National Institute of
Chemical Physics and Biophysics

Activity Report 2007–2010

NICPB 1980–2010

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Contents

Mission

NICPB is a professional science institution, where the main task of the scientists is research that values academic freedom.

NICPB carries out fundamental and applied research and engages in the development of the novel directions in material sciences, gene- and biotechnology, environmental technology and computer science.

NICPB helps to educate a new generation of scientists in accordance with the association contracts and other contracts with the universities and other academic institutions.

Institute introduces its work regularly in other research and degree-granting institutions, in specialised literature, scientific conferences and public media.

Vision

NICPB is an integrated and effective scientific institution, where all employees recognise their responsibilities and possibilities in achieving the goals of the Institute. NICPB`s reputation is based on high-level research, initiation of innovative topics and development of competence and scientific infrastructure at national and also international level.

Preface

NICPB is a unique phenomenon on the scientific landscape of Estonia, most likely also so in the Baltic States and maybe even in the whole Northern Europe. As the only Institute from the former Academy of Sciences surviving the wave of merges to various universities, it nowadays sets an example of purely professional scientific research institution in our country. NICPB celebrated its 30th birthday in year 2010, so this current summary serves also as an internal evaluation of our performance and success during the years of independent research Institute on the landscape shaped by several large and dominating universities. There are many reasons to be proud of the achievements of our scientists. Based on the Thomson Reuters ISI WoK database, the NICPB, while 60 times smaller than our best partner and competitor, the University of Tartu, has published only 15 times less peer refereed papers that have been cited only 8 times less than the whole production of the UT making the average citations per NICPB papers almost 2 times better than those from UT. Besides this historical remark, we recently deserved the trust of our national authorities to host 2 out of the 20 objects of the new Estonian Research Infrastructure Roadmap: The CERN-Estonian cooperation and the Estonian Magnet Laboratory. We will invest our experience and competence into the development of both of these scientific centres to strengthen further the good image of Estonia as an excellent place for R&D&I.

Raivo Stern
Director

I RESEARCH AND DEVELOPMENT

Research

Scientific research in the Institute is based on strategic scientific programmes that integrate different, yet closely interrelated areas of science. According to the Strategic Plan for 2005 to 2015, the programmes are:

Bioenergetical nonlinear photonics

Environmental Chemistry

In vitro toxicology and 3R

Ionic conductivity and catalysis

Macromolecular interactions

New spin materials and states

Nuclear Magnetic Resonance

Particle physics

In practice the research follows long-term research projects funded by the targeted financing schemes that have been approved by the Minister of Education and Research.

1 Bioenergetics

Topic: Mechanisms of regulation of integrated energy metabolism in cancerous and muscle cells

The project is funded from the NICPB Targeted Funding Scheme SF0180114Bs08

Principal Investigator: Professor Valdur Saks, DSc, Member of the Academy of Sciences of Estonia
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The Laboratory of Bioenergetics has actively participated in developing a new direction, Molecular Systems Bioenergetics (MSB), which is an important part of Systems Biology. The main focus of MSB are the processes of energy conversion both at molecular and cellular levels, with special emphasis on the structure and function of energy transfer and regulatory networks, mechanisms of interaction between their components, and a quantitative description of these networks by computational models.

Our earlier work described quantitatively the molecular organization, dynamics and regulation of integrated energy metabolism in adult cardiac and skeletal muscle. The existing data on regulation of mitochondrial energy conversion point to decisive role of protein-protein interactions between the cytoskeletal proteins and the mitochondrial outer membrane. This regular system with crystal-like arrangement of mitochondria is highly organized due to specific organization of the cytoskeletal system of muscle cells. During the last years we have formulated a model of regulation of respiration in a supercomplex named Mitochondrial Interactosome. In cancerous cells this complex is significantly modified.

The results of these investigations will give the basis for understanding of many cellular pathologies of heart like ischemia, heart failure, myocardial infarction, neurodegenerative diseases, bioenergetic mechanisms of cancer and mechanisms of reperfusion injury.

The Laboratory of Bioenergetics is in tight collaboration with French scientists in Bordeaux and Grenoble Universities, with Innsbruck Medical University, Daniel Swarovski Research Laboratory and with National Institutes of Health, USA.

Researchers

Valdur Saks, PhD, DSc
Tiia Anmann, PhD
Tuuli Käämbre, PhD
Peeter Sikk, PhD
Igor Ševtšuk, PhD
Vladimir Tšekulajev, PhD
Natalja Timohhina, PhD student
Kersti Tepp, PhD student
Minna Varikmaa, PhD student

Associated Targeted Financing

1. Mechanisms of integration and regulation of mitochondria and ATPases in normal oxidative muscle cell, 2003-2007, SF0182549Bs03, PI: V. Saks

Associated Estonian Science Foundation (ETF) Grants

1. Compartmentalized energy transfer in cardiomyocytes and mechanisms of preconditioning, 2005-2008, ETF6142, PI: V. Saks
2. Dynamics of formation of modular bioenergetic systems during differentiation of stem cells into myocytes and their degradation during ageing, 2009-2012, ETF7823, PI: V. Saks

Scientific Degrees Defended

1. Saaremäe, Merle. The expression of β-tublin isoforms and their role in the regulation of permeability of mitochondrial outer membrane. MSc, Tallinn University of Technology, 2010
2. Varikmaa, Minna. Model systems of dopamine transporter for the farmacological characterization of ligands. MSc, University of Tartu, 2008
3. Anmann, Tiia. Integrated and Organized Cellular Bioenergetic Systems in Heart and Brain. PhD, Tallinn University of Technology, TUT Press, 2007
4. Timohhina, Natalja. A Study Of Origination Of Characteristic Elements Of Foucault' Cardiogram. MSc, University of Tartu, 2007

Selected Publications

1. **Saks VA.** Molecular system bioenergetics: energy for life. 2007, Weinheim: Wiley-VCH. xxviii, 604 p.
2. Monge C, ... , **Saks VA**. Regulation of respiration in brain mitochondria and synaptosomes: restrictions of ADP diffusion in situ, roles of tubulin, and mitochondrial creatine kinase. Molecular And Cellular Biochemistry, 318 (1-2): 147-165
3. **Timohhina N**, et al. Direct measurement of energy fluxes from mitochondria into cytoplasm in permeabilized cardiac cells in situ: some evidence for Mitochondrial Interactosome. J. Bioenerg. Biomembr., 2009, 41(3): 259-75
4. **Saks V**, et al. Structure-function relationships in feedback regulation of energy fluxes in vivo in health and disease. Mitochondrial Interactosome. Biochim. Biophys. Acta, 2010, 1797(6-7): 678-697

2 Chemical Energy Technology

Topic: Energy flows at the quantum level and in ensemble thermodynamics

The project is funded from the NICPB Targeted Funding Scheme SF0690021s09 "Chemical energy technology"

Principal Investigator: Professor Endel Lippmaa, DSc, Member of the Academy of Sciences of Estonia
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Research carried out during recent years in Chemical Energy Technology (T140 Energetics and T370 Fuel Technology) centred around feasibility studies of various novel approaches proposed for clean energy. The techniques used involved various forms of spectrometry such as NMR, UV-VIS and chromato-mass spectrometry and, at the other extreme, the vacuum energy studied at CERN.

As a local problem, the potentialities of the abundant black argillite shales were studied both as a source of oil and some rare metals (U, Mo, V, Re). It was shown that the Maardu-type Dictyonema shale, relatively rich in oil and poor in metals, is not the only black shale available. The other form is a very different argillite mudstone that yields practically no oil, but is reasonably rich in V, Mo and Re. It is found in Eastern Estonia with the best mines at Sillamäe. In this particular case the heavy metals are bound into porphyrine rings that form extremely stable chelates. These structural elements open new approach for the studies of black shale formation and maturation, but create also technological problems just as is the case with Canadian and Venezuelan bitumens.

The main techniques used were 800 MHz NMR and also quantum-chemical calculations of molecular associations and chemical reactivity using a very modern heavily parallel-action 96-core computer with Infiniband interconnect and the latest professional Accelrys and Gaussian software.

The TOTEM results at CERN are consistent with the absence of new particles, including Higgs and the like detectable in the accessible LHC energy range.

Researchers

Endel Lippmaa, DSc

Ello Maremäe, PhD

Arno Pihlak, PhD

Risto Tanner, PhD

Aleksander Trummal, PhD

Alar Rummel, MSc

Associated Targeted Financing

Spectroscopic Chemical Physics, 2003-2007, SF0222598s03, PI: T. Pehk

Scientific Degrees Defended

Trummal, Aleksander. Computational Study of Structural and Solvent Effects on Acidities of Some Brönsted Acids. PhD, University of Tartu Tartu, Tartu University Press, 2009

Publications

1. Chatrchyan S, **Hektor A, Kadastik M, Kannike K, Lippmaa E, Müntel M, Raidal M, Rebane L.** et al. The CMS experiment at the CERN LHC, The CERN Large Hadron Collider: Accelerator and Experiments, The CMS Collaboration, 2, CERN/LHCC, CERN, Geneva, Switzerland, 2009, 1-334
2. **Lippmaa E, Maremäe E, Pihlak AT, Aguraiuja R.** Estonian Graptolitic Argillites – Ancient Ores Or Future Fuels? Oil Shale, 2009, Volume: 26, Issue: 4, Pages: 530-539
3. Anelli G, **Lippmaa E, Rummel A, Trummal A.** et al. The TOTEM Experiment at the CERN Large Hadron Collider, The CERN Large Hadron Collider: Accelerator and Experiments, The TOTEM Collaboration, 2, CERN/LHCC, CERN, Geneva, Switzerland, 2009, 1-107
4. Antchev G, **Lippmaa E, Rummel A, Trummal A.** et al. Diffraction at TOTEM, 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009, 29th June - 3rd July 2009, CERN, Geneva, Switzerland, Proceedings of the 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009 (M. Deile, D. d'Enterria, and A. De Roeck, Eds), CERN-Proceedings-2010-002, 2010, 249-256
5. Antchev G, **Lippmaa E, Rummel A, Trummal A**. et al. The TOTEM Detector at LHC, 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009, 29th June - 3rd July 2009, CERN, Geneva, Switzerland, Proceedings of the 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009 (M. Deile, D. d'Enterria, and A. De Roeck, Eds), CERN-Proceedings-2010-002, 2010, 449-455

3 Environmental chemistry

Topic: Environmentally friendly utilization strategy of oil shale processing solid wastes

The project is funded from the NICPB Targeted Funding Scheme SF0690001s09

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The use of oil shale for energy generation and oil production as a common practice for Estonia started to be a strategic issue for several other countries, including US. Processing of oil shale, however, results in vast quantities of solid wastes containing carcinogenic organic compounds and toxic trace metals deposited in environment. The mobility of hazardous ingredients in wastes was investigated in laboratory and field leaching tests. The negligible release (0.1% or less) was found for V, Mn, Zn, Pb, Ni, and Co, Cu (0.5-1.0%), whereas Cr and Cd (2.5-3.1%) were the metals of medium mobility. The environmental impact of these wastes was found to be essential. There are both economical and ecological needs to convert these wastes into a resource. However, the utilization of oil shale wastes should include treatment of material to eliminate toxic ingredients or decrease their mobility.

The special treatment strategy of oil shale ash for syntheses of geopolymers was found to be promising. The silicon in the original ash was converted into Calcium-alumino-silicate hydrates, e.g., into tobermorite structures with long silicate chains and a small number of bridging sites. A non-destructive technique, solid state MAS ^{31}Si NMR spectroscopy, was used for the investigation of the interaction of pyrogenic matter with soil and compost. Chemical methods including solid phase micro extraction (SPME) were used to extract and isolate the soluble part of the mixture followed by chromatographic analysis.

Using the preparations with catalytic and adsorbent activity, made on the bases of some ash fractions, the toxic trace compounds could be removed from the system.

Thus, for the safe recycling of oil shale solid wastes, the leaching of trace elements from the system could be avoided by pre-treatment of waste to a geopolymeric material by alkaline hydrothermal reagents.

Researchers

Uuve Kirso, DSc

Natalya Irha, PhD

Janek Reinik, PhD

Erik Teinemaa, PhD

Margit Lassi, MSc

Kelly Joa, MSc

Jekaterina Jefimova (Panova), PhD student

Gary Urb, Ph student

Jasper Adamson, Ph Student

Reelika Mägi, MSc

Associated EU and other International Projects

1. BioSpinno2 project No 19222, 2005-2007, Enterprise Estonia (EU structural funds), PI: U. Kirso
2. European SF Scientific Programme (Interdisciplinary Tropospheric Research: from the Laboratory to Global Change), 2003-2009, European SF, PI: U. Kirso

Associated Targeted Financing

1. Speciation and distribution of priority pollutants in Estonian environment, 2003-2007, SF0222597s03, PI: U. Kirso

Associated ETF Grants

1. The investigation of methods of recycling of solid waste of oil shale processing, 2006-2009, ETF6828, PI: U. Kirso

Scientific Degrees Defended

1. Mägi, Reelika. Application of a new analytical method for analysis of environmental discharges of oil shale processing. MSc (Second prize in category of master thesis), Tallinn University of Technology, 2010
2. Adamson, Jasper. Fluoride-Free Cross-Coupling Methodology Using Disiloxanes: Synthesis of Terminal Aryl Acetylenes and Biaryl Compunds. MSc, Magdalene College, University of Cambridge, UK, 2009
3. Panova, Jekaterina. The Fenton chemistry and its combination with coagulation for treatment of dye solutions. MSc, Tallinn University of Technology, 2007

Selected Publications

1. **Adamson J, Irha N, Adamson K**, Steinnes E, **Kirso** U. Effect of oil shale ash application on leaching behavior of arable soils: an experimental study. Oil Shale, 2010, 27(3), 250-257
2. **Joa K, Panova E, Irha N, Teinemaa E**, Lintelmann J, **Kirso U**. Chemical analysis of Polycyclic aromatic hydrocarbons (PAHs) in oil shale processing wastes practice and new trends. Oil Shale,2009, 26 (1), 59-72
3. **Reinik J, Heinmaa I**, Mikkola J. P, **Kirso U**. Synthesis and characterization of calcium-alumino-silicate hydrates from oil shale ash – Towards industrial applications. Fuel, 2008, 87, 1998-2003
4. **Kirso U, Irha N, Reinik J**, Urb G, Laja M. The role of laboratory and field leaching tests in hazard identification for solid materials. ATLA, 2007, 35, 1, 119 -122

4 In vitro toxicology and 3R

Topic: In vitro toxicology and (nano)ecotoxicology

The research is part of the NICPB Targeted Funding Scheme SF0690063s08: "Mechanisms and interactions in toxicology and toxinology: *in vitro* models"

Principal Investigator: Anne Kahru, PhD, leading research scientist, Head of the Laboratory of Molecular Genetics, Chair-person of the Estonian Society of Toxicology

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Following the evolution of research priorities worldwide, the Laboratory of Molecular Genetics has since 2006 developed a new research direction in NICPB - the studies of potential hazardous effects of synthetic nanoparticles. This change of priorities was supported by the renovation and updating of the facilities for ecotoxicological, microbiological, molecular biology and cellular biology research during 2005-2007.

Currently the group is first in Estonia and one of the few groups worldwide who started ecotoxicological studies of metal oxide nanoparticles (http://sciencewatch.com/dr/fbp/2009/09augfbp/09augfbpKahr/). We have developed a novel approach based on a combination of traditional ecotoxicological methods (comparing the ecotoxic effects of nanosize metal oxides with their bulk analogues and soluble salts) and metal-specific recombinant biosensors. This combined approach allows differentiating the toxic effects of metal oxide NPs per se and solubilised metal ions. Since 2007 our group participates in FP6 IP OSIRIS with 31 partners in developing high-throughput *in vitro* toxicity screens and QSARs (quantitative-structure-activity relationships) and has created a web-database E-SovTox from Russian toxicity data sources (http://kbfi-databases.eu/database/)(see also: Scientific Collections, pp 23-24). In a new FP7 project, NANOVALID, with 35 partners we lead a WP on toxicological profiling of synthetic nanoparticles that merges knowledge on high-throughput toxicity screening, environmental chemistry, physiology of various aquatic organisms and construction of mechanism-based recombinant sensor bacteria.

Our earlier work preceding to nanotoxicological research focused on development of *in vitro* test batteries of biotests and recombinant biosensors for the analysis of harmful effects of major environmental pollutants of human relevance (heavy metals, phenols, PAHs). This *in vitro* testing strategy contributes to the 3R (Reduction, Replacement, Refinement) strategy that allows to significantly reduce laboratory animal use.

The research of Laboratory of Molecular Genetics is contributing to the NICPB strategic programme "*In vitro* toxicology and 3Rs".

The Laboratory of Molecular Genetics collaborates actively with all main Estonian Universities via co-supervision of PhD students (Profs M. Lopp, T. Paalme, R. Kuusik, E. Truve, K. Sepp, R. Munter) and joint research projects and/or publications (Drs U. Maran, K. Orupõld, A. Tuvikene, L. Bitjukova). We have strong international connections with scientists from Clemson University and University of California Los Angeles (USA), Liverpool John Moore University and Teesside University (UK), Francois Rabelais University (France) and the University of Ljubljana (Slovenia), to name a few.

