami do algoritmu prirodzeného pre adiabatický model, a ukázali jeho exponenciálnu výhodosť oproti ľubovoľnej klasickej metóde. Tento článok sme pomerne rýchlo publikovali v PRL (ADCA75 v prílohe C), a prezentovali ho prednáškou na prestížnej konferencii QCMC 2012 vo Viedni.

Nakoniec sme projekt uzavreli väčším prehľadovým článkom o kvantových kráčaniach "Daniel Reitzner, Daniel Nagaj, Vladimír Bužek, Quantum Walks, Acta Physica Slovaca 61, No.6, 603-725 (2011)" a viacerými popularizačnými prednáškami na stredných aj vysokých školách (FMFI UK, FEI STU), ako aj semestrálnou výberovou prednáškou na FMFI UK, vďaka ktorej sme získali kontakty na ďalších šikovných študentov - diplomantov a potencionálnych doktorandov pre naše pracovisko. (ADCA75: "Quantum Speedup by Quantum Annealing", Phys. Rev. Lett. 109, 050501).

## **Programy: Štrukturálne fondy EÚ Výskum a vývoj**

### **44.) Budovanie Centra excelentnosti pre nové technológie v elektrotechnike – II. etapa**

**Zodpovedný riešiteľ:** Karol Fröhlich  
**Zodpovedný riešiteľ v organizácii SAV:** Eva Majková  
**Trvanie projektu:** 1.2.2010 / 31.1.2012  
**Evidenčné číslo projektu:** 26240120011  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:**  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 3 €

#### Dosiahnuté výsledky:

Koncom roku bolo dodané depozičné custom designed UUHV zariadenie Dual Ion Beam Sputtering. V súčasnosti prebiehajú testy zariadenia, príprava softwarového riadenia a tiež dobudovanie in situ monitoringu s použitím spektroskopického elipsometra.

### **45.) Kompetenčné centrum pre nové materiály, pokročilé technológie a energetiku** *(Competence Centre for New Materials, Advanced Technologies and Energetics)*

**Zodpovedný riešiteľ:** Karol Fröhlich  
**Zodpovedný riešiteľ v organizácii SAV:** Eva Majková  
**Trvanie projektu:** 1.5.2011 / 30.9.2014  
**Evidenčné číslo projektu:** ITMS 26240220073  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:**  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 0

#### Dosiahnuté výsledky:

V rámci kompetenčného centra pracujeme na vývoji nanočasticových fotovoltických štruktúr a senzorov.

### **46.) Priemyselné výskumné centrum bezpečnostných rizík havárií so stratou chladiva v jadrových elektrárnach**

**Zodpovedný riešiteľ:** Štefan Gmuca  
**Trvanie projektu:** 1.2.2011 / 31.1.2015  
**Evidenčné číslo projektu:** 26220220147

<b>Organizácia je koordinátorom projektu:</b>	nie
<b>Koordinátor:</b>	VÚEZ a.s. Levice
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	0

Dosiahnuté výsledky:

Po ukončení testovacej fázy bol do rutinej prevádzky uvedený špičkový XRF mikroskop Horiba XGT 7200. Energetické rozlíšenie detektora dosiahlo 126 eV/5.9 keV, a priestorové rozlíšenie kapilárnej optiky je 50 mikrometrov. Zariadenie je primárne určené na analýzu vzoriek zo slučky VIKTÓRIA, ale je využiteľné aj pre potreby ostatných projektov.

**47.) Centrum komercializácie poznatkov a ochrany duševného vlastníctva Slovenskej akadémie vied**

<b>Zodpovedný riešiteľ:</b>	Arpád Nagy (pôvodne M.Janek)
<b>Zodpovedný riešiteľ v organizácii SAV:</b>	Eva Majková
<b>Trvanie projektu:</b>	1.10.2009 / 31.8.2012
<b>Evidenčné číslo projektu:</b>	26240220006
<b>Organizácia je koordinátorom projektu:</b>	nie
<b>Koordinátor:</b>	TI SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	0

Dosiahnuté výsledky:

Projekt je ukončený, došlo k zmene riaditeľa projektu a dosiahnuté výstupy budú k dispozícii, až keď Technologický inštitút SAV dá k dispozícii odpočet.

**48.) Efektívne riadenie výroby a spotreby energie z obnoviteľných zdrojov**

<b>Zodpovedný riešiteľ:</b>	Marián Janek
<b>Zodpovedný riešiteľ v organizácii SAV:</b>	Eva Majková
<b>Trvanie projektu:</b>	1.6.2010 / 31.5.2013
<b>Evidenčné číslo projektu:</b>	26240220028
<b>Organizácia je koordinátorom projektu:</b>	nie
<b>Koordinátor:</b>	
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	34642 €

Dosiahnuté výsledky:

Projekt pokračuje, v súčasnosti riešitelia požiadali o predĺženie projektu. Výskumný kolektív z FU SAV už realizoval všetky nákupy zariadení a úspešne vyvíja fotovoltické štruktúry plánované v projekte.

**49.) Centrum aplikovaného výskumu nanočastíc**

**Zodpovedný riešiteľ:** Eva Majková  
**Trvanie projektu:** 1.10.2009 / 30.9.2012  
**Evidenčné číslo projektu:** 26240220011  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 20 000 €

Dosiahnuté výsledky:

Projekt bol z vecnej výskumnej stránky úspešne ukončený, finančne sa ukončuje. Pripravili sme na báze nanočastíc superhydrofóbny povrchy s kontaktným uhlom 175 deg, čo je svetovo porovnateľný výsledok.

**50.) Výskumné Centrum svetla a svetelnej techniky (*Research center of light*)**

**Zodpovedný riešiteľ:** Eva Majková  
**Trvanie projektu:** 2.12.2010 / 30.12.2014  
**Evidenčné číslo projektu:** 26220220150  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** OMS s.r.o  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 0

Dosiahnuté výsledky:

V rámci projektu obstarávame potrebnú infraštruktúru.

**51.) meta-QUTE: Centrum excelentnosti kvantových technológií (*meta-QUTE: Centre of excellence for quantum technologies*)**

**Zodpovedný riešiteľ:** Ivan Štich  
**Trvanie projektu:** 1.3.2010 / 29.2.2012  
**Evidenčné číslo projektu:** 26240120022  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 3 - Slovensko: 3

**Čerpané financie:**

FU SAV: 113541€

Dosiahnuté výsledky:

- Oddelenie Centrum pre výskum kvantovej informácie:

Na niekoľkých príkladoch sme skúmali ako môžu byť kvantové kráčania použité na hľadanie štruktúrnych anomálií v grafoch. Zistili sme, že za určitých okolností, kvantové kráčanie môže byť použité na lokalizáciu toho, kde sa mení prepojenosť siete. Našli sme príklad použitia kvantového kráčania na nájdenie miesta, kde sú dve siete spojené. Nakoniec sme použili kvantové kráčanie na úplnom bipartitnom grafe na nájdenie hrany, ktorá ničí bipartitný charakter grafu.