Researchers

Anne Kahru, PhD

Irina Blinova, PhD

Margit Heinlaan, PhD

Angela Ivask, PhD

Kaja Kasemets, PhD

Heiki Vija, MSc

Villem Aruoja, PhD student

Monika Mortimer, PhD student

Mariliis Sihtmäe, PhD student

Imbi Kurvet, PhD student

Olesja Bondarenko, PhD student

Aleksandr Käkinen, PhD student

Associated EU and other International Projects

1. OSIRIS (Optimized Strategies for Risk assessment of industrial chemicals through integration of non-test and test information) EU FP6 Integrated Project, 2007-2011. NICPB PI: A. Kahru
2. NANOVALID (Development of reference methods for hazard identification, risk assessment and LCA of engineered nanomaterials, FP7 Large-scale integrating Collaborative Project, 2011-2014. NICPB PI: A. Kahru
3. Environmental impact of oil shale combustion ashes on topsoils in Narva Powerplants region: combined geochemical and ecotoxicological approach. EMP45 Grant. Joint project between TUT and NICPB, 2008-2010. PIs: L. Bitjukova (TUT) and A. Kahru (NICPB).
4. Bioavailability of key environmental pollutants in different environmental matrices: from quantification to mechanisms. Maj ja Tor Nessling Foundation, 2007-2009. PI: A. Ivask
5. Risk Management and Remediation of Chemical Accidents (RIMA). Interreg IV A Programme, 2010-2013 PI: I. Blinova

Associated Targeted Financing

1. Toxicological risk assessment in vitro, 2003-2007, SF0222601Bs03, PI: A. Kahru

Associated ETF Grants

1. Bioavailability and (eco)toxicity of metal oxide nanoparticles: effects and mechanisms, 2007-2010, ETF 6956, PI: A. Kahru
2. Mechanism-based study of toxicity: recombinant microbial models, 2007-2010, ETF 6974, PI: A. Ivask
3. In vitro toxicity of metal oxide nanoparticles: eukaryotic models, 2008-2011, ETF 7686, PI: K. Kasemets
4. Bioavailability of contaminants in Estonian lakes and rivers, 2009-2012, ETF 8066, PI: I. Blinova
5. Ivask, Angela. High throughput bacterial screening for the characterization of toxicity of nanosized particles and materials, 2010-2012, ETF Post-Doc Grant MJD67

Scientific Degrees Defended

1. Heinlaan, Margit. Ecotoxicological Evaluation of Synthetic Nanoparticles and Particulate Environmental Samples. PhD, Estonian University of Life Sciences, 2010
2. Kurvet, Imbi. Natural and recombinant bioluminescent bacteria for high throughput toxicity screening. MSc, Tallinn University of Technology, 2009

Selected Publications

1. **Heinlaan M, Ivask A, Blinova I, Dubourguier H-C, Kahru, A**. Toxicity of nanosized and bulk ZnO, CuO and TiO2 to bacteria *Vibrio fischeri* and crustaceans *Daphnia magna* and *Thamnocephalus platyurus*. Chemosphere, 2008, 71:1308-1316. (Essential Science Indicators SM of Thomson Reuters listed this paper in Aug 2009 as Fast Breaking Paper in Environment/ Ecology) (http://sciencewatch.com/dr/fbp/2009/09augfbp/09augfbpKahr/)
2. **Kahru A, Dubourguier H-C, Blinova I, Ivask A, Kasemets K**. Biotests and Biosensors for Ecotoxicology of Metal Oxide Nanoparticles: A Minireview. Sensors, 2008, 8: 5153 - 5170.
3. **Kahru A, Dubourguier H-C**, From ecotoxicology to nanoecotoxicology. Toxicology, 2010, 269(2-3): 105-119. (Most downloaded paper from „Toxicology" from Science Direct, Jan-June 2010 (http://top25.sciencedirect.com))
4. **Ivask A, Bondarenko O**, Jepihhina N, **Kahru A**. Profiling of the reactive oxygen species-related ecotoxicity of CuO, ZnO, TiO2, silver and fullerene nanoparticles using a set of recombinant luminescent *Escherichia coli* strains: differentiating the impact of particles and solubilised metals. Anal. Bioanal. Chem, 2010, 398:701–716
5. **Aruoja V, Dubourguier H.C., Kasemets K, Kahru A**. Toxicity of nanoparticles of CuO, ZnO and TiO2 to microalgae *Pseudokirchneriella subcapitata*. Sci. Total. Environ, 2009, 407, 1461-1468

5 Ionic conductivity and catalysis

Topic: Development of Solid Oxide Fuel Cells

The Project is commissioned by Elcogen Ltd, Estonia

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Solid Oxide Fuel Cells (SOFC) is an emerging technology for electricity production for small and medium sized stationary applications. High temperature fuel cell technologies like SOFC have potential for high electrical efficiency, 55-60%, and total efficiency up to 90% for Combined Heat and Power (CHP) units combined with low emissions. The main development challenges related to the commercialization of SOFC technology are in the reduction of its cost and increasing its lifetime. Also, the electrical efficiency of SOFC systems needs to be improved to increase their competitiveness.

These challenges motivate our involvement in fuel cell development. We are active, on one hand, in the development of usable SOFC elements with our commercial partner Elcogen. On the other hand, we are investigating the atomic level structure of ceria based oxides, including ceria-zirconia mixed oxides, and its connection to oxygen dynamics in these lattices that is necessary for optimization of SOFC resistance and longevity.

In SOFC the aliovalently doped ceria can be used as an electrolyte, a barrier layer between zirconia electrolyte and cathode, or an anode catalyst to suppress coke forming from carbon containing fuels. As an electrolyte, it has higher ionic conductivity than stabilized zirconia at low temperatures, but it develops electronic conductivity and morphological instability at low anodic oxygen activities, limiting its use as a single layer electrolyte. On the other hand, it has better compatibility with efficient cathode materials than zirconia and can be used as a barrier layer between thin zirconia electrolyte and cathode. Here ceria tends to form a lower conductivity mixed oxide with zirconia, limiting efficiency of produced fuel cell. As an anode catalyst, its functioning depends again on its interactions with other anode materials, zirconia and nickel. Both ion conductivity and catalytic properties depend on atomic short range order that we do not understand well enough in these materials.

Our capability to do combined optical, electrochemical impedance, thermogravimetric and solid state NMR studies of these compounds gives us unique possibilities that we are eager to use. We have estab-

lished a complicated activated lattice dynamics in lanthanum doped ceria through temperature dependent NMR relaxation studies [1], and are currently expanding our work to different dopants.

Researchers

Juhan Subbi, PhD

Helgi Kooskora, MSc

Jüri Pahapill, MSc

Tõnu Tolk, senior engineer

Associated EU and other International Projects

1. Development of Solid Fuel Cells 2005-2007, Elcogen Ltd, PI: J. Subbi
2. Development of Solid Fuel Cells II, 2008-2010, Elcogen Ltd, PI: J. Subbi

Associated Target Financing

1. Spectroscopic Chemical Physics, 2003-2007, SF0222598s03, PI: T. Pehk
2. Physics, Chemistry and Technological Applications of Condensed Phases, 2008, SF0690176s08, PI: T. Pehk
3. New Developments and Applications of Nuclear Magnetic Resonance Techniques, 2009-2014, SF0690034s09, PI: I. Heinmaa

Selected Publications

1. **Heinmaa I, Joon T, Kooskora H, Pahapill J, Subbi J**. Local structure and oxygen dynamics in La doped ceria: 17O NMR study. Solid State Ionics, 2010, 181: 1309 - 1315.

6 Macromolecular interactions

Topic: Toxinology

The project is part of the NICPB Targeted Funding Scheme SF0690063s08 "Mechanisms and interactions in toxicology and toxinology: *in vitro* models"

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Snake venoms are a rich source of peptides and proteins of pharmacological importance. The main area of interest has been the study of structure and function of snake venom components affecting haemostasis, cell adhesion, apoptosis, and angiogenesis. The venom proteins are also attractive tools for protein-protein interaction studies and some of them are useful as diagnostics. The specific and effective snake venom components are novel and ideal lead structures to generate potential antibacterial, antithrombotic, anti-cancer therapeutics. Some venom components may be potent therapeutics in regulating tissue regeneration and wound healing.

Molecular cloning and characterization of activities of individual snake venom proteins is crucial for understanding envenomation (general toxic effects) and targeted effects (blood, nervous system, immune system, etc) as well as for developing novel agents for diagnostic and therapeutic purposes. Characterization of snake venom components structurally and functionally (venomics) needs using a lot of methods of protein chemistry, molecular biology, bioinformatics, cell culture systems and animal models.

We have isolated different proteins and peptides from *Viperidae* and *Elapidae* venoms and studied their biological function. Using *Vipera Lebetina* venom gland cDNA library different venom components were cloned and sequenced. However, the biological effects of myriad of venom components (proteins, peptides) need still to be elucidated.

We plan structural studies of newly discovered proteins (peptides) in cooperation with the laboratory of chemical physics using new NMR facility of NICPB. Structural information of these venom proteins together with recombinant technology might promote the construction of new drugs.

The research group's competence in the field of snake venom biochemistry has been used at the Tallinn Pharmaceutical Plant in producing drugs from snake venoms.

The Laboratory of Bioorganic Chemistry collaborates primarily with the Department of Gene Technology of the Tallinn University of Technology (L. Järvekülg, V. Paalme, K. Tomson, P. Kogerman, K. Vanatalu), and with Protein Chemistry Research Group and Core Facility, Institute of Biotechnology, University of Helsinki (N. Kalkkinen).

Researchers

Jüri Siigur, PhD

Anu Aaspõllu, PhD

Mari Samel, PhD

Ene Siigur,PhD

Katrin Trummal, PhD

Külli Tõnismägi, MSc

Heiki Vija, MSc

Olga Vassiljeva, MSc student

Associated Target Financing

1. Functional proteomics-structure-activity relationships and molecular recognition in natural protein systems, 2003-2007, SF0222603s03

Associated ETF Grants

1. L-Amino acid oxidases: isolation, primary structure, cellular interactions, 2003-2007, ETF5938, PI: E. Siigur
2. Biomedically important proteins and peptides from snake venoms, 2007 – 2010, ETF7251, PI: J. Siigur
3. Protein-protein interactions with the snake venom nerve growth factor, 2008 – 2011, ETF7694, PI: E. Siigur

Scientific Degrees defended (2007-2010)

1. Trummal, Katrin. Purification, Characterization and Specificity Studies of Metalloproteinases from *Vipera lebetina* Snake Venom. PhD, Tallinn University of Technology, 2007
2. Tõnismägi, Külli. Comparative study of snake venom l-amino acid oxidases. MSc, Tallinn University of Technology, 2008
3. Vija, Heiki. Separation of toxic peptides from *Amanita phalloides* and *Amanita virosa*. MSc, Tallinn University of Technology, 2008

Selected Publicationsä

1. **Vija H, Samel M, Siigur E, Aaspõllu A, Trummal K, Tõnismägi K, Subbi J, Siigur J**. Purification, characterization, and cDNA cloning of acidic platelet aggregation inhibiting phospholipases A(2) from the snake venom of *Vipera lebetina* (Levantine viper). Toxicon 2009, 54:429-439
2. **Vija H, Samel M, Siigur E, Aaspõllu A, Tõnismägi K, Trummal K, Subbi J, Siigur J**. VGD and MLD-motifs containing heterodimeric disintegrin viplebedin-2 from *Vipera lebetina* snake venom. Purification and cDNA cloning. Comp. Biochem. Physiol. B, Biochem. Mol. Biol. 2009, 153:253-260
3. Paalme V, **Trummal K, Samel M, Tõnismägi K**, Järvekülg L, **Vija H, Subbi J, Siigur J**, **Siigur E**. Nerve growth factor from *Vipera lebetina* venom. Toxicon 2009, 54:329-336
4. **Siigur J, Siigur E**. Activation of Factor X by Snake Venom Proteases, Chapter 26, in "Toxins and Hemostasis. From Bench to Bedside" Eds. Kini RM, Clemetson KJ, Markland FS, McLane MA, Morita T. 2010, Springer, pp. 447-464

7 New spin materials and states

Topic: Spectroscopy of functional materials

The project is funded by the NICPB Targeted Funding Scheme SF0690029s09

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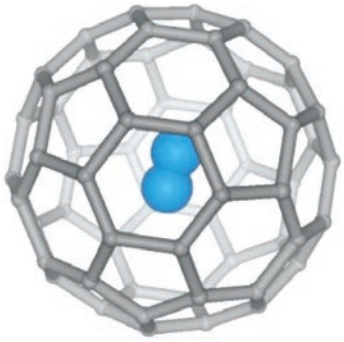
Functions of materials are caused by collective action of their constituent atoms and electrons, quantum properties of these particles, and their mutual interaction. Understanding the functioning is an iterative process between theory and experiment. Our main tools are terahertz, infrared and nuclear magnetic resonance spectroscopy which help to map different aspects of material properties and thus improve the theoretical understanding.



$H_2@C_{60}$ is a molecular complex where the simplest molecule, diatomic hydrogen, is trapped in the most symmetric molecule, buckminster fullerene C_{60}. H_2 behaves like a rotor moving inside the spherical cavity [1, 2]. The orbiting frequency of H_2 inside C_{60} is 6THz. Another carbon compound, graphite with calcium atoms between the carbon layers, is a superconductor below T_c=12K. The size of the superconducting gap of this material can be measured directly from the THz reflection spectra [3].

The highest T_c of non-copper-based superconductors, to date, belongs to recently discovered iron pnictides. IR reflection spectra evidence strong interaction between charge carriers and bosons in the normal state of an iron pnictide [4]. In the superconducting state the conventional theory of superconductivity fails to count for the excess normal charge carriers as revealed by the low frequency optical conductivity [5].

Magnetic excitations may experience Bose-Einstein condensation similar to the condensation of Cooper pairs in a superconductor or atoms in ultra-cold gases. A spatial modulation of condensed boson density in a spin-gap material $BaCuSi_2O_6$ was discovered in the collaborative NMR study where very high magnetic fields and very low temperatures were needed [6]. The high magnetic field THz spectroscopy studies show, for the first time, the complexity of magnetic excitation spectra in a spin gap material $Sr_{14}Cu_{24}O_{41}$ [7] and in multiferroic $LiCu_2O_2$ [8].

Researchers

Toomas Rõõm, PhD

Urmas Nagel, PhD

Raivo Stern, PhD

Dan Hüvonen, PhD, post-doc at ETH Zürich

Min Ge, PhD, post-doc

Mukesh Chandra Dimri, PhD, post-doc

Associated EU and other International Projects

1. Collaboration Agreement "Far Infrared Spectral Analysis Software", 2001-2020, Sciencetech Inc, Canada, PI: U. Nagel

Associated Targeted Financing

1. Spectroscopic Chemical Physics, 2003-2007, SF0222598s03, PI: T. Pehk

Associated ETF Grants

1. Singlet-triplet transitions in terahertz spectra of spin-gap materials, 2005-2008, ETF6138, PI: U. Nagel
2. Optical spectroscopy of frustrated magnets in magnetic field, 2007-2010, ETF7011, PI: T. Rõõm
3. Ge, Min. Infrared spectroscopy of endohedral hydrogen-fullerene and calmodulin-peptide complexes, 2009-2011, ETF Post-Doc Grant JD187
4. Infrared Study of the Dynamics of Endohedral Hydrogen-Fullerene Complexes, 2010-2013, ETF8170, PI: U. Nagel
5. Chandra, Mukesh. Magnetic studies on doped dielectric oxides (ZrO2 and TiO2) for spintronic applications, 2010-2013, ETF Post-Doc Grant MJD65

Scientific Degrees Defended

Hüvonen, Dan. Terahertz Spectroscopy of Low-Dimensional Spin Systems. PhD, Tallinn University of Technology, 2008

Selected Publications

1. Mamone S, **Ge M, Hüvonen D, Nagel U**, Danquigny A, Cuda F, Grossel M C, Murata Y, Komatsu K, Levitt M H, **Rõõm T**, and Carravetta M. Rotor in a cage: Infrared spectroscopy of an endohedral hydrogen-fullerene complex. J. Chem. Phys. 2009, **130**, 081103
2. Carravetta M, Danquigny A, Mamone S, Cuda F, Johannessen O G, **Heinmaa I**, Panesar K, **Stern R**, Grossel M C, Horsewill A J, **Samoson A**, Murata M, Murata Y, Komatsu K, Levitt M H. Solid-state NMR of endohedral hydrogen-fullerene complexes. Phys. Chem. Chem. Phys., 2007, **9**, 4879
3. **Nagel U, Hüvonen D, Joon E**, Kim J S, Kremer R K, **Rõõm T**. Far-infrared signature of the superconducting gap in intercalated graphite CaC_6. Phys. Rev. B, 2008, **78**, R041404
4. Yang J, **Hüvonen D, Nagel U, Rõõm T**, Ni N, Canfield P C, Bud'ko S L, Carbotte J P, Timusk T. Optical Spectroscopy of Superconducting $Ba_{0.55}K_{0.45}Fe_2As_2$: Evidence for Strong Coupling to Low-Energy Bosons. Phys. Rev. Lett., 2009, **102**, 187003
5. Lobo R. P. S. M, Dai Y M, **Nagel U, Rõõm T**, Carbotte J P, Timusk T, Forget A, D. Colson D. Optical signature of subgap absorption in the superconducting state of $Ba(Fe_{1-x}Co_x)_2As_2$. Phys. Rev. B, 2010, **82**, R100506
6. Krämer S**, Stern R**, Horvatić M, Berthier C, Kimura T, Fisher I R. Nuclear magnetic resonance evidence for a strong modulation of the Bose-Einstein condensate in $BaCuSi_2O_6$. Phys. Rev. B, 2007, 76, R100406
7. **Hüvonen D, Nagel U, Rõõm T**, Haas P, Dressel M, Hwang J, Timusk T, Wang Y-I, Akimitsu J. Magneto-optic far-infrared study of $Sr_{14}Cu_{24}O_{41}$: Triplet excitations in chains. Phys. Rev. B, 2007 **76**, 134418
8. **Hüvonen D, Nagel U, Rõõm T**, Choi Y J, Zhang C L, Park S, Cheong S-W. Magnetic excitations and optical transitions in the multiferroic spin-1/2 system $LiCu_2O_2$. Phys. Rev. B, 2009, **80**, R100402

8 Nuclear Magnetic Resonance

Topic: New Developments and Applications of NMR Techniques

The project is funded by the NICPB Targeted Funding Scheme SF0690034s09

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Nuclear magnetic resonance (NMR) is a unique analytical tool giving in principle most comprehensive information about short range atomic topology in condensed matter. Unlike other analytical methods, it demands not only appropriate hardware, but also significant competence to design measurement methods and to interpret data.

Despite great potential, NMR-studies of many important problems remain beyond sensitivity and temperature range. Problem is aggravated by low natural abundance of spin-carrying nuclei in main build-

ing elements of organic and ceramic materials. Another limit to the magic angle sample spinning (MAS) solid state NMR is comparatively narrow temperature interval, typically from -150°C to +250°C. Recent progress in NICPB involves development of CryoMAS technique and building of CryoMAS probe. We are currently able to carry out MAS NMR experiments with fast spinning of the sample from room temperature down to T=10°K.

Within the current programme we aim both to develop various NMR tools and to implement them in materials science. Projected advances in NMR technology expand measurement temperature range towards high temperatures, improve sensitivity and resolution and make spectral information more comprehensible. Research fields include ionic conduction and structure of fuel cell components, localization of charge carriers in superconductors, distribution of zeolite reaction centres, syntheses of materials from products of oil shale industry and mechanism of protein aggregation.

Our high field high resolution NMR is focused to configuration (relative and absolute) and conformation studies of various chiral molecules and diastereoisomers, bio- and synthetic polymers.

Researchers

Ivo Heinmaa, PhD

Jüri Jarvet, PhD

Jaan Past, PhD

Tõnis Pehk, DSc

Ago Samoson, PhD (currently Tallinn University of Technology)

Priit Sarv, PhD

Associated EU and other International Projects

1. A coordinated Approach to Access, Experimental Development and Scientific Exploitation of European Large Infrastructures for High Magnetic Fields (EuroMagNET), 2005-2008, Stichting Katholieke Universiteit, EC 6th Framework Programme, PI: R. Stern
2. European Network of Research Infrastructures for providing Access and Technological Advancements in bio-NMR, 2006-2010, EC 6th Framework Programme, PI: I. Heinmaa

Associated Targeted Financing

1. Spectroscopic Chemical Physics, 2003-2007, SF0222598s03, PI: T. Pehk
2. Physics, Chemistry and Technological Applications of Condensed Phases, 2008, SF0690176s08, PI: T. Pehk

Associated ETF Grants

1. Multiquantum correlations under conditions of dynamic- and hyperrotation, 2005-2008, ETF6143, PI: A. Samoson
2. Fast Magic Angle Spinning at Cryogenic Temperatures, 2006-2009, ETF6846 , PI: I. Heinmaa
3. The studies of steric interactions by high field NMR multinuclear spectroscopy, 2006-2009, ETF6778 , PI: T. Pehk
4. NMR studies of heterostructural nanocomposites, 2007-2010, ETF7232 , PI: P. Sarv
5. Sensitivity enhancement of the solid state MAS-NMR technique, 2010-2013, ETF8198, PI: I. Heinmaa

Selected Publications

1. **Heinmaa I, Joon T, Kooskora H, Pahapill J, Subbi J.** Local structure and oxygen dynamics in La doped ceria: 17O NMR study. Solid State Ionics, 2010, 181: 1309 - 1315
2. Davis L J M, **Heinmaa I**, Goward G R. Study of Lithium Dynamics in Monoclinic Li3Fe2(PO4)3 using 6Li VT and 2D Exchange MAS NMR Spectroscopy. Chemistry of Materials, 2010, 22: 769 - 775
3. Perálvarez-Marín A, Wahlström A, Lind J, Hugonin L, **Jarvet J**, Mäler L, Barth A, Gräslund A. Amyloid-like Misfolding Of Peptides By Membrane Mimicking Environments. Biophysical Journal, 2009, 96(3): 93a
4. Kropman D, Mellikov E, Öpik A, Lott K, Volobueva O, Kärner T, **Heinmaa I,** Laas T, Medvid A. Strain

relaxation mechanism in the Si-SiO2 system and its influence on the interface properties. Physica B: Condensed Matter, 2009, 404: 5153 - 5155
5. Kanger T, Kriis K, Laars M, Kailas T, Müürisepp A-M, **Pehk T**, Lopp M. Bimorpholine-Mediated Enantioselective Intramolecular and Intermolecular Aldol Condensation. Journal of Organic Chemistry, 2007, 72: 5168 - 5173
6. Pashkova V O, **Sarv P,** Derewinski M. Composite porous materials containing zeolitic domains prepared by controlled partial recrystallization of amorphous aluminosolicates. Xu R, Gao Z, Chen J, Yan W (Eds). Studies in Surface Science and Catalysis, 2007, vol. 170A: 289 – 296, Elsevier
7. Massad T, **Jarvet J, Tanner R**, Tomson K, Smirnova J, Palumaa P, Sugai M, Kohno T, Vanatalu K, Damberg P. Maximum entropy reconstruction of joint phi, psi-distribution with a coil-library prior: the backbone conformation of the peptide hormone motilin in aqueous solution from phi and psi-dependent J-couplings. Journal of Biomolecular NMR, 2007, 38(2): 107 - 123

9 Particle physics

Topic: High Energy and Theoretical Physics

The project is funded by the NICPB Targeted Funding Scheme SF0690030s09

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The successful start up of the Large Hadron Collider (LHC) at CERN has been the most important event in particle physics in the 21st century. The unprecedented centre-of-mass energy of collisions gives a chance to look for the Higgs boson and physics beyond the Standard Model.

Our team is collaborating with the Compact Muon Solenoid detector group at CERN. We host the biggest Grid clusters in Estonia and use it to analyse fresh data from the LHC. We have studied the production of double-charged Higgs, predicted by one of the main neutrino mass models, at the LHC. The search for H++ has become one of the priority searches in CMS Higgs group as the current world limits on H++ are such that fresh data from LHC can produce new results already early next year.

Astronomical observations show that the nature of about 80% of all matter in the universe – dark matter – is unknown. While it cannot be seen directly, dark matter has played a major rôle in the formation of cosmic structures at large scales. Recently there has been a surge in interest of dark matter models due to intriguing satellite data (PAMELA and others) hinting at annihilating or decaying dark matter. In addition, direct detection experiments are on the verge of finding dark matter passing through the solar system.

Our group has been tackling dark matter from several directions.

We have built a model of scalar dark matter where the matter parity stabilising dark matter arises from breaking a U(1) subgroup of the SO(10) Grand Unified symmetry group. In the model, dark matter is also connected to the electroweak symmetry breaking that together with GUT scale conditions puts heavy constraints on the parameter space. The model predicts that dark matter will be seen in next generation detectors and produced at the LHC if it is light enough.

We have worked on model-independent constraints on dark matter annihilation and decay modes from PAMELA and FERMI satellite data. We have put bounds on reactions with different end products, e.g. dark matter annihilation into electrons is virtually excluded. We have confronted possible production of gamma rays from dark matter annihilation with FERMI data, being among the first to take correctly into account the inverse Compton scattering.

We continue to build models of physics beyond the Standard Model and confront them with new data from the LHC, dark matter detection experiments and cosmic ray data from satellites.

Researchers

Martti Raidal, PhD

Els Heinsalu, PhD

Andi Hektor, PhD

Mario Kadastik, PhD

Kristjan Kannike, PhD

Yuji Kajiyama, PhD

Mait Müntel, PhD

Marco Patriarca, PhD

Antonio Racioppi, PhD

Liis Rebane, PhD student

Alessandro Strumia, PhD

Associated EU and other International Projects

1. EU FP6 project Baltic Grid, 2005-2008, EC 6th Framework Programme, PI: M. Raidal
2. EURATOM Assocation European Fusion Development Agreement, 2007-2009, EURATOM, PI. A. Hektor
3. Research Training Course in Detector Technology, 2008-2009, Nordic Council of Ministers, PI: M. Raidal
4. NordForsk project LHC and beyond, 2008-2010, Nordic Council of Ministers, PI: M. Raidal
5. Scientific and educational cooperation with CERN, 2008-2014, Estonian Ministry of Education and Research, PI: M. Raidal
6. Semantic Business Processes Based On Software-As-A-Service And Cloud Computing (SITIO), 2009-2011, Enterprise Estonia, EUREKA, PI: I. Livenson
7. EGI – European Grid Initiative 2009-2012, EC 7th Framework Programme, PI: M. Raidal

Associated ETF Grants

1. Spectroscopic Chemical Physics, 2003-2007, SF0222598s03, PI: T. Pehk
2. Leptogenesis, supersymmetry and LHC Physics, 2005-2008, ETF6140, PI: M. Raidal
3. Modern methods of statistical physics: applications to diffusion processes in complex systems, 2008-2011, ETF7466, PI: M. Patriarca
4. Racioppi, Antonio. Phenomenology of Anomalous Z', 2009-2012, ETF Post-doc Grant JD164
5. Searching for New Physics at LHC, 2009-2014, ETF8090, PI: M. Raidal
6. Scientific calculus in computer cloud and grid, 2010-2015 ETF TAP-5, PI: M. Raidal
7. Experimental high-energy physics, 2010-2013, ETF8499 PI: M. Kadastik
8. Hektor, Andi. Data mining in the CMS experiment at CERN, 2010-2013, ETF Post-doc Grant MJD52
9. Kannike, Kristjan. Properties of Dark Matter, 2010-2013, ETF Post-doc Grant MJD140
10. Strumia, Alessandro. Astro particle physics and the Large Hadron Collider, 2010-2015, ETF Top Researcher Grant MTT8

Scientific Degrees Defended

1. Heinsalu, Els. Normal and anomalously slow diffusion under external fields. PhD, University of Tartu, 2008
2. Hektor, Andi. Neutrino physics beyond the Standard Model. PhD, University of Tartu, 2008
3. Kadastik, Mario. Doubly charged Higgs boson decays and implications on neutrino physics. PhD, Tallinn University of Technology, 2008
4. Kannike, Kristjan. Implications of Neutrino Masses. PhD, University of Tartu, 2008
5. Müntel, Mait. Detection of doubly charged Higgs boson in the CMS detector. PhD, University of Tartu, 2009

Selected Publications

1. **Kadastik M, Raidal M, Strumia A**. Enhanced anti-deuteron Dark Matter signal and the implications of PAMELA. Physics Letters B, 2010, 683: 248 - 254.
2. **Kadastik M, Kannike K, Racioppi A, Raidal M.** EWSB from the soft portal into Dark Matter and prediction for direct detection. Physical Review Letters, 2010, 104(20): 201301
3. Hütsi G, **Hektor A, Raidal M**. Implications of the Fermi-LAT diffuse gamma-ray measurements on annihilating or decaying dark matter. Journal of Cosmology and Astroparticle Physics, 2010, 07: 008

4. Ellis J, Lola S, **Raidal M**. Supersymmetric Grand Unification and Lepton Universality in K- > l \nu Decays. Nuclear Physics B, 2009, 812: 128 - 143
5. Chatrchyan S, **Hektor A, Kadastik M, Kannike K, Lippmaa E, Müntel, M, Raidal M, Rebane L**, et al. The CMS experiment at the CERN LHC. Amos Breskin and Rüdiger Voss (Eds). The CERN Large Hadron Collider: Accelerator and Experiments (1 - 334), 2009, CERN, Geneva, Switzerland: CERN/LHCC
6. **Raidal M, Hektor A, Kadastik M, Kajiyama Y, Müntel M, Rebane L**. Flavour physics of leptons and dipole moments. European Physical Journal C, 2008, 57(1-2): 13-182

Development

MAS Systems Ltd

NICPB is the founder (2006) and sole owner of MAS Systems Ltd. MAS Systems is focused on development and production of solid-state NMR probes.

Relevant shifts in Zeeman transition, observed in Nuclear Magnetic Resonance (NMR) experiment, can be of the order of a fraction of a Hertz to about several hundred kHz. This frequency range can be attained also by periodic mechanical motion of macroscopical objects. Mechanical reorientation of the sample brings about change of direction of the strong magnetic field relative to e.g. internuclear space vector, giving us a powerful tool for manipulating the content of the spectral information.

Our state of the art probeheads permit rotation of the sample at speeds up to 70,000 Hz and acceleration up to 1,000,000 Hz/s for motion of sample around single axis (MAS). For simultaneous rotation about two axes (DOR) speeds 10,000/2,000 Hz have been reached.

The applicable temperature range for MAS sample spinning at present stretches from 10 K to 700 K, which is quite sufficient for optimum temperature studies of many important solid state phenomena from superconductivity to petrochemical zeolite catalysis.

General Manager: Andres Reinhold
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Core Facilities

Estonian Magnet Laboratory

Nuclear Magnetic Resonance Spectroscopy

Contact persons:
Ivo Heinmaa, PhD (ivo.heinmaa@kbfi.ee) – solid state NMR
Jüri Jarvet, PhD (Jyri.jarvet@kbfi.ee) – bioNMR
Tõnis Pehk, DSc (tonis.pehk@kbfi.ee) – HR NMR

The Laboratory has four research grade Bruker NMR spectrometers that cover a range of frequencies, nuclei and a diversity of applications.

AVANCE III 800MHz (18.8T magnetic field) spectrometer capable of performing advanced multidimensional experiments

Features:
- Triple resonance 1H/13C/15N PFG probehead
- Dual 1H/13C PFG probehead
- Solid state triple resonance 1H/13C/15N probehead
- QCI CryoProbe

AVANCE II 600MHz (14.1 T magnetic field) instrument capable of performing advanced multidimensional experiments

Features
- Triple resonance 1H/13C/15N PFG probehead
- Solid state probes 1-6 mm and DOR probehead

AMX 500 (11.7T magnetic field)

Features:
- Liquid 1H/13C probehead

CXP 360 spectrometer attached to 8.5T or 4.7T WB-magnets

Features:
- Solid state/low temperature MAS

The Lab has access to cryogenic liquids and compressed He gas for low temperature work.

Team

Jaan Past, PhD

Andres Reinhold, senior engineer

Tiit Tuherm, senior engineer

Terahertz spectroscopy and Low Temperature Physics

Contact persons:
Urmas Nagel, PhD (Urmas.Nagel@kbfi.ee) – THz, optics
Toomas Rõõm, PhD (Toomas.Room@kbfi.ee) – THz, optics
Raivo Stern, PhD (Raivo.Stern@kbfi.ee) – NMR, PPMS

THz spectrometer SPS-200

Features:
- 3 – 200 cm-1 with 0.3K bolometer
- Sample temperature 2-200K
- Magnetic field 0-12T
- Reflection (Faraday configuration) and transmission (Faraday and Voigt)

Bruker Fourier spectrometer Vertex 80v

Features:
- Two sample cryostats: cold finger 5-300K, exchange gas 2-300K
- Transmission and reflection
- 10 – 50 000 cm-1

Quantum Design PPMS

Features:
- 14T magnet
- Sample temperature 1.8-400K
- VSM magnetometer with oven (up to 1000K)
- Heat capacity measurement with He-probe (down to 300mK)
- Electrical and thermal transport measurements

Team

Min Ge, post-doc

Mukesh Chandra, Dimri, post-doc

Himani Khanduri, PhD student

Taaniel Uleksin, PhD student

Optics

Contact person:
Aleksander Rebane, PhD (sassrebane@gmail.com)

The Laboratory has a Mode-locked femtosecond Titanum Sapphire (Ti:S) laser Mira 900 pumped with 10 W frequency-doubled neodymium-doped vanadate (Nd:YVO4) laser Verdi V-10, both from Coherent, Inc.

The laser system generates 100 fs pulses at 76 MHz repetition rate and may be tuned in the spectral range 705 – 975 nm.

The Ti:S laser output average power is 0.5 – 1.5 W depending on the wavelength.

This laser system is ideally suited for two-photon absorption spectroscopy of organic and biological chromophores.

Team

Georg Liidja, DSc

Girsh Blumberg, PhD

Jüri Pahapill, MSc

Estonian Tier 2 Computing Centre and Grid & Cloud Computing

Contact persons:
Mario Kadastik, PhD (mario.kadastik@cern.ch) - Group leader
Ilja Livenson, MSc (ilja.livenson@kbfi.ee) - Support and R&D

The computing centre has developed from the need of participation in the Large Hadron Collider (LHC) Compact Muon Solenid (CMS) experiment where experimental data analysis requires using a distributed computing model. Our computing centre is Estonian Tier 2 centre for CERN Worldwide LHC Computing Grid facility. Over the years the centre has grown to facilitate not only CMS analysis, but also to support dark matter and cosmology calculations as well as various other computational genres. We are at the forefront of distributed computing resource management with our participation in Grid projects since 2004 as well as recent frontline tests and usage of computing Cloud technologies.

The centre is marked on Estonian Science Roadmap and participates in building the nationwide infrastructure for scientific computing. It is one of three centres in the country featuring computational resources and large scale storage capacity in the years 2012-2015 and onwards.

Features in 2010
- more than 1 200 compute cores
- 280TB of data storage facilities
- switching fabric that guarantees reasonable data transfer rates to every compute core.
- Grid interfaces for remote job submissions
- Cloud instances for dynamic resource reservation
- Ca 100 kW of cooling capacity

Quantum Chemistry High Performance Computing Facility

Contact persons:
Endel Lippmaa, DSc (elippmaa@nicpb.ee) – quantum chemistry, quantum computing, high energy physics
Aleksander Trummal, PhD (aleksander.trummal@kbfi.ee) – quantum chemistry, HPC
Alar Rummel, MSc (alar.rummel@kbfi.ee) – quantum chemistry, catalysis

The hardware for high performance parallel computing features optimized combination of high SMP scalability and low latency/high bandwidth communication between SMP nodes to satisfy diverse requirements for both shared memory and MPI application performance associated with various quantum chemical and other codes:

DELL 96-core server

Features:
- Four PowerEdge R905 AMD 8435 SMP nodes
- Mellanox Infiband interconnect between SMP nodes
- Peak theoretical performance 1.6 TFLOPS
- Precision 3500 console workstation

SGI 24-CPU SMP server

Features:
- Three Origin R10000 SMP modules
- NUMALink interconnect between CPUs, nodes, and modules
- O2 console workstation

Supermicro 16-CPU server

Features:
- Eight X5DP8-G2 Intel Xeon 3.06GHz SMP nodes
- Myrinet2000 interconnect between SMP nodes

Major quantum chemistry software packages:
Accelrys Materials Studio Dmol3 server and Visualize
Gaussian and GaussView
MOPAC

QCHPCF provides dedicated secure platform for running professional quantum chemistry codes. The computers have no connection to Internet, GRID or Cloud, are completely virus-free and use only licensed professional software.

Cryo Unit

Contact person:
Enno Joon, PhD (enno.joon@kbfi.ee) – Low Temperature Physics, Solid State Physics, Superconductivity, Magnetism, Nanotechnology and Cryogenic Engineering

Cryo Unit as a part of NICPB is responsible for cryogenic services of superconductive magnets installed at the institute. The services involve filling the magnets with liquid nitrogen and liquid helium, compensating for everyday evaporation of the named liquids. For this purpose about 50-60 tons of commercial liquid nitrogen and around 6 000 litres of liquid helium are used. The annual production of the liquid He despite of the long exploitation time of the liquefier (28 years) is growing: 4245 l (2007), 5890 l (2008), 7700 l (2009), 6070 l (3/4 of 2010). This amount of liquid He covers the needs of PPMS, low temperature NMR, infrared optics and Raman spectroscopy research. We also provide liquid He for SC magnet at the Tallinn University of Technology. The evaporated He gas is recovered to gas bags and compressed to high pressure storage. Liquid nitrogen is also used for precooling He liquefier, He gas cleaning, biochemical research and keeping biological samples cold.

He liquefier CTi-1410 (1979)

Features: piston detander working with two piston compressors, 20 kW each

Productivity: 20 l liquid He per hour using pure gas and 15 lph using impure recovered gas, which is prepurified during the same procedure.

Cryo Unit provides the maintenance and repairing of cryo and vacuum apparatus and devices as well.

The team

Ain Toim, senior engineer

Andres Reinhold, senior engineer

Tõnu Tolk, senior engineer

Vambola Kivisaar, technician

Scientific Collections and Databases of NICPB

Scientific Collections

Contact person: Anne Kahru, PhD (anne.kahru@kbfi.ee)

The scientific collections of the NICPB were established in 1980 when the biological research was started. During 2004-2008 the development of the collections has been supported by the "National Programme on Scientific collections" in a project "Scientific collections in cell biology and toxicological research" (HLK04-4, PI Dr. A. Kahru). Currently, the NICPB collections consist of microbial cultures (bacterial and yeast strains and collection of plasmids), cell lines, venoms and environmental samples (soils, sediments, oil-shale industry solid wastes).

The database on scientific collections in the National Institute of Chemical Physics and Biophysics is available at http://kbfi-databases.eu/ecotox/. The scientific collections of NICPB are continuously upgraded.

The development of the microbial collection of NICPB has been focusing on construction of new recombinant heavy metal sensor microbes and knock-out mutants that allow studying mechanisms of toxic action of chemicals. The collection of environmental samples (about 600 samples) includes soils and sediments with various type of pollution (Zn, Cd, Pb, PAHs, phenols) and unique set of soils and solid wastes from Estonian oil-shale industry region. The environmental samples have been characterized both chemically and ecotoxicologically. The microbial strains and environmental samples are used in scientific research projects of NICPB (including MSc and PhD studies). More information on this collection can be obtained from Kaja Kasemets kaja.kasemets@kbfi.ee). The recombinant microbial strains constructed in NICPB have been and will be distributed free of charge to other research laboratories upon written and signed agreement (enquiries: Angela Ivask angela.ivask@kbfi.ee).