Sformulovali sme nelineárnu teóriu spinových transportov v kvantových koherentných vodičoch a ukázali, ako mezoskopické zúženie s prenosom závislým od energie môže zmeniť spinový prúd injektovaný nahromadením spinu na elektrický signál, bez magnetických alebo výmenných polí. Keď je prenos cez zúženie nezávislý od spinu, tak väzba spin-náboj je nelineárna, s elektrickým signálom, ktorý je kvadratický v akumulácii. Vznikli publikácie s názvom “Universal two-body-Hamiltonian quantum computing”(ADCA62 v Prílohe C) a “Spin to charge conversion in mesoscopic structures” (ADCA77 v Prílohe C).

- Laboratórium kvantových meraní:

V roku 2012 bola kompletne ukončená dodávka a inštalácia prístrojového vybavenia laboratória. Na Slovensku tak vzniklo unikátne laboratórium na meranie supravodivých nanoštruktúr, ktoré je porovnateľné s podobnými laboratóriami vo svete.

Prebehla prvá etapa aktivity zameraná na teoretický návrh supravodivých kvantových bitov. Druhá etapa je zameraná na prípravu supravodivých rezonátorov s metamateriálom, resp. supravodivými qubitmi. Kvantový metamateriál, vytvorený z poľa supravodivých qubitov, ktorý bol navrhnutý na FMFI UK.

Na supravodivých qubitoch a kvantových metamateriáloch boli v tomto roku realizované prvé merania. Do redakcie Phys. Rev. Lett. bol zaslaný článok M.Grajcar et al. s názvom “Dressed-state amplification by a superconducting qubit” (Arxiv: 1205.3017).

- Oddelenie komplexných fyzikálnych systémov:

Metódami QMC sme popísali sendvičové magnetické nanoštruktúry vanád-benzénu a kobalt-benzénu. DFT technikami sme modelovali bezkontaktnú silovú mikroskopiu na čistom a oxidovanom povrchu medi. Modelovali sme aj nanotribologické systémy a Shottkyho ohmické kontakty. Vznikli publikácie ADCA32, ADCA90, ADCA04, ADCA18, GII01, GII02 (pozri v Prílohe C). Tu uvedieme iba názvy článkov:

GIIO2: Elektrónová štruktúra: populárne versus presné metódy,

GIIO1: Nanotribológia: chémia na pohybujúcich sa rozhraniach,

ADCA32: Spin multiplicity and symmetry breaking in vanadium-benzene complexes,

ADCA04: Chemical tip fingerprint in scanning probe microscopy of an oxidized Cu(110) surface,

ADCA18: Comment on "Simulation of Schottky and Ohmic contacts on CdTe",

ADCA90: Interplay of tip-sample junction stability and image contrast reversal on Cu(111) surface revealed by 3D force field.

**52.) QUTE – Centrum excelentnosti kvantových technológií (*QUTE - Centre of excellence for quantum technologies*)**

**Zodpovedný riešiteľ:**

Ivan Štich

**Trvanie projektu:**

1.5.2009 / 31.3.2012

**Evidenčné číslo projektu:**

26240120009

**Organizácia je**

áno

**koordinátorom projektu:**

**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 3 - Slovensko: 3  
**Čerpané financie:** 27713 €

Dosiahnuté výsledky:

Projekt skončil v marci roku 2012. Všetky vedecké výstupy boli publikované v roku 2011.

**53.) Nové materiály a technológie pre energetiku**

**Zodpovedný riešiteľ:** Milan Timko  
**Zodpovedný riešiteľ v organizácii SAV:** Ľudovít Kubičár  
**Trvanie projektu:** 10.9.2012 / 22.11.2013  
**Evidenčné číslo projektu:** 26220220061  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:**  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** ŠF EU: 19944 €

Dosiahnuté výsledky:

Vývoj a konštrukcia experimentálneho zariadenia na meranie termofyzikálnych vlastností chladiacich médií. Vývoj metódy merania termofyzikálnych vlastností chladiaceho média v rozsahu pracovných teplôt transformátora pomocou termofyzikálnych senzorov. Každé zníženie prevádzkovej teploty transformátora predlžuje jeho životnosť. Konštrukcia transformátora a použitie optimálneho chladiaceho média sú parametrami, ktoré potom určujú jeho životnosť. Cieľom etapy bola aj konštrukcia monitorovacieho systému teplotných polí transformátorov v prevádzkových podmienkach. Z nameraných priebehov teplôt jednotlivých bodov v transformátore možno získať obraz o ochladzovacích charakteristikách transformátorov.

**Programy: Štrukturálne fondy EÚ Bratislavský kraj**

**54.) CEKOMAT II - Centrum excelentnosti na výskum a vývoj konštrukčných kompozitných materiálov pre strojársku, stavebnú a medicínske aplikácie II**

**Zodpovedný riešiteľ:** František Simančík  
**Zodpovedný riešiteľ v organizácii SAV:** Peter Švec  
**Trvanie projektu:** 1.9.2009 / 31.12.2012  
**Evidenčné číslo projektu:** 26240120020  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:**  
**Počet spoluriešiteľských inštitúcií:** 0

**Čerpané financie:** ASFEU: 159 984 €

Dosiahnuté výsledky:

Metodiky vyvinuté v predošlom období boli využité na skúmanie systémov komplexných kovových kompozitov na báze Al s prímiesami viacerých kovov s ohľadom na zvýšenie tuhosti a pomeru Youngovho modulu a tuhosti v závislosti od legujúcich prímiesí a tepelného spracovania podľa indikátorov stanovených výpočtami pomocou prvoprincípových metód a metód molekulárnej dynamiky.

V rámci projektu sa obstaralo a inštalovalo zariadenie na snímanie elektrónovej difrakcie transmisným elektrónovým mikroskopom v precesnom móde a na fázové a chemické mapovanie skúmaných systémov s rozlíšením lepším ako 25nm.

**55.) Aplikovaný výskum pokročilých fotovoltaiických článkov** (*Applied research of advanced photovoltaic cells*)

**Zodpovedný riešiteľ:** Peter Šiffalovič  
**Trvanie projektu:** 1.9.2010 / 31.8.2013  
**Evidenčné číslo projektu:** ITMS 26240220047  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 614 347 €

Dosiahnuté výsledky:

V roku 2012 sme uviedli do prevádzky celú infraštruktúra potrebnú pre výrobu organických solárnych článkov. V pilotnom projekte sme dosiahli účinnosť vyššiu ako dve percentá pre solárny článok na báze ITO-P3HT:PCBM-Ca-Ag.

**Programy: Štrukturálne fondy EÚ Vzdelávanie**

**56.) Centrum rozvoja doktorandov - vzdelávanie založené na vedeckých poznatkoch** (*Center for PhD students development - education based on science methods*)

**Zodpovedný riešiteľ:** Martin Plesch  
**Trvanie projektu:** 1.4.2010 / 31.3.2013  
**Evidenčné číslo projektu:** 26110230006  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 64 149 €

Dosiahnuté výsledky:

Prebehol ročný školiaci program pre doktorandov a mladých vedeckých pracovníkov, v lete 2012 prebehli dve pilotné letné školy, ktoré absolvovalo bežmála 40 študentov. Okrem toho boli spracovávané dotazníky a ankety.