References

1. **Ivask A**, Rõlova T, **Kahru A**. A suite of recombinant luminescent bacterial strains for the quantification of bioavailable heavy metals and toxicity testing. BMC Biotechnology 2009, 9:41 (8 May 2009), doi:10.1186/1472-6750-9-41 http://www.biomedcentral.com/1472-6750/9/41/abstract
2. Leedjärv A, **Ivask A**, Virta M. The interplay of different transporters in the mediation of divalent heavy metal resistance in Pseudomonas putida KT2440. J. Bacteriology, 2008, 190 (8): 2680-2689
3. **Kahru A, Põllumaa L**. Environmental hazard pf the waste streams of the Estonian oil-shale industry: an ecotoxicological review - Oil Shale, 2006, 23 (1): 53-93

E-SovTox - An Online Database of the Main Publicly available Sources of Toxicity Data Concerning REACH-relevant Chemicals Published in the Russian Language

While FP6 project OSIRIS was prepared, our partners proposed to the consortium to compose a database of the main publicly available sources of toxicity data concerning REACH-relevant chemicals published in the Russian language. By evaluators, this was one of the novel aspects of OSIRIS. REACH is a new EU chemical policy (Registration, Evaluation, Authorisation and Restriction of Chemicals). The database contains information selected mainly from scientific journals published during the Soviet Union era and that are available as hard copies in Estonian libraries. Currently the E-SovTox database contains toxicity data selected from more than 500 papers covering more than 600 chemicals. The user is provided with the main toxicity information, as well as abstracts of these papers in Russian and in English (given as provided in the original publication). The search engine allows cross-searching of the database by the name or CAS

number of the compound and the author of the paper. The E-SovTox database can be used as a decision-support tool by researchers and regulators for the hazard assessment of chemical substances. The database is hosted by the Laboratory of Molecular Genetics (MGL), National Institute of Chemical Physics and Biophysics, Tallinn, Estonia. The MGL is in charge of data collection and editing, database maintenance and dissemination. The online E-SovTox database is designed for scientists and regulators to provide them with (eco)toxicological data from literature published in Russian informative for the hazard assessment of chemical substances.

The database was created by the late H.C. Dubourguier, M. Sihtmäe, I. Blinova and A. Kahru. Bibliographical assistance was provided by E. Saar and S. Mae. Database was programmed by N. Legrand (Protopro-websites OÜ, www. dynameeks.com)

Characterisation of the Database
- Name of the Database: E-SovTox;
- Web address: http://kbfi-databases.eu/;
- Cost: Free after registration;
- Year of availability of the demo-version: 2010;
- Hardware and software required: Any computer with Internet capabilities;
- Programming language: HTML/PHP/MySQL;

Workshop

Contact persons:
Andres Reinhold, senior engineer (reinhold@kbfi.ee)
Tiit Tuherm, senior engineer (tuherm@kbfi.ee)

The workshop has the following machine tools:
Lathe Weiler Matador, accuracy 0,005mm
Milling machine ALG-100, accuracy 0,005mm
CNC KERN HSPC 2522, accuracy 0.001mm

II EDUCATION AND CO-OPERATION

All research groups and Laboratories of the Institute actively collaborate with all main Estonian universities – University of Tartu, Tallinn University of Technology, Tallinn University of Life Sciences, – either via common curricula and co-supervision of PhD students or as external examiners of thesis works.

The facilities of the Institute are used for graduate and postgraduate training in the fields of biochemistry and –technology, environmental chemistry and chemical physics.

Thesis Works Defended by co-workers of NICPB

Thesis	2007	2008	2009	2010	Total
MSc	2	3	2	2	9
PhD	2	5	2	1	10
Total	**4**	**8**	**4**	**3**	**19**

In addition to the above universities, the Institute has joint research projects and/or publications with a number of domestic and international academic institutions like Clemson University and University of California Los Angeles, National Institutes of Health (USA), Liverpool John Moore University, Southampton University, Teesside University and Warwick University (UK), Bordeaux and Grenoble Universities, Francois Rabelais University (France), Institute of Biotechnology and Helsinki University (Finland), Innsbruck Medical University (Austria), Forschungszentrum Jülich (Germany), University of Ljubljana (Slovenia), University of Lund (Sweden), ETH Zürich and CERN (Switzerland), to name a few.

III EVALUATIONS

Evaluations of 2000-2001

Evaluation of the Laboratory of Chemical Physics was carried out on February 14, 2001 under the „Evaluation of Estonian Research in Physical, Inorganic and Analytical Chemistry“ by an international team consisting of Pekka Pyykkö (Chairman), Jorma Hölsä, Irene Montenegro and Jarl B. Rosenholm appointed by the Estonian Higher Education Accreditation Centre. The committee ranked the Laboratory as Excellent / Good.

The Laboratories of Bioenergetics and of Molecular Genetics were jointly evaluated in the fall of 2000 under the „Research Evaluation on Genetics, Physiology, Microbiology and Molecular Biology“.

Finally, the Laboratory of Bioorganic Chemistry was evaluated in January and February of 2001 under the „Evaluation of Estonian Research in Organic and Bioorganic Chemistry and Biochemistry“. The overall ranking for the Laboratory was satisfactory.

Evaluation of 2010

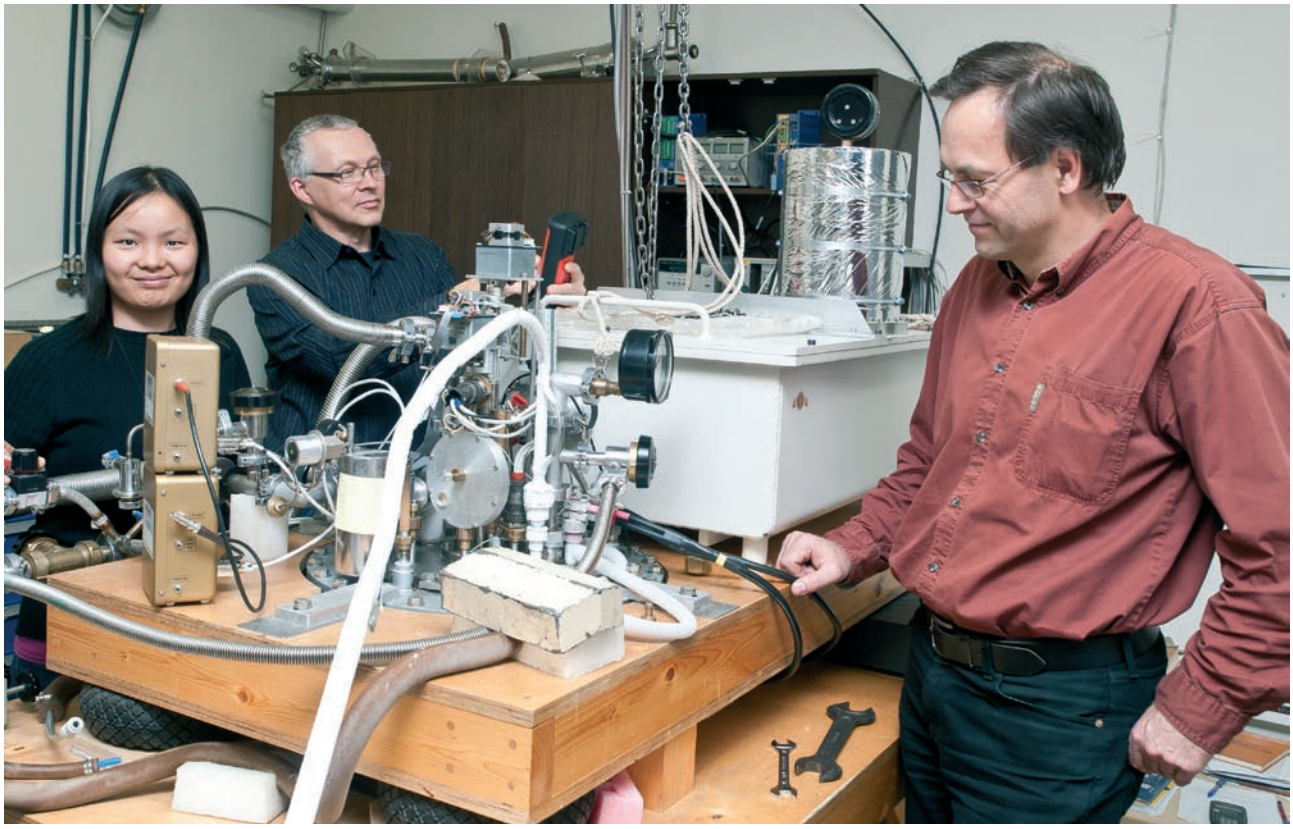
The most recent evaluation was carried out by the orders of the Estonian Minister of Education and Science by a 16-strong international team headed by Ronald Axtmann, Professor at the Sussex University (GB) in May, 2010. The team also included as the heads of subcommittees Professor Hans Brix (Aarhus University, DEN), Professor Kenneth Douglas (Manchester University, GB) and Professor Eric Gregoire (D'Artoise University, FRA).

The evaluation was carried out in three fields of scientific research: Biosciences and Environment, Health and Natural Sciences and Engineering. The process included assessments in three categories: 1) the volume and level of R&D activities in comparison to international criteria; 2) R&D infrastructure; 3) Qualification of researchers in comparison to international criteria.

The NCIPB was evaluated as „positive“ in all fields and by criteria and sub-criteria, with a final assessment as „positive“. The results of the evaluation were approved and confirmed by Minister's decree on July 6, 2010.

Senior Researcher Tuuli Käämbre (left) and PhD student Kersti Tepp measuring the oxygen consumption of biosamples.

EUREKA! Senior Researcher Kaja Kasemets (from left) and PhD students Olesja Bondarenko and Imbi Kurvet.



Post-doc Min Ge (from left) and Senior Researchers Urmas Nagel and Toomas Rõõm with a FIR spectrometer setup.

Post-doc Mukesh Chandra Dimri operating a PPMS.

Leading Researcher Jaan Past (front) and Senior Engineer Tiit Tuherm tuning a home-built MAS NMR probehead.

Senior Researcher Ivo Heinmaa with a home-built cryo-MAS NMR probehead.

Post-doc Andi Hektor is maintaining the high performance computing servers at the computing centre of the NICPB.

Senior Researcher Enno Joon in front of the helium liquefier in the Cryo unit.

IV ORGANISATION AND ADMINISTRATION

The organisation and administration of the NICPB – a legal person under public law - are governed by the "National Institute of Chemical Physics and Biophysics Act" of 1998 (Estonian text: https://www.riigiteataja.ee/ert/act.jsp?id=215551, English translation see: http://www.kbfi.ee/?id=27) and the Statute of the NICPB.

According to the Act, the directing bodies of NICPB are the Director and the Scientific Board.

Scientific Board

The Scientific Board is the collegiate decision-making body of NICPB which consists of 19 members. The Scientific Board includes the Director, Deputy Directors, Scientific Secretary and leading scientists of NICPB and from related fields.

The Scientific Board, among other activities, approves the main directions of the activities of NICPB, approves the Statutes of NICPB, approves the budget of NICPB and elects the Director of NICPB. The Board is headed by a Chairperson.

The sessions of the Scientific Board take place as necessary, but at least once in every three months. A meeting is called by the Chairman of the Scientific Board.

The Scientific Board on October 31, 2010

Member	Affiliation
Professor Jaak Aaviksoo, Chairman of the Board	Member of the Estonian Academy of Sciences, Minister of Defence
Jüri Jarvet, PhD, Deputy Chairman	NICPB
Professor Peeter Burk	Dean of the Faculty of Science and Technology, University of Tartu
Ivo Heinmaa, PhD	NICPB
Anne Kahru, PhD	NICPB
Marco Kirm, PhD	Director of the Institute of Physics, University of Tartu
Tuuli Käämbre, PhD	NICPB
Professor Ülo Niinemets	Estonian University of Life Sciences
Tõnis Pehk, DSc	NICPB
Martti Raidal, PhD	NICPB
Toomas Rõõm, PhD	NICPB
Valdur Saks, DSc	NICPB
Tiit Saluvere, PhD	NICPB, Deputy Director
Jüri Siigur, PhD	NICPB, Scientific Secretary
Raivo Stern, PhD	NICPB, Director
Erik Teinemaa, PhD	Estonian Environmental Research Centre
Professor Rein Vaikmäe	Institute of Geology, Tallinn University of Technology
Toomas Välimäe, PhD	NICPB, Deputy Director

Director

The Director takes care of the expedient management of research and development, represents NICPB in all legal acts, approves all internal regulations and rules of house, concludes employment contracts, etc. The Director is also in charge of preparing the draft budget and ensures the implementation of the budget.

The Director is elected by the Scientific Board for a five year period and he/she is accountable before the Scientific Board.

The Director of the NICPB since 2006 is Raivo Stern, PhD.

Deputy Directors

The Deputy Director on Administrative affairs is responsible for the Institute's administration and finances together with all administrative services and maintenance of the premises. Mr Tiit Saluvere, PhD. has served as Deputy Director since 1980.

The Deputy Director on Strategic Planning is responsible for the strategic development and financial planning including budgeting. Together with the Director they hold responsibility for the achievement of Institute's long-term goals. The Deputy Director is Toomas Välimäe, PhD.

The International Science Advisory Board

The International Science Advisory Board evaluates periodically the current research programmes of the NICPB and advises the Scientific Board to open new programmes and/or to terminate existing programmes. The Advisory Board also evaluates scientific and administrative capacities of the candidates to the posts of the Director and/or the heads of Laboratories and working groups.

The sessions of the Scientific Board take place as necessary and they are called by the Director. Members of the Science Advisory Board are:

Member	Affiliation
Professor Peter Littlewood, Chairman	Cavendish Laboratory, University of Cambridge (UK)
Professor Dmitri Basov	Department of Physics, University of California, San Diego (USA)
Professor Carlos Ibáñez	Laboratory of Molecular Neurobiology, Karolinska Institute (SWE)
Professor Robert Kaptein	Bijvoet Centre for Biomolecular Research, Utrecht University (The Netherlands)
Professor Tapio Niinikoski	CERN
Professor Mart Saarma	University of Helsinki (FIN)
Professor Hanna Tähti	FICAM, University of Tampere (IN)
Professor Marten Wikström	Institute of Biotechnology, University of Helsinki (FIN)

Structure

According to the Statute, the structure of NICPB includes scientific, administrative and economic units. Currently there are no other units except scientific ones.

The scientific units are laboratories of:

Chemical Physics (CP)

Head: Tõnis Pehk, DSc

tonis.pehk@kbfi.ee

Phone +372 6398 319

Bioorganic Chemistry (BOC)

Head: Jüri Siigur, PhD

juri.siigur@kbfi.ee

Phone +372 6398 360

Molecular Genetics (MG)

Head: Anne Kahru, PhD

anne.kahru@kbfi.ee

Phone +372 6398 373

Bioenergetics (BE)

Head: Professor Valdur Saks, DSc

vsaks@ujf-grenoble.fr

Phone +372 6398 383

The actual scientific research is carried out by informal research groups comprising of co-workers of different laboratories (see also the Organisation Chart on p 54).

V STATISTICS

Finances

Outline of the financing of science in Estonia

The financing of (public) scientific institutions consists of a number of financing instruments.

Targeted financing, which is used to fund the activities of research groups from research institutions, is the most important financing instrument in Estonian scientific research. State budgetary resources are allocated for this purpose through the budget of the Ministry of Education and Research (MER). Proposals regarding the targeted financing of research topics of R&D institutions are submitted by the Estonian Research Council acting as an advisory body to the Minister of Education and Research. Targeted financing is used to fund evaluated R&D institutions' research topics (both basic and applied research).

Baseline financing involves the financing of R&D institutions that have received positive evaluations with the aim of realizing strategic development goals, co-financing foreign and domestic projects and opening up new research directions. Baseline financing is intended to guarantee the stability of financing and increases the sense of security, initiative, and responsibility of research institutions in planning their R&D activities. Thus, baseline financing makes it possible for the institutions to focus more on their main activities, and thereby achieve better results. Baseline financing is provided from the state budget through the budget of the MER. Baseline financing is also a performance-based instrument, as 50% of the sum is divided between the recipients according to their respective share of publications in the Thomson Reuters Web of Science database.

Resources are provided from the state budget through the MER budget in order to support the **covering of infrastructure costs** incurred by R&D institutions operating as legal persons governed by public law or as establishments thereof.

Research grants are available to individuals as well as research groups who have to undergo a research project financing competition. Annual public grant competitions, funded from the state budget through the budget of the MER, are conducted by the Estonian Science Foundation.

The implementation of EU Structural Funds for supporting research and development activities is governed by the MER and takes place through the Archimedes Foundation's Implementing Agency of Structural Support. The total cost of the most important **measure - measure for modernizing research equipment and devices** (together with co-financing and value added tax) comes to 115 million EUR, of which over 86 million EUR is provided from the Structural Funds.

Table 1 Funding of the NICPB in 2007-2010

Source	2007		2008		2009		2010	
	EUR	%	EUR	%	EUR	%	EUR	%
National budget	1 425 556	38,5	1 649 636	52,3	1 582 917	72,5	1 823 517	56,9
External project funding	2 164 663	58,5	1 338 426	42,4	400 311	18,3	1 128 421	35,2
Other Revenue	108 650	2,9	168 464	5,3	198 970	9,1	252 375	7,9
GRAND TOTAL	3 698 869	100,0	3 156 526	100,0	2 182 197	100,0	3 204 312	100,0

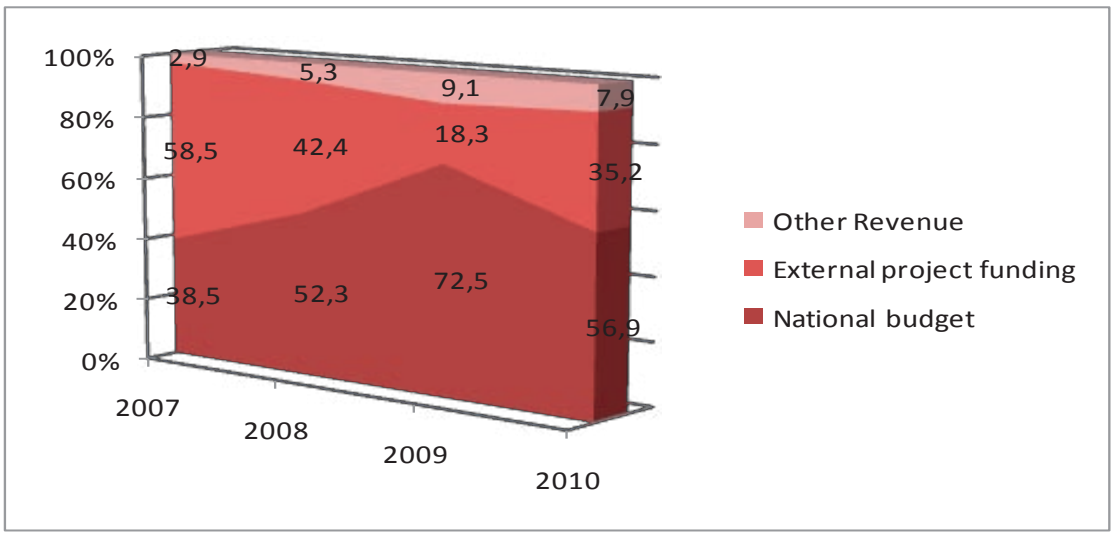


Table 2 Financing from National Budget 2007-2010

Source	2007		2008		2009		2010	
	EUR	%	EUR	%	EUR	%	EUR	%
Targeted financing (TF)	711 030	49,9	468 472	28,4	923 581	58,3	849 514	46,6
Basline financing	229 750	16,1	265 578	16,1	189 072	11,9	145 642	8,0
TF of Infrastructure	250 150	17,5	250 150	15,2	246 969	15,6	244 047	13,4
TF of equipment	0	0,0	0	0,0	0	0,0	372 391	20,4
TF of renovation		0,0	121 432	7,4	0	0,0		0,0
ESF grants	221 205	15,5	245 152	14,9	223 295	14,1	211 923	11,6
Othe rTF	13 421	0,9	11 248	0,7	0	0,0	0	0,0
Non-earmarked financing		0,0	287 602	17,4	0	0,0	0	0,0
National budget total	1 425 556	100,0	1 649 636	100,0	1 582 917	100,0	1 823 517	100,0