## **Programy: Centrá excelentnosti SAV**

### **57.) Centrum excelentnosti pre funkcionalizované viacfázové materiály**

**Zodpovedný riešiteľ:** Marián Krajčí  
**Trvanie projektu:** 1.8.2011 / 31.12.2014  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 6  
**Čerpané financie:** U SAV: 40100 €

#### Dosiahnuté výsledky:

Pomocou vhodného výberu kombinácií vrstiev sme pripravili viacvrstvové amorfné kovové sklá s funkcionalizovanými objemovými vlastnosťami, najmä citlivosťou na vonkajšie magnetické polia a procesy magnetizácie a demagnetizácie. Navrhli a pripravili sme funkčne gradované materiály so zvýrazneným magnetokalorickým javom. Preskúmali sme vplyv funkcionalizácie objemov amorfných a kryštalických kovových systémov v dôsledku prítomnosti nekovových submikrónových častíc, vakancií a riadene vnesených defektov. Stanovili sme význam atomárneho usporiadania povrchov vybraných systémov kvázikryštálov a polykryštalických intermetalík na ich katalytické vlastnosti.

### **58.) Centrum excelentnosti – Kvantové technológie (Center of Excellence – Quantum Technologies)**

**Zodpovedný riešiteľ:** Mário Ziman  
**Trvanie projektu:** 1.2.2009 / 31.01.2013  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Fyzikálny ústav SAV  
**Počet spoluriešiteľských inštitúcií:** 4  
**Čerpané financie:** SAV: 34100 €

#### Dosiahnuté výsledky:

##### **CENTRUM PRE VÝSKUM KVANTOVEJ INFORMÁCIE:**

Všetky výsledky oddelenia CVKI (FÚ SAV) v rámci tohto projektu sú zhrnuté v knihe M.Ziman a T.Heinossari: "The mathematical language of quantum theory: from uncertainty to entanglement" (pozri AAA01 v Prílohe C) a v kapitole "Quantum Memory Channels in Quantum Optics" publikovanej v Mathematical Optics: Classical, Quantum, and Computational Methods (evidované ako ABC03 v Prílohe C). Publikácie objasňujú myšlienku kvantových pamäťových kanálov použitú



v experimentoch kvantovej optiky.

#### ODDELENIE KOMPLEXNÝCH FYZIKÁLNYCH SYSTÉMOV:

Skupina Dr. Olejníka sa v rámci projektu zaoberala teóriou silnej väzby pre klasické dvojvrstvé Wignerove kryštály a dosiahla nasledovné výsledky: a) Preskúmanie bezpečnosti kvantových protokolov za použitia slabej náhodnosti, b) Zovšeobecnenie procedúry mapovania difúznej rovnice v 2D/3D nehomogénnom kanáliku na pozdĺžnu súradnicu za účelom dimenzionálnej redukcie Fokkerovej-Planckovej rovnice. Počas riešenia projektu bola napísaná monografia: L. Šamaj, Z. Bajnok: Introduction to the Statistical Physics of Integrable Many-body Systems (Cambridge Univ. Press, vyjde v r. 2013).

Vedecké články publikované v roku 2012 sú uvedené v Prílohe C pod označením: ADCA08, ADCA07, ADCA45, ADCA97, ADCA98, ADCA95, ADCA93, ADCA94, ADCA111.

(ADCA111) Improving the Hadamard extractor,  
(ADCA08) Encryption with weakly random keys using quantum ciphertext,  
(ADCA07) Weak randomness seriously limits the security of quantum key distribution,  
(ADCA45) Phase space reduction of the one-dimensional Fokker-Planck (Kramers) equation,  
(ADCA98) Strong-coupling theory for a polarizable planar colloid,  
(ADCA95) Strong-coupling electrostatics for two dissimilar charged walls,  
(ADCA93) Ground state of classical bilayer Wigner crystals,  
(ADCA94) Critical phenomena and phase sequence in a classical bilayer Wigner crystal at zero T,  
(ADCA97) Long-range correlations of the surface charge density between electrical media with flat and spherical interfaces.

Skupina prof. Šticha v rámci riešenia projektu realizovala publikácie: ADCA90, ADCA10, ADCA32, ADCA04 (sú uvedené v Prílohe C).

(ADCA90) Interplay of tip-sample junction stability and image contrast reversal on Cu(111) surface revealed by 3D force field,  
(ADCA10) Van der Waals interaction energies of small fragments of P, As, Sb, S, Se, and Te; comparison of complete basis set limit CCSD(T) and DFT with approximate dispersion,  
(ADCA32) Spin multiplicity and symmetry breaking in vanadium-benzene complexes,  
(ADCA04) Chemical tip fingerprinting in scanning probe microscopy of an oxidized Cu(110) surface.

Do tlače bola zaslaná publikácia: Quantum Monte Carlo Study of  $\pi$ -bonded Transition-metal Organometallics: Neutral and Cationic Vanadium-benzene and Cobalt-benzene Half-sandwiches (vyšla v J. Chem. Theor. Comput. r. 2013).

#### MEDZINÁRODNÉ LASEROVÉ CENTRUM:

V roku 2012 bolo aj s finančnou podporou CE SAV QUTE ďalej materiálovo vybavované spoločné laboratórium Medzinárodného laserového centra (MLC) a FÚ SAV. Výsledkom výskumnej činnosti pracovníkov MLC sú 3 CC publikácie a jedna popularizačná non-CC publikácia.

Okrem toho boli výsledky konzorcia QUTE/metaQUTE prezentované v rámci 14 príspevkov na domácich a zahraničných konferenciách, ako aj na špecializovanej výstave „Prezentácia výsledkov činnosti centier excelentnosti výskumu” v rámci Týždňa vedy a techniky na Slovensku.

## Príloha C

### Publikačná činnosť organizácie (zoradená podľa kategórií)

#### AAA Vedecké monografie vydané v zahraničných vydavateľstvách

- AAA01 HEINOSAARI, Teiko - ZIMAN, Mário. The Mathematical Language of Quantum Theory : From Uncertainty to Entanglement. Cambridge : Cambridge University Press, 2012. 327 s. ISBN 978-0-521-19583-6.

#### ABC Kapitoly vo vedeckých monografiách vydané v zahraničných vydavateľstvách

- ABC01 GMUCOVÁ, Katarína. A review of non-Cottrellian diffusion towards micro-and nano- structured electrodes : Chapter 1. In Electrochemical cells- New advances in fundamental reseaches and applications. - Rijeka : InTech, 2012, p. 3-20. ISBN 978-953-51-0032-4.
- ABC02 MORHÁČ, Miroslav - MATOUŠEK, Vladislav. Multidimensional Experimental Data Processing in Nuclear Physics. In Computer Physics. - N.York : Nova Science Publishers, Inc., 2012, p. 1-236. ISBN 978-1-61324-790-7.
- ABC03 RYBÁR, Tomáš - ZIMAN, Mário - BUŽEK, Vladimír. Quantum Memory Channels in Quantum Optics : Chapter: Quantum Optics Methods. In Mathematical Optics: Classical, Quantum, and Computational Methods. - CRC Press Inc., 2012, p. ISBN 981-1-43-986960-4.
- ABC04 ŠIFFALOVICH, Peter - MAJKOVÁ, Eva - JERGEL, Matej - VÉGSÖ, Karol - WEIS, Martin Jr. - LUBY, Štefan. Self-assembly of nanoparticles at solid and liquid surfaces. In Smart Nanoparticle Technology. - Rijeka : Tech, 2012, p. 441-466. ISBN 978-953-51-0500-8.