Table 3 External Project Funding 2007-2010

Source	2007		2008		2009		2010	
	EUR	%	EUR	%	EUR	%	EUR	%
Enterprise Estonia [1]	0	0,0	0	0,0	0	0,0	499 867	44,3
European Union [2]	1 742 862	80,5	873 110	65,2	0	0,0	0	0,0
R&D [3]	421 801	19,5	465 316	34,8	400 311	100,0	628 553	55,7
Total	2 164 663	100,0	1 338 426	100,0	400 311	100,0	1 128 421	100,0

[1] – Enterprise Estonia funding for purchase of scientific equipment

[2] – EU Structural Funds for purchase of scientific equipment and development of infrastructure

[3] – R&D grants from and contracts with various institutions

Personnel

Table 4 Personnel of NICPB (total number), November 1, 2010

Staff Category	Number	Percentage	% of women
Researchers incl graduate students	61	54,0	37,7
Laboratory technicians (undergraduate students)	26 (2)	23,0 (1.8)	43.5 (0.0)
Administration	11	9,7	54,5
Technical staff (ancillary services)	15	13,3	60,0
Total	113	100,0	44,2

Table 5 Personnel of NICPB (person years), November 1, 2010

Staff Category	Person Years	Percentage
Researchers incl graduate students	52,0	54,6
Laboratory technicians (undergraduate students)	21,2 (1,5)	22,2 (1,6)
Administration	10,3	10,7
Technical staff (ancillary services)	11,9	12,5
Total	95,3	100,0

Table 6 Proportions of staff categories (%) in person years in 2007-2010

Staff Category	2007	2008	2009	2010
Researchers incl graduate students	60,3	56,3	56,8	54,6
Laboratory technicians	14,9	20,5	21,3	22,2
Administration	11,2	9,5	10,6	10,7
Technical staff (ancillary services)	13,6	13,7	11,3	12,5
Total	100,0	100,0	100,0	100,0
Total Person Years	96,3	97,4	96,5	95,3
Total employees	118	120	118	113

Table 7 Proportion of PhDs and foreign researchers among researchers (Person Years)

Staff Category	2007	2008	2009	2010
Number of Researchers	58	55	55	52
Number of PhDs	39	40	43	43
Proportion of PhDs	66,2%	73,6%	79,0%	82,2%
Number of foreign researchers (PY)	3	7	6	6
Proportion of foreign researchers	4,3%	11,9%	10,0%	11,1%

Staff

The Staff of the Institute in 2010, including

Leading Researchers

Kahru Anne
Kirso Uuve
Past Jaan
Pehk Tõnis
Saks Valdur[1]
Siigur Jüri
Dubourguier Henri-Charles[2]

Senior Researchers

Aaspõllu Anu[1]
Anman Tiia
Blinova Irina
Blumberg Girsh[1]
Heinmaa Ivo
Irha Natalja
Ivask Angela[6]
Jarvet Jüri
Joon Enno
Kajiyama Yuji
Kasemets Kaja
Kesvatera Tõnu
Käämbre Tuuli[1]
Liidja Georg[1]
Lippmaa Endel
Maremäe Ello-Ragne
Nagel Urmas
Patriarca, Marco
Pihlak Arno-Toomas[1]
Raidal Martti
Põllumaa Lee[2]
Rebane Aleksander[1]
Reinik Janek
Rõõm Toomas
Samel Mari
Samoson Ago[2]
Sarv Priit[1]
Siigur Ene
Sikk Peeter[1]
Strumia Alessandro[1, 2]
Subbi Juhan
Ševtšuk Igor
Tanner Risto
Teinemaa Erik[1]
Tiivel Toomas[2]
Trummal Aleksander
Trummal Katrin

Researchers

Adamson Jasper[2]
Anupõld Tiit[2]
Aruoja Villem[1]
Chandra Mukesh[3]
Ge Min[3]
Heinsalu Els
Hektor Andi[4]
Hüvonen Dan[1, 5]
Joa Kelly
Kadastik Mario
Kannike Kristjan[7]
Kriisa Annika[2]
Kurvet Imbi[1]
Lassi Margit[1]
Mortimer Monika[1]
Müntel, Mait
Nutt Anu[2]
Racioppi Antonio[3]
Rebane Liis
Rummel Alar
Sihtmäe Mariliis
Timohhina Natalja
Tõnismägi Külli
Tšekulajev Vladimir
Vija Heiki

Laboratory Technicians

Aguraiuja Arvo
Aguraiuja Reet
Bondarenko Olesja
Heinlaan Margit
Jefimova (Panova) Jekaterina
Kanarbik Liina[1,2]
Keskrand Kalle[2]
Khanduri Himani[2]
Kiirend Ene[1]

Kivisaar Vambola
Kooskora Helgi[1]
Laas Pilvi
Livenson Ilja[2]
Pahapill Jüri
Peitel Maire[1]
Putting Valter[2]
Põder Reio[1]
Reinhold Andres
Saaremäe Merle[2]
Sihver Arvo[1]
Simm Aia[2]
Tepp Kersti
Tiko Andres
Toim Ain
Tolk, Tõnu
Tuherm Tiit
Uleksin Taaniel
Varikmaa /Karu Minna
Vija Sirje

Graduate (Doctorate) Students

Aruoja Villem[1]
Bondarenko Olesja[1]
Heinlaan Margit[1]
Khanduri Himani[2]
Kurvet Imbi[1]
Käkinen Aleksandr[1]
Livenson Ilja
Mortimer Monika[1]
Panova Jekaterina
Põder Reio[1]
Rebane Liis
Sihtmäe Mariliis
Tepp Kersti
Tiko Andres[2]
Timohhina Natalja
Varikmaa / Karu Minna

Undergraduate Students

Filippova Irina
Juganson Katre
Kanarbik Liina
Uleksin Taaniel

Administration

Laigar Aili[1]
Raba Mari
Saar Ene
Saluvere Tiit
Stern Raivo
Suursalu Urmas
Sülluste Kristian
Till Mare
Valdmann Ene
Vallner Tatjana
Välimäe Toomas[2]

Technical Staff

Aldur Niina
Bahurinskaja Svetlana[1]
Boitsova Jevgenia[1]
Jesaar Rein
Keemann Elle[1]
Kristal Silvia[1]
Kristal Valdur
Lepp Rein
Lillemägi Adolf
Nurme Reet[1]
Ploom Leili
Zahharenkova Jelena
Tammist Aino[1]
Tomson Jüri
Torn Toivo[1]

1 – worked part-time
2 – worked part of the year
3 – post-doc in NICPB
4 – post-doc in CERN
5 – post-doc in ETH, Zürich
6 – post-doc in UCLA
7 – post-doc in University of Pisa

VI PUBLICATIONS

Original articles

1. Adamson J, **Irha N, Adamson K**, Steinnes E, **Kirso U.** Effect of oil shale ash application on leaching behavior of arable soils: an experimental study. Oil Shale, 2010, 27 (3): 250-257
2. Antchev G, **Lippmaa E, Rummel A, Trummal A** et al. The TOTEM detector at LHC. Conference Information: 11th Pisa Meeting on Advanced Detectors, MAY 24-30, 2009 Isola Elba, Italy, Nuclear Instruments & Methods In Physics Research Section A-Accelerators Spectrometers Detectors And Associated Equipment, 2010, 617 (1-3): 62-66
3. **Blinova I, Ivask A**, Heinlaan M, **Mortimer M, Kahru A**. Ecotoxicity of nanoparticles of CuO and ZnO in natural water. Environmental Pollution, 2010, 158 (1): 41-47
4. **Bondarenko O**, Rahman PKSM, Rahman TJ, **Kahru A, Ivask A.** Effects of Rhamnolipids from *Pseudomonas aeruginosa* DS10-129 on Luminescent Bacteria: Toxicity and Modulation of Cadmium Bioavailability. Microbial Ecology, 2010, 59 (3): 588-600
5. Christjanson P, **Pehk T,** Paju J. Structure and curing mechanism of resol phenolformaldehyde prepolymer resins. Proc. of the Est. Acad. of Sci, 2010, 59 (3): 225-232
6. Davis LJM, **Heinmaa I**, Goward GR. Study of Lithium Dynamics in Monoclinic Li3Fe2(PO4)(3) using Li-6 VT and 2D Exchange MAS NMR Spectroscopy. Chemistry of Materials, 2010, 22 (3): 769-775
7. **Dimri MC,** Kashyap SC, Dube DC. High frequency behaviour of low temperature sintered polycrystalline NiCuZn ferrites and their composite thick films. Physica Status Solidi A - Applications and Materials Science, 2010, 207 (29): 396-400
8. Fucito F, Lionetto A, Mammarella A, **Racioppi A**. Stuckelino dark matter in anomalous U(1)' models. European Physical Journal C, 2010, 69 (3-4): 455-465
9. Giudice GF, **Raidal M**, Strumia A. Lorentz violation from the Higgs portal. Physics Letters B, 2010, 690 (3): 272-279
10. Guerrero K, Monge C, Bruckner A, Puurand Ü, Kadaja L, **Käämbre T**, Seppet E, **Saks V**. Study of possible interactions of tubulin, microtubular network, and STOP protein with mitochondria in muscle cells. Molecular And Cellular Biochemistry, 2010, 337 (1-2): 239-249
11. Guzun R, **Saks V.** Application of the Principles of Systems Biology and Wiener's Cybernetics for Analysis of Regulation of Energy Fluxes in Muscle Cells *in Vivo*. International Journal Of Molecular Sciences, 2010, 11 (3): 982-1019
12. **Heinmaa I, Joon T, Kooskora H, Pahapill J, Subbi J.** Local structure and oxygen ion dynamics in La doped ceria: O-17 NMR study. Solid State Ionics, 2010, 181 (29-30): 1309-1315
13. **Heinsalu E, Patriarca M**, Marchesoni F. Stochastic resonance in a surface dipole. Chemical Physics, 2010, 375 (2-3): 410-415
14. Hütsi G, **Hektor A, Raidal M.** Implications of the Fermi-LAT diffuse gamma-ray measurements on annihilating or decaying dark matter. Journal of Cosmology And Astroparticle Physics, 2010, 7: 008
15. **Ivask A, Bondarenko O**, Jepihhina N, **Kahru A.** Profiling of the reactive oxygen species-related ecotoxicity of CuO, ZnO, TiO2, silver and fullerene nanoparticles using a set of recombinant luminescent *Escherichia coli* strains: differentiating the impact of particles and solubilised metals. Analytical And Bioanalytical Chemistry, 2010, 398 (2): 701-716
16. **Joon E**. High T-c superconductors – Soliton lattices? Conference Information: 6th International Conference on Vortex Matter in Nanostructured Superconductors, Sep 17-24, 2009 Rhodes, Greece, Physica C-Super-Conductivity And Its Applications, 2010, 470 (19): 926-928
17. Järvik O, Kamenev S, **Kasemets K**, Kamenev I. Effect of Ozone on Viability of Activated Sludge Detected by Oxygen Uptake Rate (OUR) and Adenosine-5'-triphosphate (ATP) Measurement. Ozone-Science & Engineering, 2010, 32 (6): 408-416
18. **Kadastik M, Kannike K, Racioppi A, Raidal M.** Electroweak Symmetry Breaking from the Soft Portal into Dark Matter and Prediction for Direct Detection. Physical Review Letters, 2010, 104 (20): 201301

19. **Kadastik M, Kannike K, Racioppi A, Raidal M**. Implications of Dark Matter direct detection results on LHC physics. Physics Letters B, 2010, 694 (3): 242-245
20. **Kadastik M, Kannike K, Raidal M**. Matter parity as the origin of scalar dark matter. Physical Review D, 2010, 81 (1): 015002
21. **Kadastik M, Raidal M**, Strumia A. Enhanced anti-deuteron Dark Matter signal and the implications of PAMELA. Physics Letters B, 2010, 683 (4-5: 248-254
22. **Kahru A, Dubourguier HC**. From ecotoxicology to nanoecotoxicology. Conference Information: Symposium on Potential Hazard of Nanoparticles, OCT 05-08, 2008 Rhodes, Greece, Toxicology, 2010, 269 (2-3), SI: 105-119
23. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** et al. Transverse-momentum and pseudorapidity distributions of charged hadrons in pp collisions at root s=0.9 and 2.36 TeV. Journal Of High Energy Physics, 2010, 2: 041
24. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** et al. First Measurement of Bose-Einstein Correlations in Proton-Proton Collisions at root s=0.9 and 2.36 TeV at the LHC. Physical Review Letters, 2010, 3: 032001
25. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** et al. Transverse-Momentum and Pseudorapidity Distributions of Charged Hadrons in pp Collisions at root s=7 TeV. Physical Review Letters, 2010, 105, (2): 022002
26. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** et al. Measurement of the charge ratio of atmospheric muons with the CMS detector. Physics Letters B, 2010, 692 (2): 83-104
27. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of CMS muon reconstruction in cosmic-ray events. Journal of Instrumentation, 2010, 5: T03022
28. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Precise mapping of the magnetic field in the CMS barrel yoke using cosmic rays. Journal of Instrumentation, 2010,: 5: T03021
29. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Alignment of the CMS muon system with cosmic-ray and beam-halo muons. Journal of Instrumentation, 2010, 5: T03020
30. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Aligning the CMS muon chambers with the muon alignment system during an extended cosmic ray run. Journal of Instrumentation, 2010, 5: T03019
31. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of the CMS cathode strip chambers with cosmic rays. Journal of Instrumentation, 2010, 5: T03018
32. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance study of the CMS barrel resistive plate chambers with cosmic rays. Journal of Instrumentation, 2010, 5: T03017
33. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of the CMS drift tube chambers with cosmic rays. Journal of Instrumentation, 2010, 5: T03015
34. Khachatryan V, Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L et al. Identification and filtering of uncharacteristic noise in the CMS hadron calorimeter. Journal of Instrumentation, 2010, 5: T03014
35. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of CMS hadron calorimeter timing and synchronization using test beam, cosmic ray, and LHC beam data. Journal of Instrumentation, 2010, 5: T03013
36. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of the CMS hadron calorimeter with cosmic ray muons and LHC beam data. Journal of Instrumentation, 2010, 5: T03012
37. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Time reconstruction and performance of the CMS electromagnetic calorimeter. Journal of Instrumentation, 2010, 5: T03011
38. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Measurement of the muon stopping power in lead tungstate. Journal Of Instrumentation, 2010, 5: P03007
39. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance and operation of the CMS electromagnetic calorimeter. Journal of Instrumentation, 2010, 5: T03010

40. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Alignment of the CMS silicon tracker during commissioning with cosmic rays. Journal of Instrumentation, 2010, 5: T03009
41. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Commissioning and performance of the CMS silicon strip tracker with cosmic ray muons. Journal of Instrumentation, 2010, 5: T03008
42. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Commissioning of the CMS High-Level Trigger with cosmic rays. Journal of Instrumentation, 2010, 5: T03005
43. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Fine synchronization of the CMS muon drift-tube local trigger using cosmic rays. Journal of Instrumentation, 2010, 5: T03004
44. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of the CMS drift-tube chamber local trigger with cosmic rays. Journal of Instrumentation, 2010, 5: T03003
45. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane L** *et al.* Performance of the CMS Level-1 trigger during commissioning with cosmic ray muons and LHC beams. Journal of Instrumentation, 2010, 5: T03002
46. Khachatryan V, **Hektor A, Kadastik M, Kannike K, Müntel M, Raidal M, Rebane** L *et al.* Commissioning of the CMS experiment and the cosmic run at four tesla. Journal of Instrumentation, 2010, 5: T03001
47. Khachatryan V, **Hektor A, Kadastik M, Müntel M, Raidal M, Rebane L** *et al.* Observation of long-range, near-side angular correlations in proton-proton collisions at the LHC. Journal of High Energy Physics, 2010, 9: 091
48. Khachatryan V, **Hektor A, Kadastik M, Müntel M, Raidal M, Rebane L** *et al.* Search for Dijet Resonances in 7 TeV pp Collisions at CMS. Physical Review Letters, 2010, 105 (21): 211801
49. Kim KY, Shelton AH, Drobizhev M, Makarov N, **Rebane A**, Schanze KS. Optimizing Simultaneous Two-Photon Absorption and Transient Triplet-Triplet Absorption in Platinum Acetylide Chromophores. Journal Of Physical Chemistry A, 2010, 114 (26): 7003-7013
50. Kriis K, Ausmees K, **Pehk T**, Lopp M, Kanger T. A Novel Diastereoselective Multicomponent Cascade Reaction. Organic Letters, 2010, 12 (10): 2230-2233
51. Lauri K, **Tanner R**, Jerotskaja J, Luman M, Fridolin I. HPLC Study Of Uremic Fluids Related To Optical Dialysis Adequacy Monitoring. International Journal Of Artificial Organs, 2010, 33 (2): 96-104
52. Lobo RPSM, Dai YM, **Nagel U, Rõõm T**, Carbotte JP, Timusk T, Forget A, Colson D. Optical signature of subgap absorption in the superconducting state of Ba(Fe1-xCox)(2)As-2. Physical Review B, 2010, 82 (10): 100506
53. Lionetto A, **Racioppi A**. Gaugino radiative decay in an anomalous U(1)' model. Nuclear Physics B, 2010, 831, (1-2): 329-343
54. Lippur K, Elmers C, Kailas T, Müürisepp AM, **Pehk T**, Kanger T, Lopp M. Synthesis of 5,5'-Disubstituted Bimorpholines. Synthetic Communications, 2010, 40 (2): 266-281
55. **Mortimer M, Kasemets K, Kahru A**. Toxicity of ZnO and CuO nanoparticles to ciliated protozoa *Tetrahymena thermophila*. Conference Information: Symposium on Potential Hazard of Nanoparticles, Oct 05-08, 2008 Rhodes, Greece, Toxicology, 2010, 269, (2-3) SI: 182-189
56. Paju A, Pari M, Selyutina A, Zusinaite E, Merits A, **Pehk T**, Siirde K, Müürisepp AM, Kailas T, Lopp M. Synthesis of Novel Acyclic Nucleoside Analogues with Anti-Retroviral Activity. Nucleosides Nucleotides & Nucleic Acids, 2010, 29, (9): 707-720
57. **Patriarca M, Heinsalu E**, Chakraborti A. Basic kinetic wealth-exchange models: common features and open problems. European Physical Journal B, 2010, 73 (1): 145-153
58. Pochard I, Labbez C, Nonat A, **Vija H,** Jonsson B. The effect of polycations on early cement paste. Cement And Concrete Research, 2010, 40 (10): 1488-1494
59. **Rebane A**, Drobizhev MA, Makarov NS, Beuerman E, Nacke C, **Pahapill J.** Modeling non-Lorentzian two-photon absorption line shape in dipolar chromophores. Journal Of Luminescence, 2010, 130 (6): 1055-1059
60. **Rebane A**, Drobizhev M, Makarov NS et al. New all-optical method for measuring molecular permanent dipole moment difference using two-photon absorption spectroscopy. Conference Information:

10th International Meeting on Hole Burning, Single Molecule and Related Spectroscopies, JUN 22-27, 2009 Palm Cove, Australia, Journal Of Luminescence, 2010, 130 (9) SI: 1619-1623

61. **Reinik J, Heinmaa I**, Mikkola JP, Kordas K, **Kirso U**. Synthesis Of Calcium-Alumino-Silicate Hydrates From Oil Shale Ash In Different Alkaline Media. Oil Shale, 2010, 27 (1): 47-57
62. Saks V, Guzun R, **Timohhina N, Tepp K, Varikmaa M**, Monge C, Beraud N, **Käämbre T**, Kuznetsov A, Kadaja L, Eimre M, Seppet E. Structure-function relationships in feedback regulation of energy fluxes *in vivo* in health and disease: Mitochondrial Interactosome. Conference Information: 16th European Bioenergetics Conference, JUL 17-22, 2010 Warsaw, Poland, Biochimica Et Biophysica Acta-Bioenergetics, 2010, 1797 (6-7): 678-697
63. Sepp M, Vendelin M, **Vija H**, Birkedal R. ADP Compartmentation Analysis Reveals Coupling between Pyruvate Kinase and ATPases in Heart Muscle. Biophysical Journal, 2010, 98 (12): 2785-2793
64. **Sihtmäe M, Blinova I, Aruoja V, Dubourguier HC**, Legrand N, **Kahru A**. E-SovTox: An Online Database of the Main Publicly-available Sources of Toxicity Data Concerning REACH-relevant Chemicals Published in the Russian Language. Atla-Alternatives To Laboratory Animals, 2010, 38 (4): 297-301
65. **Sihtmäe M, Mortimer M, Kahru A, Blinova I**. Toxicity of five anilines to crustaceans, protozoa and bacteria. Journal of the Serbian Chemical Society, 2010, 75 (9): 1291-1302
66. **Siigur J, Vija H, Samel M, Tõnismägi K, Trummal K, Aaspõllu A, Subbi J**, Ronnholm G, Kalkkinen N, **Siigur E**. Separation and analysis of peptides and proteins from *Vipera lebetina* snake venom. Conference Information: 5th International Conference of the Nordic-Separation-Science-Society, AUG 26-29, 2009 Tallinn Univ Technol, Tallinn, Estonia. Source: 5th Symposium By Nordic Separation Science Society (NOSSS 2009), Book Series: Procedia Chemistry, 2010, 2 (1): 109-115
67. Siimer K, Kaljuvee T, **Pehk T**, Lasn I. Thermal behaviour of melamine-modified urea-formaldehyde resins. Conference Information: 9th Mediterranean Conference on Calorimetry and Thermal Analysis, JUN 15-18, 2009 Marseille, France, Journal Of Thermal Analysis And Calorimetry, 2010, 99 (3): 755-762
68. Tillo SE, Hughes TE, Makarov NS, **Rebane A**, Drobizhev M. A new approach to dual-color two-photon microscopy with fluorescent proteins. BMC Biotechnology, 2010, 10: 6
69. Tuvikene R, Truus K, Robal M, Volobujeva O, Mellikov E, **Pehk T**, Kollist A, Kailas T, Vaher M. The extraction, structure, and gelling properties of hybrid galactan from the red alga *Furcellaria lumbricalis* (Baltic Sea, Estonia). Journal Of Applied Phycology, 2010, 22 (1): 51-63
70. **Aruoja V, Dubourguier HC, Kasemets K, Kahru A**. Toxicity of nanoplarticles of CuO, ZnO and TiO2 to microalgae *Pseudokirchneriella subcapitata*. Science Of The Total Environment, 2009, 407 (4): 1461-1468
71. Bagliesi G, Bauerdick L, Belforte S, **Kadastik M**, et al. The CMS Data Transfer Test Environment in Preparation for LHC Data Taking. Conference Information: IEEE Nuclear Science Symposium/Medical Imaging Conference, OCT 19-25, 2008 Dresden, Germany, 2008 IEEE Nuclear Science Symposium And Medical Imaging Conference (2008 NSS/MIC), VOLS 1-9 Book Series: IEEE Nuclear Science Symposium - Conference Record, 2009: 2750-2757
72. Beraud N, Pelloux S, Usson Y, Kuznetsov AV, Ronot X, **Saks V**. Mitochondrial dynamics in heart cells: Very low amplitude high frequency fluctuations in adult cardiomyocytes and flow motion in non beating Hl-1 cells. Journal Of Bioenergetics And Biomembranes, 2009, 41 (2): 195-214
73. Chakraborti A, **Patriarca M**. Variational Principle for the Pareto Power Law. Physical Review Letters, 2009, 103 (22): 228701
74. Cirelli M, **Kadastik M, Raidal M**, Strumia A. Model-independent implications of the e(+/-), (p)overbar cosmic ray spectra on properties of Dark Matter. Nuclear Physics B, 2009, 813 (1-2): 1-21
75. **Dimri MC, Stern R,** Kashyap SC, Bhatti KP, Dube DC. Magnetic and dielectric properties of pure and doped barium hexaferrite nanoparticles at microwave frequencies. Physica Status Solidi A-Applications And Materials Science, 2009, 206 (2): 270-275
76. Drobizhev M, Tillo S, Makarov NS, Hughes TE, **Rebane A**. Absolute Two-Photon Absorption Spectra and Two-Photon Brightness of Orange and Red Fluorescent Proteins. Journal Of Physical Chemistry B, 2009, 113 (4): 855-859
77. Drobizhev M, Tillo S, Makarov NS, Hughes TE, **Rebane A**. Color Hues in Red Fluorescent Proteins Are Due to Internal Quadratic Stark Effect. Journal Of Physical Chemistry B, 2009, 113 (39): 12860-12864

78. Ellis J, Lola S, **Raidal M**. Supersymmetric grand unification and lepton universality in K -> l nu decays. Nuclear Physics B, 2009, 812 (1-2): 128-143
79. Guzun R, **Timohhina N, Tepp K**, Monge C, **Käämbre T, Sikk P**, Kuznetsov AV, Pison C, **Saks V**. Regulation of respiration controlled by mitochondrial creatine kinase in permeabilized cardiac cells *in situ.* Importance of system level properties. Biochimica Et Biophysica Acta-Bioenergetics, 2009, 1787 (9): 1089-1105
80. **Heinsalu E, Patriarca M**, Goychuk I, Haenggi P. Fractional Fokker-Planck subdiffusion in alternating force fields. Physical Review E, 2009, 79 (4): 041137 Part: Part 1
81. **Heinsalu E, Patriarca M**, Marchesoni F. Stochastic resonance in bistable confining potentials. European Physical Journal B, 2009, 69 (1): 19-22
82. Homes CC, Dordevic SV, Gozar A, Gozar A, **Blumberg G, Rõõm T, Hüvonen D, Nagel U**, LaForge AD, Basov DN, Kageyama H. Infrared spectra of the lowdimensional quantum magnet SrCu2(BO3)(2): Measurements and ab initio calculations. Physical Review B, 2009, 79 (12): 125101
83. Hung I, Howes AP, Parkinson BG, **Anupõld T, Samoson A**, Brown SP, Harrison PF, Holland D, Dupree R. Determination of the bond-angle distribution in vitreous B2O3 by B-11 double rotation (DOR) NMR spectroscopy. Journal Of Solid State Chemistry, 2009, 182 (9): 2402-2408
84. Hung I, Wong A, Howes AP, **Anupõd T, Samoson A**, Smith ME, Holland D, Brown SP, Dupree R. Separation of isotropic chemical and second-order quadrupolar shifts by multiple-quantum double rotation NMR. Journal Of Magnetic Resonance, 2009, 197 (2): 229-236
85. Hütsi G, Hektor A, **Raidal M**. Constraints on leptonically annihilating dark matter from reionization and extragalactic gamma background. Astronomy & Astrophysics, 2009, 505 (3): 999-1005
86. **Hüvonen D, Nagel U, Rõõm T**, Choi Y J, Zhang CL, Park S, Cheong SW. Magnetic excitations and optical transitions in the multiferroic spin-1/2 system LiCu2O2. Physical Review B, 2009, 80 (10): 100402
87. **Irha N**, Steinnes E, **Kirso U**, Petersell V. Mobility of Cd, Pb, Cu, and Cr in some Estonian soil types. Estonian Journal Of Earth Sciences, 2009, 58 (3): 209-214
88. **Ivask A**, Rõlova T, **Kahru A**. A suite of recombinant luminescent bacterial strains for the quantification of bioavailable heavy metals and toxicity testing. BMC Biotechnology, 2009, 9: 41
89. **Joa K, Panova E, Irha N, Teinemaa E**, Lintelmann J, **Kirso U**. Determination Of Polycyclic Aromatic Hydrocarbons (Pahs) In Oil Shale Processing Wastes: Current Practice And New Trends. Oil Shale, 2009, 26 (1): 59-72
90. Jõgi A, Paju A, **Pehk T**, Kailas T, Müürisepp AM, Lopp M. Synthesis of 4'-aryl-2',3'-dideoxynucleoside analogues. Tetrahedron, 2009, 65 (15): 2959-2965
91. **Kadastik M, Kannike K, Raidal M**. Dark matter as the signal of grand unification. Physical Review D, 2009, 80 (8): 085020
92. **Kajiyama Y**, Khalil S, **Raidal M**. Electron EDM and soft leptogenesis in supersymmetric B-L extension of the Standard Model. Nuclear Physics B, 2009, 820 (1-2): 75-88
93. **Kasemets K, Ivask A, Dubourguier HC, Kahru A**. Toxicity of nanoparticles of ZnO, CuO and TiO2 to yeast *Saccharomyces cerevisiae*. Toxicology In Vitro, 2009, 23 (6): 1116-1122
94. Kuimova MK, Collins HA, Balaz M, Dahlstedt E, Levitt JA, Sergent N, Suhling K, Drobizhev M, Makarov NS, **Rebane A**, Anderson HL, Phillips D. Photophysical properties and intracellular imaging of water-soluble porphyrin dimers for two-photon excited photodynamic therapy. Organic & Biomolecular Chemistry, 2009, 7 (5): 889-896
95. Kuznetsov AV, Hermann M, **Saks V**, et al. The cell-type specificity of mitochondrial dynamics. International Journal Of Biochemistry & Cell Biology, 2009, 41 (10), SI: 1928-1939
96. **Lippmaa E, Maremäe E, Pihlak AT, Aguraiuja R**. Estonian Graptolitic Argillites – Ancient Ores Or Future Fuels? Oil Shale, 2009, 26 (4), Pages: 530-539
97. Mamone S, **Ge M, Hüvonen D, Nagel U**, Danquigny A, Cuda F, Grossel MC, Murata Y, Komatsu K, Levitt MH, **Rõõm T**, Carravetta M. Rotor in a cage: Infrared spectroscopy of an endohedral hydrogenfullerene complex. Journal Of Chemical Physics,2009, 130 (8): 081103
98. Mialitsin A, Kim JS, Kremer RK, **Blumberg G**. Raman scattering from the CaC6 superconductor in the presence of disorder. Physical Review B, 2009, 79 (6): 064503
99. Monge C, Beraud N, **Tepp K**, Pelloux S, Chahboun S, **Käämbre T**, Kadaja L, Roosimaa M, Piirsoo A, Tourneur Y, Kuznetsov AV, **Saks V**, Seppet E. Comparative analysis of the bioenergetics of adult cardiomyocytes and nonbeating HL-1 cells: respiratory chain activities, glycolytic enzyme profiles, and

metabolic fluxes. Conference Information: NATO Advanced Research Workshop on Translational Knowledge for Heart Health, MAY 12-16, 2008 Istanbul, Turkey, Canadian Journal Of Physiology And Pharmacology, 2009, 87 (4): 318-326
100. Orru H, **Teinemaa E**, Lai T, et al. Health impact assessment of particulate pollution in Tallinn using fine spatial resolution and modeling techniques. Environmental Health, 2009, 8: 7
101. Paalme V, **Trummal K, Samel M, Tõnismägi K**, Järvekülg L, **Vija H, Subbi J, Siigur J, Siigur E**. Nerve growth factor from *Vipera lebetina* venom. Toxicon, 2009, 54 (3): 329-336
102. Paju J, **Pehk T**, Christjanson P. Structure of phenol-formaldehyde polycondensates. Conference Information: Baltic Polymer Symposium 2008, May 13-16, 2008 Otepää, Estonia, Proceedings Of The Estonian Academy Of Sciences, 2009, 58 (1): 45-52
103. **Patriarca M, Heinsalu E**. Influence of geography on language competition. Physica A - Statistical Mechanics And Its Applications, 2009, 388 (2-3): 174-186
104. Roots O, Roose A, Eerme K, **Teinemaa E**. Developing long-term monitoring of ozone in Estonia: the mandate of the Montreal Protocol. International Journal Of Remote Sensing, 2009, 30 (15-16): 4181-4194
105. **Saks V**, Monge C, Guzun R. Philosophical Basis and Some Historical Aspects of Systems Biology: From Hegel to Noble - Applications for Bioenergetic Research. International Journal Of Molecular Sciences, 2009, 10 (3): 1161-1192
106. Schneider D, Toufar H, **Samoson A**, Freude D. O-17 DOR and other solidstate NMR studies concerning the basic properties of zeolites LSX. Solid State Nuclear Magnetic Resonance, 2009, 35 (2): 87-92
107. **Sihtmäe M, Dubourguier HC, Kahru A.** Toxicological information on chemicals published in the Russian language: Contribution to REACH and 3Rs. Toxicology, 2009, 262 (1): 27-37
108. Siimer K, Christjanson P, Kaljuvee T, **Pehk T**, Saks I. Thermal behaviour of hydroxymethyl compounds as models for adhesive resins. Journal Of Thermal Analysis And Calorimetry, 2009, 97 (2): 459-466
109. **Sikk P, Käämbre T, Vija H, Tepp K, Tiivel T, Nutt A, Saks V**. Ultra performance liquid chromatography analysis of adenine nucleotides and creatine derivatives for kinetic studies. Proceedings Of The Estonian Academy Of Sciences, 2009, 58 (2): 122-131
110. Sokolov IM, **Heinsalu E**, Hanggi P, Goychuk I. Universal fluctuations in subdiffusive transport. EPL 2009, 86 (3): 30009
111. **Timohhina N**, Guzun R, **Tepp K**, Monge C, **Varikmaa M, Vija H, Sikk P, Käämbre T**, Sackett D, **Saks V**. Direct measurement of energy fluxes from mitochondria into cytoplasm in permeabilized cardiac cells *in situ*: some evidence for mitochondrial interactosome. Journal Of Bioenergetics And Biomembranes, 2009, 41 (3): 259-275
112. **Trummal A, Rummel A, Lippmaa E**, Burk P, Koppel IA. IEF-PCM Calculations of Absolute pK(a) for Substituted Phenols in Dimethyl Sulfoxide and Acetonitrile Solutions. Journal of Physical Chemistry A, 2009, 113 (21): 6206-6212
113. Tuvikene R, Truus K, Robal M, **Pehk T**, Kailas T, Vaher M, Paalme T. Structure and thermal stability of pyruvated carrageenans from the red alga *Coccotylus truncates*. Carbohydrate Research, 2009, 344 (6): 788-794
114. **Vija H, Kesvatera T**. The effect of solvent composition on complex formation of S100B protein with peptides. Conference Information: Baltic Polymer Symposium 2008, MAY 13-16, 2008 Otepää, Estonia, Proceedings Of The Estonian Academy Of Sciences, 2009, 58 (1): 67-72
115. **Vija H, Samel M, Siigur E, Aaspõllu A, Tõnismägi K, Trummal K, Subbi J, Siigur J**. VGD and MLD-motifs containing heterodimeric disintegrin viplebedin-2 from *Vipera lebetina* snake venom Purification and cDNA cloning. Comparative Biochemistry And Physiology B-Biochemistry & Molecular Biology, 2009, 153 (3): 253-260
116. **Vija H, Samel M, Siigur E, Aaspõllu A, Trummal K, Tõnismägi K, Subbi J, Siigur J.** Purification, characterization, and cDNA cloning of acidic platelet aggregation inhibiting phospholipases A(2) from the snake venom of *Vipera lebetina* (Levantine viper). Toxicon, 2009, 54 (4): 429-439
117. Wickramasinghe NP, Parthasarathy S, Jones CR, Bhardwaj C, Long F, Kotecha M, Mehboob S, Fung LWM, **Past J, Samoson A**, Ishii Y. Nanomole-scale protein solidstate NMR by breaking intrinsic H-1 T-1 boundaries. Nature Methods, 2009, 6 (3): 215-218
118. Wong A, Howes AP, Parkinson B, **Anupõld T, Samoson A**, Holland D, Dupree R. High-resolution O-17 double-rotation NMR characterization of ring and nonring oxygen in vitreous B2O3. Physical Chemistry Chemical Physics, 2009, 11 (32): 7061-7068