#### ADCA Vedecké práce v zahraničných karentovaných časopisoch impaktovaných

- ADCA01 ADAMUŠČIN, Cyril - DUBNIČKA, Stanislav - DUBNIČKOVÁ, A.Z. New value of the proton charge root mean square radius. In Progress in Particle and Nuclear Physics, 2012, vol. 67, p. 479-485. (2.614 - IF2011). (2012 - Current Contents). ISSN 0146-6410.
- ADCA02 presunuté do kategórie ADEB05  
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- ADCA03 BALOG, Martin - YU, P. - QIAN, M. - BEHULOVA, M. - ŠVEC, Peter - CICKA, R. Nanoscaled Al-AIN composites consolidated by equal channel angular pressing (ECAP) of partially in situ nitrided Al powder. In Materials Science and Engineering A - Structural Materials Properties Microstructure and Processing, 2013, vol.562, p.190-195. ISSN 0921-5093.
- ADCA04 BAMIDELE, J. - KINOSHITA, Y. - TURANSKÝ, Robert - LEE, S.H. - NAITOH, Y. - LI, Y.J. - SUGAWARA, Y. - ŠTICH, Ivan - KANTOROVICH, L. Chemical tip fingerprinting in scanning probe microscopy of an oxidized Cu(110) surface. In Physical Review B, 2012, vol. 86, no. 15, 155422. (3.691 - IF2011). (2012 - Current Contents, WOS, SCOPUS). ISSN 1098-0121.
- ADCA05 BARTOŠ, Josef - ISKROVÁ - MIKLOŠOVIČOVÁ, Martina - CANGIALOSI, D. - ALEGRÍA, A. - ŠAUŠA, Ondrej - ŠVAJDLENKOVÁ, Helena - ARBE, A. - KRIŠTIK, Jozef - COLMENERO, J. Positron annihilation and relaxation dynamics from dielectric spectroscopy: poly (vinylmethylether). In Journal of Physics: Condensed Matter, 2012, vol. 24, art.no.155104. (2.546 - IF2011). (2012 - Current Contents, WOS, SCOPUS). ISSN 0953-8984.

- ADCA06 BISIO, A. - D'ARIANO, G.M. - PERINOTTI, P. - SEDLÁK, Michal. Memory cost of quantum protocols. In Physical Review A, 2011, vol. 85, no. 3, 032333. (2.861 - IF2010). (2011 - Current Contents). ISSN 1050-2947.
- ADCA07 BOUDA, J. - PIVOLUSKA, M. - PLESCH, Martin - WILMOTT, C. Weak randomness seriously limits security of quantum key distribution. In Physical Review A, 2012, vol. 86, 062308. (2.878-IF2011). (2012 - Current Contents). ISSN 1050-2947.
- ADCA08 BOUDA, J. - PIVOLUSKA, M. - PLESCH, Martin. Encryption with weakly random keys using a quantum ciphertext. In Quantum Information and Computation, 2012, vol. 12, no. 5-6, p. 395-403. (1.659 - IF2011). (2012 - Current Contents). ISSN 1533-7146.
- ADCA09 BRAVYI, S. - CAHA, Libor - MOVASSAGH, R. - NAGAJ, Daniel - SHOR, P. Criticality without frustration for quantum spin-1 chains. In Physical Review Letters, 2012, vol. 109, 207202. (7.370 - IF2011). (2012 - Current Contents, WOS, SCOPUS). ISSN 0031-9007.
- ADCA10 BRNDIAR, Ján - ŠTICH, Ivan. Van der Waals interaction energies of small fragments of P, As, Sb, S, Se and Te: Comparison of complete basis set limit CCSD(T) and DFT with approximate dispersion. In Journal of Chemical Theory and Computation, 2012, vol. 8, no. 7, p. 2301-2309. (5.215 - IF2011). (2012 - Current Contents). ISSN 1549-9618.
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- ADCA12 BUTVINOVÁ, Beata - BUTVIN, Pavol - KUZMINSKI, M. - KADLEČÍKOVÁ, M. - ŠLAWSKA-WANIEWSKA, A. Indication of intrinsic macroscopic forces affecting magnetic properties of Fe-Nb/Mo-Cu-B-Si ribbons. In IEEE Transactions on Magnetics, 2012, vol. 48, no. 4, p. 1340-1343. (1.363 - IF2011). (2012 - Current Contents). ISSN 0018-9464.
- ADCA13 BUŽEK, Vladimír - RAPČAN, Peter - RAU, J. - ZIMAN, Mário. Direct estimation of decoherence rates. In Physical Review A, 2012, vol. 86, 052109. (2.878 - IF2011). (2012 - Current Contents). ISSN 1050-2947.
- ADCA14 CIZEK, J. - LUKAC, F. - PROCHAZKA, I. - KUZEL, R. - JIRASKOVA, Y. - JANIČKOVIČ, Dušan - ANWAND, W. - BRAUER, G. Characterization of quenched-in vacancies in Fe-Al alloys. In Physica B: Condensed Matter, 2012, vol. 407, no. 14, p. 2659-2664. (1.063 - IF2011). (2012 - Current Contents). ISSN 0921-4526.
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- ADCA16 DBEYSSI, A. - TOMASI-GUSTAFSSON, E. - GAKH, G.I. - ADAMUŠČIN, Cyril. Experimental constraint on the rho-meson form factors in the time-like region. In Physical Review C. Nuclear physics, 2012, vol. 85, no. 4, 048201. (3.308 - IF2011). (2012 - Current Contents, SCOPUS). ISSN 0556-2813.
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- ADCA23 FILIPPOV, S.N. - RYBÁR, Tomáš - ZIMAN, Mário. Local two-qubit entanglement-annihilating channels. In Physical Review A, 2012, vol. 85, no. 1, 012303. (2.878 - IF2011). (2012 - Current Contents). ISSN 1050-2947.
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- ADCA25 GMUCOVÁ, Katarína - NÁDAŽDY, Vojtech - WEIS, Martin Jr. - BENKOVIČOVÁ, Monika - MAJKOVÁ, Eva. Anomalous charge transfer on a microstructured composite electrode: Application in sensing. In Chemical Physics Letters, 2012, vol. 544, p. 59-63. (2.337 - IF2011). (2012 - Current Contents). ISSN 0009-2614.
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- ADCA39 JANOTOVÁ, Irena - HOŠKO, Jozef - ŠVEC, Peter Jr. - JANIČKOVIČ, Dušan - VLASÁK, Gabriel - ŠVEC, Peter. The study of magnetically soft Fe-B-P based nanostructures. In Journal of Superconductivity and Novel Magnetism, 2012, vol., no., p. 1-4. (0.650 - IF2011). (2012 - Current Contents). ISSN 1557-1939.
- ADCA40 JANOTOVÁ, Irena - HOŠKO, Jozef - ŠVEC, Peter Jr. - MAŤKO, Igor - JANIČKOVIČ, Dušan - ŠVEC, Peter - GEMMING, T. - STOICA, M. The study of structure of Fe-B-P based metallic glasses. In Applied Surface Science, 2012, p. 1-4. (2.103 - IF2011). (2012 - Current Contents). ISSN 0169-4332.
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*3. [1.1] MCGANNON, Kerry R. - JOHNSON, Christina R. - SPENCE, John C. - KENNEDY, E - MARKULA, P. I Am (Not) Big ... It's the Pictures that Got Small Examining Cultural and Personal Exercise Narratives and the Fear of Fat. In WOMEN AND EXERCISE: THE BODY, HEALTH AND CONSUMERISM, 2011, vol.5, 101., WOS*



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1. [1.1] PANDEY, B. - PANDEY, K. - AGRAWAL, H.M. In ANNALS OF NUCLEAR ENERGY, 2011, vol. 38, p. 853., WOS

## **Príloha D**

### **Údaje o pedagogickej činnosti organizácie**

#### Semestrálne prednášky:

Doc. RNDr. Emil Běták, DrSc.

Názov semestr. predmetu: Ionizační záření v životním prostředí

Počet hodín za semester: 18

Názov katedry a vysokej školy: Filozoficko-přírodovědecká fakulta Slezské univerzity, Česká republika, Ústav fyziky

Doc. RNDr. Emil Běták, DrSc.

Názov semestr. predmetu: Statistická fyzika a kinetika

Počet hodín za semester: 24

Názov katedry a vysokej školy: Filozoficko-přírodovědecká fakulta Slezské univerzity, Česká republika, Ústav fyziky

Doc. RNDr. Emil Běták, DrSc.

Názov semestr. predmetu: Termodynamika a statistická fyzika

Počet hodín za semester: 36

Názov katedry a vysokej školy: Filozoficko-přírodovědecká fakulta Slezské univerzity, Česká republika, Ústav fyziky

Doc. RNDr. Emil Běták, DrSc.

Názov semestr. predmetu: Úvod do teorie jaderných reakcí

Počet hodín za semester: 24

Názov katedry a vysokej školy: Filozoficko-přírodovědecká fakulta Slezské univerzity, Česká republika, Ústav fyziky

Prof.,Ing. Štefan Luby, DrSc.

Názov semestr. predmetu: Nanoelektronika a informatika

Počet hodín za semester: 6

Názov katedry a vysokej školy: Slovenská technická univerzita v Bratislave, Univerzita III. veku

RNDr. Marek Mihalkovič, CSc.

Názov semestr. predmetu: Solid State Physics

Počet hodín za semester: 45

Názov katedry a vysokej školy: Carnegie-Mellon University, Pittsburgh, USA, Physics Department

Mgr. Daniel Nagaj, PhD.

Názov semestr. predmetu: Úvod do kvantovej teórie informácie

Počet hodín za semester: 24

Názov katedry a vysokej školy: Fakulta matematiky, fyziky a informatiky UK, Katedra experimentálnej fyziky

Mgr. Kristian Petrík, PhD.

Názov semestr. predmetu: Kurz z fyziky pre zahraničných študentov

Počet hodín za semester: 60

Názov katedry a vysokej školy: Univerzita Komenského v Bratislave, Centrum ďalšieho vzdelávania UK, ÚJOP

Doc. Mgr. Mário Ziman, PhD.

Názov semestr. predmetu: Matematické štruktúry kvantovej teórie

Počet hodín za semester: 26

Názov katedry a vysokej školy: Fakulta matematiky, fyziky a informatiky UK, Katedra

Doc. Mgr. Mário Ziman, PhD.

Názov semestr. predmetu: Mathematical basics of quantum entanglement

Počet hodín za semester: 15

Názov katedry a vysokej školy: University of Turku, Fínsko, Department of Physics and Astronomy

Doc. Mgr. Mário Ziman, PhD.

Názov semestr. predmetu: Vybrané kapitoly z kvantovej mechaniky

Počet hodín za semester: 26

Názov katedry a vysokej školy: Fakulta Informatiky, Masarykova univerzita, Vysoce paralelní a distribuované výpočetní systémy

#### Semestrálne cvičenia:

Doc. RNDr. Emil Běťák, DrSc.

Názov semestr. predmetu: Ionizační záření v životním prostředí

Počet hodín za semester: 6

Názov katedry a vysokej školy: Filozoficko-přírodovědecká fakulta Slezské univerzity, Česká republika, Ústav fyziky

RNDr. Daniel Reitzner, PhD.

Názov semestr. predmetu: Analysis 3

Počet hodín za semester: 2

Názov katedry a vysokej školy: Zentrum Mathematik der Technischen Universität München, Nemecko, M5 Mathematische Physik

Mgr. Michal Sedlák, PhD.

Názov semestr. predmetu: Matematické štruktúry kvantovej teórie

Počet hodín za semester: 13

Názov katedry a vysokej školy: Fakulta matematiky, fyziky a informatiky UK, Katedra teoretickej fyziky a didaktiky fyziky

#### Semináre:

RNDr. Martin Plesch, PhD.

Názov semestr. predmetu: Kvantový seminár

Počet hodín za semester: 26

Názov katedry a vysokej školy: Masarykova univerzita Brno, ČR, Fakulta Informatiky

RNDr. Daniel Reitzner, PhD.

Názov semestr. predmetu: Mathematics & Magic

Počet hodín za semester: 2

Názov katedry a vysokej školy: Zentrum Mathematik der Technischen Universität München, Nemecko, M5 Mathematische Physik

RNDr. Daniel Reitzner, PhD.

Názov semestr. predmetu: Mathematics & Magic

Počet hodín za semester: 2

Názov katedry a vysokej školy: Zentrum Mathematik der Technischen Universität München, Nemecko, M5 Mathematische Physik

Doc. Mgr. Mário Ziman, PhD

Názov semestr. predmetu: Kvantový seminár

Počet hodín za semester: 28

Názov katedry a vysokej školy: Fakulta Informatiky, Masarykova Univerzita, Vysoce paralelní a distribuované výpočetní systémy

#### Terénne cvičenia:

Ing. Ľudovít Kubičár DrSc.

Názov cvičenia: Prax v Termofyzikálnom laboratóriu FÚ SAV

Počet hodín za semester: 6 mesačná prax 2x španielskych študentov

Názov organizácie: Mobility program ARGO GLOBAL (MŠ SR)

#### Individuálne prednášky:

Mgr. Michal Daniška

Názov semestr. predmetu: Density matrix renormalizaion group

Počet hodín za semester: 1

Názov katedry a vysokej školy: Univerzita Komenského v Bratislave, Katedra experimentálnej fyziky

Ing. Vojtech Nádaždy, CSc.

Názov semestr. predmetu: Experimentálne metódy

Počet hodín za semester: 2

Názov katedry a vysokej školy: Univerzita Komenského v Bratislave, Katedra experimentálnej fyziky

Mgr. Michal Sedlák, PhD.

Názov semestr. predmetu: Kvantové hrebene - formalizmus všeobecných kvantových protokolov

Počet hodín za semester: 1

Názov katedry a vysokej školy: Fakulta matematiky, fyziky a informatiky UK, Katedra teoretickej fyziky a didaktiky fyziky

Ing. Ján Kliman, DrSc.