119. Yang J, **Hüvonen D, Nagel U, Rõõm T**, Ni N, Canfield PC, Bud'ko SL, Carbotte JP, Timusk T. Optical Spectroscopy of Superconducting Ba0.55K0.45Fe2As2: Evidence for Strong Coupling to Low-Energy Bosons. Physical Review Letters, 2009, 102 (18): 187003
120. Anelli G, **Lippmaa E, Rummel A, Trummal A** et al. The TOTEM Experiment at the CERN Large Hadron Collider. Journal Of Instrumentation, 2008, 3: S08007
121. **Bondarenko O**, Rõlova T, **Kahru A, Ivask A**. Bioavailability of Cd, Zn and Hg in Soil to Nine Recombinant Luminescent Metal Sensor Bacteria. Sensors, 2008, 8 (11): 6899-6923
122. Brinkmann A, Kentgens APM, **Anupõld T, Samoson A**. Symmetry-based recoupling in double-rotation NMR spectroscopy. Journal Of Chemical Physics, 2008, 129 (17): 174507
123. Burk P, Koppel W, **Trummal A**, Koppel IA. Feasibility of the spontaneous gasphase proton transfer equilibria between neutral Bronsted acids and Bronsted bases. Journal Of Physical Organic Chemistry, 2008, 21 (7-8): 571-574
124. Chakraborti A, **Patriarca M**. Gamma-distribution and wealth inequality. PRAMANA-Journal Of Physics, 2008, 71 (2): 233-243
125. Chatrchyan S, ..., **Hektor A, Kadastik M, Kannike K, Lippmaa E, Müntel M, Raidal M, Rebane L**, et al. The CMS experiment at the CERN LHC. Journal Of Instrumentation, 2008, 3: S08004
126. Christjanson P, **Pehk T**, Siimer K, Paju J. Structure of polycondensates from hydroxymethylphenols. Journal Of Applied Polymer Science, 2008, 107 (2): 1226-1234
127. Collins HA, Khurana M, Moriyama EH, Mariampillai A, Dahlstedt E, Balaz M, Kuimova MR, Drobizhev M, Yang VXD, Phillips D, **Rebane A**, et al. Blood-vessel closure using photosensitizers engineered for two-photon excitation. Nature Photonics, 2008, 2 (7): 420-424
128. Drobizhev M, Makarov NS, **Rebane A**, et al. Strong two-photon absorption in push-pull phthalocyanines: Role of resonance enhancement and permanent dipole moment change upon excitation. Journal Of Physical Chemistry C, 2008, 112 (3): 848-859
129. Drobizhev M, Makarov NS, **Rebane A**, et al. Very efficient two-photon induced photo-tautomerization in non-symmetrical phthalocyanines. Journal Of Luminescence, 2008, 128 (2): 217-222
130. Eimre M, Paju K, Pelloux S, Beraud N, Roosimaa M, Kadaja L, Gruno M, Peet N, Orlova E, Remmelkoor R, Piirsoo A, **Saks V**, Seppet E. Distinct organization of energy metabolism in HL-1 cardiac cell line and cardiomyocytes. Biochimica Et Biophysica Acta-Bioenergetics, 2008, 1777 (6): 514-524
131. **Ge M**, Zhao HW, Wang WF, et al. Terahertz time-domain spectroscopic investigation on quinines. Science In China Series B-Chemistry, 2008, 51 (4): 354-358
132. Guiraud A, de Lorgeril M, Zeghichi S, Laporte F, Salen P, **Saks V**, Berraud N, Boucher F, de Leiris J. Interactions of ethanol drinking with n-3 fatty acids in rats: potential consequences for the cardiovascular system. Source: British Journal Of Nutrition, 2008, 100 (6) 1237-1244
133. **Heinlaan M, Ivask A, Blinova I, Dubourguier HC, Kahru A**. Toxicity of nanosized and bulk ZnO, CuO and TiO2 to bacteria *Vibrio fischeri* and crustaceans *Daphnia magna* and *Thamnocephalus platyurus*. Chemosphere, 2008, 71 (7): 1308-1316
134. **Heinsalu E**, Patriarca M, Marchesoni F. Dimer diffusion in a washboard potential. Physical Review E, 2008, 77 (2): 021129 Part 1
135. **Hektor A, Kajiyama Y, Kannike K**. Muon anomalous magnetic moment and lepton flavor violating tau decay in unparticle physics. Physical Review D, 2008, 78 (5): 053008
136. Hill JP, **Blumberg G**, Kim YJ, et al. Observation of a 500 meV collective mode in La2-xSrxCuO4 and Nd2CuO4 using resonant inelastic x-ray scattering. Physical Review Letters, 2008, 100 (9): 097001
137. Holmes L, Peng L, **Heinmaa I**, et al. Variable-temperature O-17 NMR study of oxygen motion in the anionic conductor Bi26Mo10O69. Chemistry Of Materials, 2008, 20 (11): 3638-3648
138. Jõgi A, Ilves M, Paju A, **Pehk T**, Kailas T, Müürisepp AM, Lopp M. Asymmetric synthesis of 4'-C-benzyl-2',3'-dideoxynucleoside analogues from 3-benzyl-2-hydroxy-2-cyclopenten-1-one. Tetrahedron-Asymmetry, 2008, 19 (5): 628-634
139. **Kadastik M, Raidal M, Rebane L**. Direct determination of neutrino mass parameters at future colliders. Physical Review D, 2008, 77 (11): 115023
140. **Kahru A, Dubourguier HC, Blinova I, Ivask A, Kasemets K**. Biotests and biosensors for ecotoxicology of metal oxide nanoparticles: A minireview. Sensors, 2008, 8 (8): 5153-5170
141. Kropman D, Mellikov E, Kärner T, Ugaste U, Laas T, **Heinmaa I**, Abru U, Medvid A. Hydrogen interaction with point defects in the Si-SiO2 structures and its influence on the interface properties. Conference Information: 12th International Autumn Meeting on Gettering and Defect Engineering

in Semiconductor Technology, OCT 14-19, 2007 Erice, Italy, Source: Gettering And Defect Engineering In Semiconductor Technology XII, Book Series: Solid State Phenomena, 2008, 131-133, Pages: 345-349

142. Kropman D, Mellikov E, Öpik A, Lott K, Volobueva O, Kärner T, **Heinmaa I**, Laas T, Medvid A. Strain Relaxation Mechanism In The Si-SiO2 System And Its Influence On The Interface Properties. Conference Information: International Conference on Radiation Interaction with Materials and Its Use in Technologies, SEP 24-27, 2008 Kaunas, Lithuania, Source: International Conference On Radiation Interaction With Materials And Its Use In Technologies 2008, Book Series: Radiation Interaction with Material and Its Use in Technologies, 2008, 204-207
143. Kuznetsov AV, Veksler V, Gellerich FN, **Saks V**, Margreiter R, Kunz WS. Analysis of mitochondrial function *in situ* in permeabilized muscle fibers, tissues and cells. Source: Nature Protocols, 2008, 3 (6): 965-976
144. Laars M, Kriis K, Kailas T, Müürisepp AM, **Pehk T**, Kanger T, Lopp M. Structural constraints for C-2-symmetric heterocyclic organocatalysts in asymmetric aldol reactions. Tetrahedron-Asymmetry, 2008, 19 (6): 641-645
145. Lari T, Pape L. Porod W, Hektor A, **Kadastik M, Müntel M, Raidal M, Rebane L**, et al. Collider aspects of flavor physics at high Q. European Physical Journal C, 2008, 57 (1-2): 183-307
146. Leedjärv A, **Ivask A**, Virta M. Interplay of different transporters in the mediation of divalent heavy metal resistance in *Pseudomonas putida* KT2440. Journal Of Bacteriology, 2008, 190 (8): 2680-2689
147. Leito I, Herodes K, Huopolainen M, Virro K, Künnapas A, Kruve A, **Tanner R**. Towards the electrospray ionization mass spectrometry ionization efficiency scale of organic compounds. Rapid Communications In Mass Spectrometry, 2008, 22 (3): 379-384
148. Link S, Arvelakis S, Spliethoff H, De Waard P, **Samoson A**. Investigation of biomasses and chars obtained from pyrolysis of different biomasses with solid-state C-13 and Na-23 nuclear magnetic resonance spectroscopy. Energy & Fuels, 2008, 22 (5): 3523-3530
149. Liu GF, Ma XJ, Ma SH, Zhao HW, Ma MW, **Ge M**, Wang WF. Identification of explosives 2,4-DNT and 2,6-DNT using terahertz time-domain spectroscopy. Chinese Journal Of Chemistry, 2008, 26 (7): 1257-1261
150. Ma YJ, Zhao HW, Dai B, **Ge M**. Progress in Application of THz -TDS to Protein Study. Spectroscopy And Spectral Analysis, 2008, 28 (10): 2237-2242
151. Makarov NS, Drobizhev M, **Rebane A**. Two-photon absorption standards in the 550-1600 nm excitation wavelength range. Optics Express, 2008, 16 (6): 4029-4047
152. Makarov NS, Drobizhev M, **Rebane A**. Two-photon absorption standards in the 550-1600 nm excitation range: Establishing a correction curve for accurate cross section. Conference Information: Conference on Organic Photonic Materials and Devices X, JAN 22-24, 2008 San Jose, CA, Source: Organic Photonic Materials And Devices X, Book Series: Proceedings Of The Society Of Photo-Optical Instrumentation Engineers (SPIE), 2008, 6891, U24-U35
153. Monge C, Beraud N, Kuznetsov AV, Rostovtseva T, Sackett D, Schlattner U, Vendelin M, **Saks VA**. Regulation of respiration in brain mitochondria and synaptosomes: restrictions of ADP diffusion *in situ*, roles of tubulin, and mitochondrial creatine kinase. Molecular And Cellular Biochemistry, 2008, 318 (1-2): 147-165
154. **Mortimer M, Kasemets K, Heinlaan M, Kurvet I, Kahru A**. High throughput kinetic *Vibrio fischeri* bioluminescence inhibition assay for study of toxic effects of nanoparticles. Toxicology In Vitro, 2008, 22 (5): 1412-1417
155. **Nagel U, Hüvonen D, Joon E**, Kim JS, Kremer RK, **Rõõm T.** Far-infrared signature of the superconducting gap in intercalated graphite CaC6. Physical Review B, 2008, 78 (4): 041404
156. Nevala H, Ylikomi T, **Tähti H**. Evaluation of the selected barrier properties of retinal pigment epithelial cell line ARPE-19 for an *in-vitro* blood-brain barrier model. Source: Human & Experimental Toxicology, 2008, 27 (10): 741-749
157. Peng WK, **Samoson A**, Kitagawa M. Simultaneous adiabatic spin-locking cross polarization in solid-state NMR of paramagnetic complexes. Chemical Physics Letters, 2008, 460 (4-6): 531-535
158. **Raidal M**, van der Schaaf A, Bigi I, **Kadastik M, Kajiyama Y, Müntel M, Rebane L**, et al. Flavor physics of leptons and dipole moments. European Physical Journal C, 2008, 57 (1-2): 13-182
159. **Rebane A**, Drobizhev M, Makarov NS, et al. Two-photon absorption properties of meso-substituted A(3)-corroles. Chemical Physics Letters, 2008, 462 (4-6): 246-250

160. **Rebane A**, Makarov NS, Drobizhev M, et al. Quantitative prediction of twophoton absorption cross section based on linear spectroscopic properties. Journal Of Physical Chemistry C, 2008, 112 (21): 7997-8004
161. Reile I, Paju A, Eek M, **Pehk T**, Lopp M. Aerobic oxidation of cyclopentane-1,2-diols to cyclopentane-1,2-diones on Pt/C catalyst. Synlett, 2008, 3: 347-350
162. **Reinik J, Heinmaa I**, Mikkola JP, **Kirso U**. Synthesis and characterization of calcium-alumino-silicate hydrates from oil shale ash - Towards industrial applications. Fuel, 2008, 87 (10-11): 1998-2003
163. Reintamm T, Kuusksalu A, Metsis M, Pari M, Vallmann K, **Lopp A**, Justesen J, Kelve M. Sponge OAS has a distinct genomic structure within the 2-5A synthetase family. Source: Molecular Genetics And Genomics, 2008, 280 (5): 453-466,
164. Rostovtseva TK, Sheldon KL, Hassanzadeh E, Monge C, **Saks V**, Bezrukov SM, Sackett DL. Tubulin binding blocks mitochondrial voltage-dependent anion channel and regulates respiration. Proceedings Of The National Academy Of Sciences Of The United States Of America, 2008, 105 (48): 18746-18751
165. **Saks V**, Beraud N, Wallimann T. Metabolic compartmentation - A system level property of muscle cells. International Journal Of Molecular Sciences, 2008, 9 (5): 751-767
166. **Samel M, Tõnismägi K**, Ronnholm G, **Vija H, Siigur J**, Kalkkinen N, **Siigur E**. L-Amino acid oxidase from *Naja naja oxiana* venom. Comparative Biochemistry And Physiology B-Biochemistry & Molecular Biology, 2008, 149 (4): 572-580
167. Siimer K, Christjanson P, Kaljuvee T, **Pehk T**, Lasn I, Saks I. TG-DTA study of melamine-urea-formaldehyde resins. Journal Of Thermal Analysis And Calorimetry, 2008, 92 (1): 19-27
168. Siimer K, Kaljuvee T, Christjanson **P, Pehk T**, Saks I. Effect of alkylresorcinols on curing behaviour of phenol-formaldehyde resol resin. Journal Of Thermal Analysis And Calorimetry, 2008, 91 (2): 365-373
169. Starkey JR, **Rebane AK**, Drobizhev MA, et al. New Two-Photon Activated Photodynamic Therapy Sensitizers Induce Xenograft Tumor Regressions after Near-IR Laser Treatment through the Body of the Host Mouse, Clinical Cancer Research, 2008, 14 (20): 6564-6573
170. Tamp S, Danilas K, Kreen M, Vares L, **Kiirend E, Vija S, Pehk T**, Parve O, Metsala A. A total conformational analysis of diastereomeric esters and calculation of their conformational shielding models. Journal Of Molecular Structure-Theochem, 2008, 851 (1-3): 84-91
171. Toimela T, **Tähti H**, Ylikorni T. Comparison of an automated pattern analysis machine vision time-lapse system with traditional endpoint measurements in the analysis of cell growth and cytotoxicity. Source: ATLA-Alternatives To Laboratory Animals, 2008, 36 (3): 313-325
172. Tuvikene R, Truus K, Kollist A, Volobujeva O, Mellikov E, **Pehk T**. Gel-forming structures and stages of red algal galactans of different sulfation levels. Journal Of Applied Phycology, 2008, 20 (5): 527-535
173. Uldry AC, Griffin JM, Yates JR, **Samoson A**, et al. Quantifying weak hydrogen bonding in uracil and 4-cyano-4 '-ethynylbiphenyl: A combined computational and experimental investigation of NMR chemical shifts in the solid state. Journal Of The American Chemical Society, 2008, 130 (3): 945-954
174. Vassiljev A, **Blinova I**, Ennet P. Source apportionment of nutrients in Estonian rivers. Desalination, 2008, 226 (1-3): 222-230
175. Wahlstrom A, Hugonin L, Peralvarez-Marin A, **Jarvet J**, Graslund A. Secondary structure conversions of Alzheimer's A beta(1-40) peptide induced by membrane-mimicking detergents. FEBS Journal, 2008, 275 (20): 5117-5128
176. Westerlund K, Moran SD, Privett HK, Hay S, **Jarvet J**, et al. Making a single-chain four-helix bundle for redox chemistry studies. Protein Engineering Design & Selection, 2008, 21 (11): 645-652
177. Bayatian GL, Chatrchyan S, Hmayakyan G, **Hektor A, Kadastik M, Kannike K, Lippmaa E, Müntel M, Raidal M**, et al. CMS physics technical design report, volume II: Physics performance. Journal Of Physics G-Nuclear And Particle Physics, 2007, 34 (6): 995-1579
178. **Blumberg G**, Mialitsin A, Dennis BS, et al. Observation of Leggett's collective mode in a multiband MgB2 superconductor. Physical Review Letters, 2007, 99 (22): 227002
179. **Blumberg G,** Mialitsin A, Dennis BS, Zhigadlo ND, Karpinski J. Multi-gap superconductivity in MgB2: Magneto-Raman spectroscopy. Physica C-Superconductivity And Its Applications, 2007, 456 (1-2): 75-82

180. Bogdanov R, Ozernaya S, **Pihlak AT**, Timofeev S. Radiogenic uranium-234 in humus acids of graptolitic argillite. Oil Shale, 2007, 24 (1): 73-89
181. Carravetta M, Danquigny A, Mamone S, Cuda F, Johannessen OG, **Heinmaa I**, Panesar K, **Stern R**, Grossel MC, Horsewill AJ, Samoson A, Murata M, Murata Y, Komatsu K, Levitt MH, Solid-state NMR of endohedral hydrogen-fullerene complexes. Physical Chemistry Chemical Physics, 2007, 9 (35): 4879-4894
182. Drobizhev M, Makarov NS, Hughes T, **Rebane A**. Resonance enhancement of two-photon absorption in fluorescent proteins. Journal Of Physical Chemistry, B 2007, 111 (50): 14051-14054
183. Enkvist E, Raidaru G, Vaasa A, **Pehk T**, Lavogina D, Uri A. Carbocyclic 3'-deoxyadenosine-based highly potent bisubstrate-analog inhibitor of basophilic protein kinases. Bioorganic & Medicinal Chemistry Letters, 2007, 17 (19): 5336-5339
184. Griffin JM, Tripon C, **Samoson A**, Filip C, Brown SP. Low-load rotor-synchronised Hahn-echo pulse train (RS-HEPT) H-1 decoupling in solid-state NMR: factors affecting MAS spin-echo dephasing times. Magnetic Resonance In Chemistry, 2007, 45: S198-S208, Suppl. S
185. Hambye T, **Kannike K**, Ma E, **Raidal M**. Emanations of dark matter: Muon anomalous magnetic moment, radiative neutrino mass, and novel leptogenesis at the TeV scale. Physical Review D, 2007, 75 (9): 095003
186. **Heinlaan M, Kahru A, Kasemets K, Kurvet I**, Waterlot C, Sepp K, Dubourguier HC, Douay F. Rapid screening for soil ecotoxicity with a battery of luminescent bacteria tests. ATLA-Alternatives To Laboratory Animals, 2007, 35 (1): 101-110
187. **Hektor A, Kadastik M, Muntel M, Raidal M, Rebane L**. Testing neutrino masses in little Higgs models via discovery of doubly charged Higgs at LHC. Nuclear Physics B, 2007, 787 (1-2): 198-210
188. Hung I, Wong A, Howes AP, **Anupõld T, Past J, Samoson A**, Mo X, Wu G, Smith ME, Brown SP, Dupree R. Determination of NMR interaction parameters from double rotation NMR. Journal Of Magnetic Resonance, 2007, 188 (2): 246-259
189. **Hüvonen D, Nagel U, Rõõm T**, Haas P, Dressel M, Hwang J, Timusk T, Wang YJ, Akimitsu J. Magneto-optic far-infrared study of Sr14Cu24O41: Triplet excitations in chains. Physical Review B, 2007, 76 (13): 134418
190. **Irha N, Blinova I**. The use of bioassays for the risk assessment of toxic leachates: An experimental study. ATLA-Alternatives To Laboratory Animals, 2007, 35 (1): 111-118
191. **Ivask A**, Green T, Polyak B, Mor A, **Kahru A**, Virta M, Marks R. Fibre-optic bacterial biosensors and their application for the analysis of bioavailable Hg and As in soils and sediments from Aznalcollar mining area in Spain. Biosensors & Bioelectronics, 2007, 22 (7): 1396-1402
192. **Jarvet J**, Danielsson J, Damberg P, Oleszczuk M, Graslund A. Positioning of the Alzheimer A beta(1-40) peptide in SDS micelles using NMR and paramagnetic probes. Journal Of Biomolecular NMR, 2007, 39 (1): 63-72
193. **Kajiyama Y**, Kubo J, Okada H. D-6 family symmetry and cold dark matter at CERN LHC. Physical Review D, 2007, 75 (3): 033001
194. **Kajiyama Y, Raidal M**, Strumia A. Golden ratio prediction for solar neutrino mixing. Physical Review D, 2007, 76 (11): 117301
195. **Kajiyama Y**. R-parity violation and family symmetry. International Journal Of Modern Physics A, 2007, 22 (31): 5909-5919
196. **Kajiyama Y**. R-parity violation and non-abelian discrete family symmetry. Journal Of High Energy Physics, 2007, (4): 007
197. Kanger T, Kriis K, Laars M, Kailas T, Muurisepp AM, **Pehk T**, Lopp M. Bimorpholine-mediated enantioselective intramolecular and intermolecular aldol condensation. Journal Of Organic Chemistry, 2007, 72 (14): 5168-5173
198. Kapanen G, Punning JM, **Blinova I**, Kangur K. The Roles of Natural and Anthropogenic Factors of Ecological State in the Lake Peipsi. Conference Information: Conference of the World-Academy-of-Science-Engineering-and-Technology, JUL 27-29, 2007 Prague, Czech Republic, Book Series: Proceedings Of World Academy Of Science Engineering And Technology, 2007, 22: 133-138
199. **Kasemets K**, Nisamedtinov I, Laht TM, Abner K, Paalme T. Growth characteristics of *Saccharomyces cerevisiae* S288C in changing environmental conditions: auxoaccelerostat study. Antonie Van Leeuwenhoek International Journal Of General And Molecular Microbiology, 2007, 92 (1): 109-128