Názov semestr. predmetu: On line mass spectrometry of superheavy atoms

Počet hodín za semester: 2x2 (pre študentov JAR)

Názov katedry a vysokej školy: JINR University Center of Moscow State University, Dubna, Rusko

**Príloha E****Medzinárodná mobilita organizácie****(A) Vyslanie vedeckých pracovníkov do zahraničia na základe dohôd:**

Krajina	D r u h d o h o d y					
	MAD, KD, VTS		Medziústavná		Ostatné	
	Meno pracovníka	Počet dní	Meno pracovníka	Počet dní	Meno pracovníka	Počet dní
Belgicko	Štefan Luby	2			Vladimír Bužek	2
					Vladimír Bužek	2
					Vladimír Bužek	2
					Vladimír Bužek	2
					Vladimír Bužek	4
					Vladimír Bužek	2
					Dušan Janičkovič	2
					Matej Jergel	1
					Matej Jergel	6
					Štefan Luby	1
					Eva Majková	1
					Peter Švec	3
					Lukas Theussl	2
					Lukas Theussl	2
Brazília					Ivan Štich	8
Česko	Stanislav Hlaváč	5			Pavol Butvin	4
					Beata Butvinová	4
					Vladimír Bužek	1
					Vladimír Bužek	1
					Štefan Gmuca	3
					Stanislav Hlaváč	1
					Jozef Hoško	1
					Dušan Janičkovič	5
					Dušan Janičkovič	1
					Matej Jergel	2
					Štefan Lányi	1

				Štefan Lányi	2
				Eva Majková	2
				Igor Maťko	2
				Igor Maťko	2
				Igor Maťko	1
				Igor Maťko	3
				Daniel Nagaj	1
				Štefan Olejník	1
				Štefan Olejník	3
				Michal Sedlák	1
				Michal Sedlák	1
				Michal Sedlák	3
				Michal Sedlák	1
				Peter Šiffalovič	2
				Martin Venhart	2
				Martin Veselský	2
Čína				Emil Pinčík	7
				Martin Veselský	53
Dánsko				Dušan Janičkovič	5
Fínsko				Vladislav Matoušek	12
				Michal Sedlák	10
				Martin Venhart	13
				Martin Veselský	12
Francúzsko				Cyril Adamuščin	3
				Stanislav Hlaváč	6
				Stanislav Hlaváč	6
				Martin Hodas	2
				Lubomir Martinovič	21
				Marek Mihalkovič	11
				Ladislav Šamaj	50



					Ladislav Šamaj	52
Holandsko					Igor Mat'ko	3
					Peter Švec	3
					Peter Švec, Jr.	3
Chorvátsko					Vladimír Bužek	3
					Štefan Luby	3
Maďarsko	Štefan Lányi	8			Štefan Lányi	12
					Kristian Petrik	11
					Tomáš Rybár	1
Mexiko					Ivan Štich	7
Nemecko	Štefan Luby	7			Monika Benkovičová	5
					Monika Benkovičová	5
					Vladimír Bužek	1
					Vladimír Bužek	3
					Vladimír Bužek	3
					Vladimír Bužek	3
					Peter Filip	2
					Peter Filip	14
					Stanislav Hlaváč	4
					Stanislav Hlaváč	6
					Martin Hodas	3
					Jozef Hoško	11
					Ján Ivančo	3
					Ján Ivančo	7
					Ján Ivančo	5
					Irena Janotová	11
					Eva Majková	5
					Eva Majková	5
					Marek Mihalkovič	9
					Peter Mrafko	19
					Peter Mrafko	19
					Vojtech Nádaždy	3
					Peter Šiffalovič	5
					Peter Šiffalovič	3

				Peter Šiffalovič	5
				Peter Šiffalovič	3
				Lukas Theussl	2
				Karol Végső	7
				Karol Végső	3
				Karol Végső	5
				Karol Végső	5
				Martin Venhart	2
Poľsko	Beata Butvinová	4		Beata Butvinová	2
				Michal Daniška	5
				Andrej Gendiar	5
Portugalsko				Vladimír Bužek	4
				Daniel Reitzner	7
Rakúsko				Vladimír Bužek	1
				Vladimír Bužek	1
				Vladimír Bužek	1
				Michal Daniška	1
				Stefano Facchini	1
				Andrej Gendiar	1
				Andrej Gendiar	1
				Stanislav Hlaváč	4
				Marián Krajčí	1
				Marián Krajčí	1
				Marián Krajčí	1
				Štefan Luby	2
				Igor Maťko	4
				Igor Maťko	3
				Igor Maťko	24
				Igor Maťko	14
				Igor Maťko	6
				Daniel Nagaj	1
				Štefan Olejník	1
				Martin Plesch	1

				Martin Plesch	5
				Tomáš Rybár	1
				Michal Sedlák	1
				Ladislav Šamaj	1
				Ladislav Šamaj	1
				Peter Šiffalovič	1
				Peter Šiffalovič	1
				Peter Šiffalovič	1
				Peter Šiffalovič	1
				Ivan Štich	1
				Lukas Theussl	1
Rusko				Erik Bartoš	14
				Stanislav Dubnička	5
				Stanislav Dubnička	11
				Stanislav Dubnička	6
				Ján Kliman	57
				Ján Kliman	26
				Ján Kliman	18
				Andrej Liptaj	13
				Andrej Liptaj	61
				Vladislav Matoušek	19
				Vladislav Matoušek	19
				Ivan Turzo	19
Španielsko				Eva Majková	2
Švajčiarsko				Cyril Adamuščin	11
				Erik Bartoš	13
				Vladimír Bužek	3
				Stanislav Dubnička	12
				Stanislav Dubnička	10
				Stanislav Dubnička	14
				Andrej Liptaj	13
				Peter Staňo	7
				Martin	7

				Venhart	
				Martin Veselský	2
				Martin Veselský	7
Taiwan				Eva Majková	13
				Peter Šiffalovič	13
Taliansko				Štefan Luby	3
				Michal Sedlák	7
				Michal Sedlák	6
				Lukas Theussl	5
				Martin Veselský	2
USA				Vladimír Bužek	32
				Vladimír Bužek	4
				Peter Filip	21
				Peter Filip	35
				Pavol Kalinay	32
				Ján Kliman	5
				Marek Mihalkovič	26
				Marek Mihalkovič	175
				Martin Venhart	8
Veľká Británia				Vladimír Bužek	2
				Igor Maťko	3
				Martin Plesch	60
				Martin Plesch	5
				Gabriela Pleschová	6
				Gabriela Pleschová	5
				Gabriela Pleschová	6
				Gabriela Pleschová	62
				Ivan Štich	3
				Peter Švec	3
				Peter Švec, Jr.	3
				Martin Venhart	8
				Mário Ziman	4

<b>Počet vyslaní spolu</b>	<b>5</b>	<b>26</b>			<b>188</b>	<b>1641</b>
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**(B) Prijatie vedeckých pracovníkov zo zahraničia na základe dohôd:**

<b>Krajina</b>	<b>D r u h d o h o d y</b>					
	<b>MAD, KD, VTS</b>		<b>Medziústavná</b>		<b>Ostatné</b>	
	<b>Meno pracovníka</b>	<b>Počet dní</b>	<b>Meno pracovníka</b>	<b>Počet dní</b>	<b>Meno pracovníka</b>	<b>Počet dní</b>
Belgicko					Prof. Christ Glorieux	1
Česko	Ing. Ondřej Svoboda, PhD.	3			Doc. Jaromír Fiurášek	2
	Oleksandr Stupakov	3			Ing. Butta Mattia, PhD.	4
	RNDr. Andrej Kugler, CSc.	3			Ing. František Lukáč	6
	RNDr. Pavel Tlustý, CSc.	3			Ing. Jan Vyhnánek	3
					Ing. Marián Vlček	5
					Ing. Michal Janoušek	3
					Ing. Pavel Mlejnek, PhD.	3
					Ing. Ripka Pavel, CSc.	3
					Ing. Yvonna Jirásková, PhD.	1
					Prof. RNDr. Pavel Exner, DrSc.	2
					RNDr. Jiří Buršík, DrSc.	1
					RNDr. Tomáš Žák, PhD.	1
Fínsko					Erkka Haapasalo	26
Francúzsko					Emilie Lebrun	9
Grécko					Ioannis Kartsonakis	91
					Polyxeni Vouma	91
Japonsko					Prof. Tomotoshi Nishino	13
Kanada					Prof. Debbie	2

					Leung	
Maďarsko					Denes Petz	1
					Dr. Zoltán Bajnok	2
					Dr. Zoltán Bajnok	2
					János Bergou	4
Nemecko	Dr. Anja Waske	4			Matthias Kleinmann	5
	Dr. Maria Krautz	4			Prof. Jochen Rau	5
	Dr. Oleg Borisenko	7			Stephan Weis	3
Poľsko					Janek Kolodynski	3
Rakúsko					Dr. Roman Hollwieser	1
					Prof. Manfred Faber	1
Rusko					Dr. Maxim Demidenko	2
					Dr. Taras Kavetsky	61
					Prof. Olga Sidorova	30
					Prof. Peter Zuev	8
Španielsko					Andreas Gomes Ruis	183
					Rafael Sensen Aparicio	183
					Rafael Sesena Aparicio	1
Ukrajina					Dr. Dmitry Vorobiev	125
USA					Dr. Leonard Mlodinow	2
					Prof. Mark Hillery	12
					Prof. Mark Hillery	5
Veľká Británia					Prof. Kim Myungshik	3
<b>Počet prijatí spolu</b>	<b>7</b>	<b>27</b>			<b>41</b>	<b>909</b>

**(C) Účasť pracovníkov pracoviska na konferenciách v zahraničí (nezahrnutých v "A"):**

Krajina	Názov konferencie	Meno pracovníka	Počet dní
Austrália	APERIODIC 2012	Marián Krajčí	9
Belgicko	DFTM 2012, Ghent	Matúš Dubecký	6



	DFTM2012	Matúš Dubecký	6
	Workshop on detailed spectroscopy at ISOL@MYRRHA	Martin Venhart	5
Brazília	Amazonia Physics Meeting	Ivan Štich	7
Česko	15th International Conference on non-contract Atom	Ivan Štich	5
	289. Rozhovory o aktuálnych otázkach rentgenové a	Matej Jergel	1
	9th European Conference on Magnetic Sensors and Ac	Pavol Butvin	5
		Beata Butvinová	5
	MEMICS 2012	Martin Plesch	4
	Seminár TEM v materiálovom výzkumu	Igor Maľko	2
		Peter Švec	2
		Peter Švec, Jr.	2
	Seminár užívateľa TA Instruments	Emília Illeková	2
	Summer school on Quantum physics and Quantum Infor	Michal Sedlák	1
Čína	1 st Annual Conference and EXPO of AnalytiX 2012	Peter Šiffalovič	6
	AQIS 2012	Martin Plesch	12
	ICASI'2012 and CCATM'2012	Emil Pinčík	6
Francúzska Polynézia	CompStar 2012	Kristian Petrik	17
Francúzsko	14th ICOM	Karol Végső	6
	SECAM	Ladislav Šamaj	4
	SPLDS	Marián Krajčí	6
Grécko	NANO 2012	Eva Majková	8
Chorvátsko	JVC 14 a EVC 12	Štefan Luby	6
	Nuclear Structure and Dynamics	Emil Běták	8
Írsko	QuAMP Summer School 2012	Jozef Genzor	6
Japonsko	ICTAC 15	Emília Illeková	8
	Workshop Perspectives in Nuclear Fission, Tokai	Martin Veselský	7
Maďarsko	3. Konferencia DAC	Štefan Luby	2
	6th Workshop of Young researchers in Astronomy and	Kristian Petrik	5
	QIPECS 2012	Vladimír Bužek	3

		Peter Rapčan	4
Malta	Quantum Malta 2012	Martin Plesch	6
		Tomáš Rybár	5
Mexiko	XXI International materials research congress 2012	Ivan Štich	8
Nemecko	COQUIT Workshop 2012	Michal Sedlák	5
	HASYLAB USERS MEETING 2012	Karol Végső	4
	Xth Quark Confinement and the Hadron Spectrum	Stanislav Dubnička	7
		Štefan Olejník	7
Nórsko	ECM27	Matej Jergel	5
Poľsko	CHIST-ERA Project Kick-off Seminar	Vladimír Bužek	2
	CMAC DAYS 2012	Marián Krajčí	5
	Light Cone 2012	Lubomir Martinovič	3
	MESON 2012	Stanislav Dubnička	6
Portoriko	Hot Quarks 2012	Peter Filip	10
Portugalsko	ICOMC 2012	Matúš Dubecký	7
		Lucia Horváthová	7
Rakúsko	CoQuS Summer School 2012 Wien	Jozef Genzor	5
	DMRG Gathering 2012	Michal Daniška	1
		Andrej Gendiar	1
		Daniel Nagaj	1
	EGU 2012	Danica Fidriková	4
	European Geoscience Union	Ľudovít Kubičár	1
	QCMC 2012	Daniel Nagaj	5
	QISM 2012	Michal Daniška	5
		Andrej Gendiar	5
	Seefeld Quantum Information Workshop 2012	Tomáš Rybár	6
Rumunsko	CEWQO 2012	Michal Sedlák	7
Rusko	HSQCD 2012	Cyril Adamuščin	6
		Erik Bartoš	6
		Stanislav Dubnička	6
		Andrej Liptaj	7
	LFVE	Peter Filip	6
	SPIN 2012	Peter Filip	9
Španielsko	NMP NCPs Training Workshop	Dušan Janičkovič	4
	Workshop on Quantum Simulations 2012	Jozef Genzor	6
Švajčiarsko	Konferencia Nanomedicina	Štefan Luby	5
Švédsko	EELS in material	Peter Švec, Jr.	4

	sciences		
	EFTF 2012	Vladimír Štofanič	7
Taliansko	13th International Conference on Nuclear Reaction	Emil Běták	6
	3rd COQUIT conference	Michal Sedlák	5
		Mário Ziman	5
	ASY-EOS 2012	Martin Veselský	5
	NanoSEA 2012	Monika Benkovičová	7
	SURFINT- SREN III	Róbert Brunner	6
		Jozef Hoško	6
		Irena Janotová	6
		Emil Pinčík	6
		Jaroslav Rusnák	6
		Peter Švec	6
	SURFINT-SREN III	Mária Hartmanová	6
	Winter School 2012, Trieste, Italy	Lucia Horváthová	15
Turecko	ICSM2012	Jozef Hoško	7
		Irena Janotová	7
	TUBITAK-SAS Joint Workshop	Peter Švec	4
Ukrajina	4th International Conference on Current Problems i	Emil Běták	7
USA	18th Symposium on Thermophysical Properties	Vlastimil Boháč	9
	Computational Chemistry 2012	René Derian	8
	ICFN5	Ján Kliman	7
	March Meeting 2012 Boston	Ivan Štich	10
	New Frontiers in Astronomy and Cosmology	Vladimír Bužek	8
Veľká Británia	6th Annual Progress Conference in conjunction	Peter Švec	3
	ICPA - 16	Ondrej Šauša	8
	SuperSTEM Workshop	Igor Matko	5
		Peter Švec	5
		Peter Švec, Jr.	5
<b>Spolu</b>	<b>74</b>	<b>96</b>	<b>548</b>