200. **Kiirend EO**, Chumakova SP, **Pehk TI**. Identification of nematic lyomesophases with discotic and cylindrical micelles in lyotropic amphiphilic systems. Crystallography Reports, 2007, 52 (1): 155-158, [Kristallografiya 2007, 52 (1), 158-161]
201. **Kirso U, Irha N, Reinik J**, Urb G, Laja M. The role of laboratory and field leaching tests in hazard identification for solid materials. ATLA-Alternatives To Laboratory Animals, 2007, 35 (1): 119-122
202. Kramer S, **Stern R**, Horvatic M, Berthier C, Kimura T, Fisher R. Nuclear magnetic resonance evidence for a strong modulation of the Bose-Einstein condensate in BaCuSi2O6, Physical Review B, 2007, 76 (10): 100406
203. **Kundla E**. An ensemble of paired spin-1/2 nuclei in a rotating solid: Polarization evolution and NMR spectrum in a wobbling frame. Solid State Nuclear Magnetic Resonance, 2007, 31 (2): 91-99
204. Lippur K, Kanger T, Kriis K, Kailas T, Muurisepp AM, **Pehk T**, Lopp M. Synthesis of (2S,2'S)-bimorpholine N,N '-quaternary salts as chiral phase transfer catalysts. Tetrahedron-Asymmetry, 2007, 18 (1): 137-141
205. **Lopp A, Reintamm T, Vallmann K**, Pari M, Mikli V, Richelle-Maurer E, **Kelve M**. Molecular identification, characterization and distribution of freshwater sponges (*Porifera: Spongillidae*) in Estonia. Fundamental And Applied Limnology, 2007, 168 (1): 93-103
206. Makarov NS, **Rebane A**, Drobizhev M, Wolleb H, Spahni H. Optimizing twophoton absorption for volumetric optical data storage. Journal Of The Optical Society Of America B-Optical Physics, 2007, 24 (8): 1874-1885
207. Massad T, **Jarvet J, Tanner R**, Tomson K, Smirnova J, Palumaa P, Sugai M, Kohno T, Vanatalu K, Damberg P. Maximum entropy reconstruction of joint phi,psi-distribution with a coil-library prior: the backbone conformation of the peptide hormone motilin in aqueous solution from phi and psi-dependent J-couplings. Journal Of Biomolecular NMR, 2007, 38 (2): 107-123
208. Mialitsin A, Dennis BS, Zhigadlo ND, Karpinski J, **Blumberg G**. Anharmonicity and self-energy effects of the E-2g phonon in MgB2. Physical Review B, 2007, 75 (2): 020509
209. Molina-Terriza G, **Rebane L**, Torres JP, et al. Probing canonical geometrical objects by digital spiral imaging. Journal Of The European Optical Society-Rapid Publications, 2007, 2: 07014
210. Pari M, **Kuusksalu A, Lopp A, Reintamm T**, Justesen J, **Kelve M**. Expression and characterization of recombinant 2 ',5 '-oligoadenylate synthetase from the marine sponge *Geodia cydonium*. FEBS Journal, 2007, 274 (13): 3462-3474
211. **Rebane A**, Christensson N, Drobizhev M, Stepanenko Y, Spangler CW. Quantum interference between multi photon absorption pathways in organic solid. Journal Of Luminescence, 2007, 127 (1): 28-33
212. **Rebane A**, Shakhmuratov RN, Megret P, Odeurs J. Slow light with persistent spectral hole burning in waveguides. Journal Of Luminescence, 2007, 127 (1): 22-27
213. **Reinik J, Heinmaa I**, Mikkola JP, Mikkola JP, **Kirso U**. Hydrothermal alkaline treatment of oil shale ash for synthesis of tobermorites. Fuel, 2007, 86 (5-6): 669-676
214. Rogers JE, Slagle JE, Krein DM, Burke AR, Hall BC, Fratini A, McLean DG, Fleitz PA, Cooper TM, Drobizhev M, Makarov NS, **Rebane A**, Kim KY, Farley R, Schanze KS. Platinum acetylide two-photon chromophores. Inorganic Chemistry, 2007, 46 (16): 6483-6494
215. Villo L, Danilas K, Metsala A, Kreen M, Vallikivi I, Vija S, **Pehk T**, Saso L, Parve O. Synthesis of deoxy sugar esters: A chemoenzymatic stereoselective approach affording deoxy sugar derivatives also in the form of aldehyde. Journal Of Organic Chemistry, 2007, 72 (15): 5813-5816
216. Wickramasinghe NP, Kotecha M, **Samoson A, Past J**, Ishii Y. Sensitivity enhancement in C-13 solid-state NMR of protein microcrystals by use of paramagnetic metal ions for optimizing H-1 T-1 relaxation. Journal Of Magnetic Resonance, 2007, 184 (2): 350-356
217. Wong A, Hung I, Howes AP, **Anupõld T, Past J, Samoson A**, Brown SP, Smith ME, Dupree R. The determination of O-17 NMR parameters of hydroxyl oxygen: A combined deuteration and DOR approach. Magnetic Resonance In Chemistry, 2007, 45: S68-S72 Suppl. S
218. Zvyagin SA, Wosnitza J, Krzystek J, **Stern R**, Jaime M, Sasago Y, Uchinokura K. Spin-triplet excitons and anisotropy effects in the S=1/2 gapped antiferromagnet BaCuSi2O6. Journal Of Magnetism And Magnetic Materials, 2007, 310 (2): 1206-1208 Part 2

Books

Pihlak, Arno-Toomas. Kilde isesüttimise protsesside ja õhuhapniku probleemide uurimise ajaloost Eestis, Tallinn, Aura Trükk Publishing, 2009, 61 pages (in Estonian)
Pihlak, Arno-Toomas. Õhuhapniku Probleemid, Tallinn, City Print OÜ, 2008, 198 pages (in Estonian)

Book Chapters and Articles in Proceedings

1. Antchev, G.; **Lippmaa, E.; Rummel, A.; Trummal, A**. et al. Diffraction at TOTEM. 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009, 29th June - 3rd July 2009, CERN, Geneva, Switzerland, Proceedings of the 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009 (toimetajad M. Deile, D. d'Enterria, and A. De Roeck), CERN-Proceedings-2010-002, 2010, 249-256
2. Antchev, G.; **Lippmaa, E.; Rummel, A.; Trummal, A**. et al. The TOTEM Detector at LHC. 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009, 29th June - 3rd July 2009, CERN, Geneva, Switzerland, Proceedings of the 13th International Conference on Elastic and Diffractive Scattering ("Blois Workchop"), EDS 2009 (toimetajad M. Deile, D. d'Enterria, and A. De Roeck), CERN-Proceedings-2010-002, 2010, 449-455
3. Derewiński, Miroslaw; Pashkova, Veronika; **Sarv, Priit**. Assembling protozeolitic nanoclusters of MFI type into a mesostructured material of wormhole-layered arrangement and acidic properties. Stud. Surf. Sci. Catal., Elsevier/North-Holland 2010, 111-112
4. Monge, Cells Claire; Guzun, Rita; **Tepp, Kersti; Timohhina, Natalja; Varikmaa, Minna; Sikk, Peeter; Käämbre, Tuuli; Saks, Valdur**. Mitochondrial Interactosome in Health and Disease: Structural and Functional Aspects of Molecular System Bioenergetics of Muscle and Neuronal Cells. Mitochondria: Structure, Functions and Dysfunctions, Ed. Oliver L. Svensson, Nova Science Publisher Inc. 2010, 7-10
5. **Siigur, Jüri; Siigur, Ene**. Activation of Factor X by Snake Venom Proteases. Toxins and Hemostasis. From Bench to Bedside, (Eds Kini, R.M.; Clemetson, K.J.; Markland, F.S.; Morita, T.), Springer 2010, 447-464
6. Anelli, G.; **Lippmaa, E.; Rummel, A.; Trummal, A**. et al. The TOTEM Experiment at the CERN Large Hadron Collider. The CERN Large Hadron Collider: Accelerator and Experiments, The TOTEM Collaboration, 2, CERN/LHCC, CERN, Geneva, Switzerland, 2009, 1-107
7. Bogdanov, Dan; **Livenson, Ilja**. VirtualLife: Secure Identity Management in Peer-to-Peer Systems. 1st International ICST Conference on User Centric Media, Venice, 9-11 December 2009, LNICST, Springer 2009, 181-188
8. Chatrchyan, S.; **Hektor, A.; Kadastik, M.; Kannike, K.; Lippmaa, E.; Müntel, M.; Raidal, M.; Rebane, L**. et al. The CMS experiment at the CERN LHC. The CERN Large Hadron Collider: Accelerator and Experiments, The CMS Collaboration, 2, CERN/LHCC, CERN, Geneva, Switzerland, 2009, 1-334
9. Kahru A. A chapter on situation of gender balance in Estonian science decision making. Widmer, M., Raudma, T. (Rapporteurs) Mapping the Maze: Getting More Women to the Top in Research. Luxembourg: Office for Official Publications of the European Communities, 2008, pp 44 – 45

Other Publications (Dissertations)

1. Heinlaan, Margit. Ecotoxicological evaluation of synthetic nanoparticles and particulate environmental samples. PhD, Estonian University of Life Sciences, 2010
2. Trummal, Aleksander. Computational Study of Structural and Solvent Effects on Acidities of Some Brönsted Acids. PhD, University of Tartu Tartu, Tartu University Press, 2009
3. Heinsalu, Els. Normal and anomalously slow diffusion under external fields. PhD, University of Tartu, TU Press, 2008

4. Hektor, Andi. Neutrino physics beyond the Standard Model. PhD, University of Tartu, TU Press, 2008
5. Hüvonen, Dan. Terahertz Spectroscopy of Low-Dimensional Spin Systems. PhD, Tallinn University of Technology, TUT Press, 2008
6. Kadastik, Mario. Doubly charged Higgs boson decays and implications on neutrino physics. PhD, Tallinn University of Technology , TUT Press, 2008
7. Kannike, Kristjan. Implications of Neutrino Masses. PhD, University of Tartu, TU Press, 2008
8. Müntel, Mait. Detection of doubly charged Higgs boson in the CMS detector. PhD, University of Tartu, TU Press, 2008
9. Anmann, Tiia. Integrated and Organized Cellular Bioenergetic Systems in Heart and Brain. PhD, Tallinn University of Technology, TUT Press, 2007
10. Trummal, Katrin. Purification, Characterization and Specificity Studies of Metalloproteinases from *Vipera lebetina* Snake Venom. PhD, Tallinn University of Technology, TUT Press, 2007
11. Mägi, Reelika. Application of a new analytical method for analysis of environmental discharges of oil shale processing. MSc (Second prize in category of master thesis), Tallinn University of Technology, 2010
12. Saaremäe, Merle. The expression of β-tublin isoforms and their role in the regulation of permeability of mitochondrial outer membrane. MSc, Tallinn University of Technology, TUT Press, 2010
13. Adamson, Jasper. Fluoride-Free Cross-Coupling Methodology Using Disiloxanes: Synthesis of Terminal Aryl Acetylenes and Biaryl Compunds. MSc, Magdalene College, University of Cambridge, UK, 2009
14. Kurvet, Imbi. Natural and recombinant bioluminescent bacteria for high throughput toxicity screening. MSc, Tallinn University of Technology, TUT Press, 2009
15. Tõnismägi, Külli. Comparative study of snake venom l-amino acid oxidases. MSc, Tallinn University of Technology, TUT Press, 2008
16. Varikmaa, Minna. Model systems of dopamine transporter for the farmacological characterization of ligands. MSc, University of Tartu, TU Press, 2008
17. Vija, Heiki. Separation of toxic peptides from *Amanita phalloides* and *Amanita virosa*. MSc, Tallinn University of Technology, TUT Press, 2008
18. Timohhina, Natalja. A Study Of Origination Of Characteristic Elements Of Foucault' Cardiogram. MSc, University of Tartu, TU Press, 2007
19. Panova, Jekaterina. The Fenton chemistry and its combination with coagulation for treatment of dye solutions. MSc, Tallinn University of Technology, 2007

VII VISITING RESEARCHERS

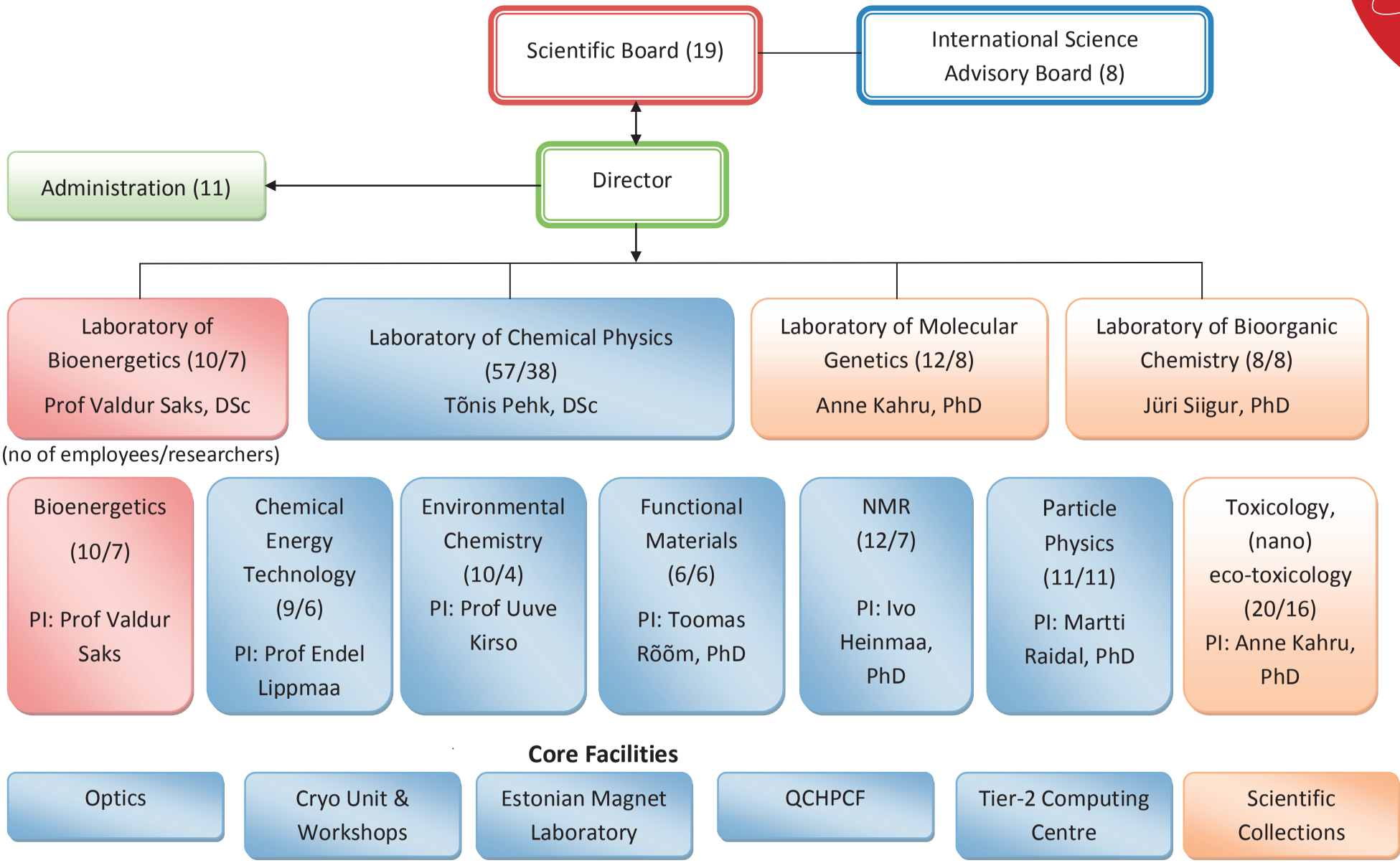
No	Visitor's name and title	Visitor's affiliation	Visited member /unit of NICPB	Time
1.	Claire Monge, Ph.D, research scientist	Laboratory of Fundamental and Applied Bioenergetics, INSERM E221, Joseph Fourier University, Grenoble, France	Laboratory of BE	June 2009
2.	Prof. Pierre DosSantos	Service Pr-Clementy, Hôpital Haut-Lévêque, avenue Magellan, 33600 Pessac, INSERM Bordeaux France	Laboratory of BE	April 2009
3.	*Dr. C.A.M. (Kees) van Gestel*	Department of Animal Ecology, Institute of Ecological Science, Vrije Universiteit Amsterdam, The Netherlands	Laboratory of MG	May 2009
4.	Dr. Sc. Professor Irina Perminova	Department of Chemistry, Lomonosov Moscow State University	Laboratory of CP, Environmental Chemistry Group	June 2009
4.	Dr. Anita Jemec	National Institute of Chemistry, Ljubljana, Slovenia	Laboratory of MG	Dec 2009
5.	Dr. Pu-Chun Ke	Laboratory of Single-Molecule Biophysics and Polymer Physics, Department of Physics and Astronomy, Clemson University, US	Laboratory of MG	March and Dec 2010
6.	Dr. Olli-Pekka Penttinen	University of Helsinki Department of Environmental Sciences, Finland	Laboratory of MG	March, May, Oct 2010
7.	Anna Kiiski, MSc	University of Helsinki, Palmenia Centre for Continuing Education, Finland	Laboratory of MG	March, May, Oct 2010
8.	Dr. Suzanne Kadereit	Stemcell Group, Doerenkamp-Zbinden Chair for in vitro Toxicology and Biomedicine, University of Konstanz, Germany	Laboratory of MG	Sept 2010
9	Prof. Damjana Drobne	Department of Biology, Biotechnical faculty, University of Ljubljana, Slovenia	Laboratory of MG	Dec 2010

VIII OTHER ACTIVITIES

During the period of 2007-2010 our employees have participated at dozens of conferences worldwide, they have taken part in tens of various co-operation events and have spent more than 1,400 days researching abroad or domestically in other scientific institutions. The activities are summarised in table 7 below.

Table 7 Summary of conference, co-operation and research activities of NICPB personnel 2007 - November 2010

Event	2007		2008		2009		2010	
	Participations	Days	Participations	Days	Participations	Days	Participations	Days
Internat. conferences	74	454	77	526	94	612	59	446
Nat conferences	33	68	81	140	10	15	66	103
Internat. Co-operation.	14	79	16	104	17	130	7	41
Nat. Co-oper.	7	7	8	10	3	8	3	3
Internat. research	22	303	34	301	26	388	43	491
Nat. Research	12	26	8	14	9	11	12	59


Scientific Board (19)
International Science Advisory Board (8)
Director
Administration (11)
Laboratory of Bioenergetics (10/7)
Prof Valdur Saks, DSc
Laboratory of Chemical Physics (57/38)
Tõnis Pehk, DSc
Laboratory of Molecular Genetics (12/8)
Anne Kahru, PhD
Laboratory of Bioorganic Chemistry (8/8)
Jüri Siigur, PhD
(no of employees/researchers)
Bioenergetics (10/7)
PI: Prof Valdur Saks
Chemical Energy Technology (9/6)
PI: Prof Endel Lippmaa
Environmental Chemistry (10/4)
PI: Prof Uuve Kirso
Functional Materials (6/6)
PI: Toomas Rõõm, PhD
NMR (12/7)
PI: Ivo Heinmaa, PhD
Particle Physics (11/11)
PI: Martti Raidal, PhD
Toxicology, (nano) eco-toxicology (20/16)
PI: Anne Kahru, PhD
Core Facilities
Optics
Cryo Unit & Workshops
Estonian Magnet Laboratory
QCHPCF
Tier-2 Computing Centre
Scientific Collections