*Vysvetlivky: MAD - medziakademické dohody, KD - kultúrne dohody, VTS - vedecko-technická spolupráca v rámci vládnych dohôd*

Skratky použité v tabuľke C:

1 st Annual Conference and EXPO of AnalytiX 2012 - 1 st Annual Conference and EXPO of AnalytiX 2012 , Theme: Quality, Safety and Harmonization, Beijing

13th International Conference on Nuclear Reaction - 13th International Conference on Nuclear Reaction Mechanisms, Varenna  
 14th ICOM - 14th International Conference on Organised Molecular films and Langmuir-Blodgett films, Paris  
 15th International Conference on non-contract Atom - 15th International Conference on non-contract Atomic Force Microscopy, Český Krumlov  
 18th Symposium on Thermophysical Properties - 18th Symposium on Thermophysical Properties, Bolder  
 289. Rozhovory o aktuálných otázkách rentgenové a - 289. Rozhovory o aktuálných otázkách rentgenové a neutronové štruktúrne analýzy, Praha  
 3.Konferencia DAC - 3.Konferencia DAC, Budapešť  
 3rd COQUIT conference - Third COQUIT Workshop  
 4th International Conference on Current Problems i - 4th International Conference on Current Problems in Nuclear Physics and Atomic Energy,Kyiv  
 6th Annual Progress Conference in conjunction - 6th Annual Progress Conference in conjunction  
 6th Workshop of Young researchersin Astronomy and - 6th Workshop of Young researchersin Astronomy and Astrophysics, The Multi-wavelength Universe, Budapešť  
 9th European Conference on Magnetic Sensors and Ac - 9th European Conference on Magnetic Sensors and Actuators, Praha  
 Amazonia Physics Meeting - Amazonia Physics Meeting, Belem  
 APERIODIC 2012 - APERIODIC 2012, Cairns  
 AQIS 2012 - AQIS 2012, Suzhai  
 ASY-EOS 2012 - International Workshop on Nuclear Symmetry Energy and Reaction Mechanism, Siracusa  
 CEWQO 2012 - Central European Workshop on Quantum Optics  
 CHIST-ERA Project Kick-off Seminar - CHIST-ERA Project Kick-off Seminar  
 CMAC DAYS 2012 - CMAC DAYS 2012, Krakow  
 CompStar 2012 - The Physics and Astrophysics of Compact Stars, Papeete, Tahiti  
 Computational Chemistry 2012 - Computational Chemistry 2012, Vermont  
 COQUIT Workshop 2012 - COQUIT Workshop 2012  
 CoQuS Summer School 2012 Wien - CoQuS Summer School 2012 Wien  
 DFTM2012 - Challenges in Density Matrix and Density Functional Theory, Ghent  
 DMRG Gathering 2012 - Density Matrix Renormalization Group (DMRG) Gathering 2012  
 ECM27 - The 27th European Crystallographic Meeting, Bergen  
 EELS in material sciences - EELS in material sciences, Uppsala  
 EFTF 2012 - European Frequency and Time Forum 2012  
 EGU 2012 - EGU 2012, Viedeň  
 European Geoscience Union - European Geoscience Union, Viedeň  
 HASYLAB USERS MEETING 2012 - HASYLAB USERS MEETING 2012, Hamburg  
 Hot Quarks 2012 - Hot Quarks 2012, Copamarina  
 HSQCD 2012 - International Workshop: Hadron Structure and QCD from Low to High energies, Gatchina  
 ICASI'2012 and CCATM'2012 - International Conference and Exhibition on ANALYSIS and TESTING of METALLURGICAL PROCESS and MATERIALS,Beijing  
 ICFN5 - Fission and Properties of Neutron-rich Nuclei, Sanibel Island  
 ICOMC 2012 - XXV International Conference on Organometallic Chemistry, Lisabon  
 ICPA - 16 - 16th International Conference on Positron Annihilation, Bristol  
 ICSM2012 - ICSM2012, Istanbul  
 ICTAC 15 - 15th International Congress on Thermal Analysis and Calorimetry, Osaka  
 JVC 14 a EVC 12 - Vákuová konferencia JVC 14 a Vákuová konferencia EVC 12, Dubrovnik  
 Konferencia Nanomedicína - Konferencia Nanomedicína, Zurich  
 LFVE - XXI International Baldin Seminar on High Energy Physics Problems, Dubna  
 Light Cone 2012 - Light Cone 2012, Krakow  
 March Meeting 2012 Boston - March Meeting 2012 Boston  
 MEMICS 2012 - MEMICS 2012, Znojmo  
 MESON 2012 - MESON 2012, Krakow  
 NANO 2012 - International Conference on NanoStructured Materials, Rhodes  
 NanoSEA 2012 - NanoSEA 2012 International Conference, St. Margarita Di Pula  
 New Frontiers in Astronomy and Cosmology - New Frontiers in Astronomy and Cosmology  
 NMP NCPs Training Workshop - NMP NCPs Training Workshop, Malaga  
 Nuclear Structure and Dynamics - The second International Conference "Nuclear Structure and Dynamics" , Opatija  
 QCMC 2012 - Conference on Quantum Communication, Measurement and Computing  
 QIPECS 2012 - Pécs Workshop on Quantum Information and Quantum Optics  
 QISM 2012 - Quantum Information meets Statistical Mechanics 2012  
 QuAMP Summer School 2012 - QuAMP Summer School 2012  
 Quantum Malta 2012 - Quantum Malta 2012: Fundamental Problems in Quantum Physics  
 SECAM - SECAM, Tolouse

Seefeld Quantum Information Workshop 2012 - Seefeld Quantum Information Workshop 2012  
Seminár TEM v materiálovém výzkumu - Seminár TEM v materiálovém výzkumu, Ostrava  
Seminár uživatele TA Instruments - Seminár uživatele TA Instruments, Brno  
SPIN 2012 - The 20th International Symposium on Spin Physics, Dubna  
SPLDS - Statistical Physics and Low Dimensional Systems, Pont-à-Mousson  
Summer school on Quantum physics and Quantum Information  
SuperSTEM Workshop - 5th SuperSTEM Summer School on Oberration-Corrected STEM  
SuperSTEM Workshop - SuperSTEM Workshop, Manchester  
SURFINT- SREN III - SURFINT- SREN III, Florencia  
TUBITAK-SAS Joint Workshop - TUBITAK-SAS Joint Workshop, Tubitak  
Winter School 2012, Trieste, Italy - Winter School 2012, Trieste, Italy  
Workshop on detailed spectroscopy at ISOL@MYRRHA, Mol  
Workshop on Quantum Simulations 2012 - Workshop on Quantum Simulations 2012  
Workshop Perspectives in Nuclear Fission, Tokai - Workshop Perspectives in Nuclear Fission, Tokai  
Xth Quark Confinement and the Hadron Spectrum - Xth Quark Confinement and the Hadron Spectrum, Munich  
XXI International materials research congress 2012 - XXI International materials research congress 2012, Cancun