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INVESTMENTS IN EDUCATION DEVELOPMENT

The conference is organized by project POST-UP II
Project registration number: CZ.1.07/2.3.00/30.0041

Palacký University, Olomouc

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Author:	Jiří Kvita, Ph.D.
Faculty, Department:	Faculty of Science, RCPTM Department of Optics
Title of Conference Contribution:	Exploring the pseudotop-top quark concept with the ATLAS detector at CERN

Top quarks are a unique probe of physics at high energies in proton-proton collisions at the Large Hadron Collider at CERN.

Precision measurement of top quark spectra enable us to constrain theoretical predictions, update models of systematic uncertainties for other top-quark related analyses, or search for new physics.

I will briefly mention the prominence of the top quark in the standard model of elementary particles, and I will describe my contribution to the analysis of the data recorded by the ATLAS detector at the center-of-mass energy of 8TeV, focusing on the concept of the so-called pseudo-top quarks, serving as a proxy-object to parton-level top quarks, by defining observables with a high correlations to top quark kinematics at a well-defined particle level.

Key Words: Top quark, quantum chromodynamic, high energy physics.



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Author:	Daniel McNulty, Ph.D.
Faculty, Department:	Faculty of Science Department of Optics
Title of Conference Contribution:	Activating entanglement from nonclassical correlations

Entanglement and more general nonclassical correlations are special features of quantum mechanics, very different from the classical effects we are accustomed to. In this talk I will begin with a a brief description of these properties and some of their consequences. I will then describe a protocol which activates entanglement in all nonclassically correlated states. This gives rise to a measure of nonclassical correlations, relating to the amount of entanglement activated. Finally, I will describe some recent work, where we show that the activation protocol can be extended from the finite dimensional quantum world to the continuous-variable case, but only with the aid of more complicated non-Gaussian operations.



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Author:	Bohumil Stoklasa, Ph.D.
Faculty, Department:	Faculty of Science Department of Optics
Title of Conference Contribution:	Quantum enhanced wavefront sensing

The analogies between wave optics and quantum mechanics have been known since the early days: wave effects like interference and diffraction were borrowed from optics and applied to demonstrate the wave nature of quantum particles, such as electrons, neutrons and atoms. After the rise of quantum theory and full development of coherent light sources, the exchange of concepts in the opposite direction started to occur. Exploring the potential of the methods of quantum information to unearth new fundamental results in classical optics is the main motivation behind this talk. As we have recently demonstrated, wave-front detection, when combined with techniques previously developed for quantum information processing and diagnostics of quantum behaviour, can be used to reconstruct the mutual coherence function of the optical signal. The purpose of this talk is to reformulate some optical methods from the point of view of quantum tomographic protocols. This would allow us to cast the inversion problem as a tomographic reconstruction, which conveys full information. Going beyond the standard interpretation of wave-front detection will be a substantial step forward providing novel means of characterization and utilization of the spatial degrees of freedom of light.

Key Words: Quantum tomography, wavefront detection, spatial coherence, vortex beams.



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Author:	Hamed Saberi, Ph.D.
Faculty, Department:	Faculty of Science Department of Optics
Title of Conference Contribution:	Integrated quantum technologies

The idea of employing quantum features of nature to devise novel technologies has received growing attention in recent years thanks to advances in nanotechnology. Such quantum devices promise, in particular, to revolutionize our computing technologies by allowing us to address otherwise intractable problems. We present various scenarios for realization of integrated photonic circuits that exhibit practical advantages over bulk approaches and report on the state-of-the-art of the experimental developments by our experimental partners. We demonstrate how all these pave the way for physical realization of novel quantum devices and problem solvers that potentially outperform the existing classical counterparts.

Key Words: Integrated photonic circuits, quantum features of nature, nanotechnology.



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Author:	Cristian Nistor, PhD
Faculty, Department:	Faculty of Science Department of Optics
Title of Conference Contribution:	Diffraction dispersion correction in white light SLM imaging

The spatial light modulators (SLMs) are devices using microelectromechanical systems (MEMS) or liquid crystal display (LCD) technology for a real-time amplitude or phase modulation of optical waves in space. Their operation is optimal when using almost monochromatic light but an extremely strong diffractive dispersion occurs when white light is applied. In this work, we propose the design concepts resulting in optimization and implementation of a refractive corrector operating with the SLM. The corrector maintains the operation of the SLM unchanged for the central wavelength of the light and ensures achromatic dispersion compensation throughout the visible region in applications based on a lens-pattern formation. Using an optimization method for kinoform lenses, the monochromatic diffraction efficiency of the SLM lens with a quantized phase and variable number of phase levels in individual zones will be calculated. The integral diffraction efficiency of the SLM operating with a broadband light will be also estimated.

The correction of the diffractive dispersion can be useful for a variety of applications in imaging and metrology, including the Fresnel incoherent correlation holography (FINCH) experiments, where the SLM operates as a beam splitter ensuring holographic recording of 3D objects in spatially incoherent light.

Key Words: Spatial light modulator, diffractive lenses, dispersion, diffractive dispersion correction.



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Author:	Daniel Šimíček, Ph.D.
Faculty, Department:	Faculty of Science Department of Geology
Title of Conference Contribution:	Sequence stratigraphic and provenance analyses of sedimentary archives using gamma-ray spectrometry

POST -UP II project at Department of Geology deals with stratigraphic, sequence-stratigraphic and provenance studies in siliciclastic synorogenic deep-water turbiditic sediments. A range of methods, which determine depositional environment and mineral and chemical composition of sediments were used for interpretation of processes driving genesis of studied sedimentary rocks.

The results from investigation in the Moravskoslezské Beskydy area were presented in June 2014 at Central European Meeting of Sedimentary Geology held in Olomouc and in August 2014 at 19th IAS Congress in Geneva (Switzerland). The paper with name Spectral gamma-ray logging of the Grès d'Annot, SE France: An outcrop analogue to geophysical facies mapping and well-log correlation of sand-rich turbidite reservoirs was published in the journal Marine and Petroleum Geology (IF 2.469). The paper with name Application of outcrop spectral gamma-ray record in provenance study of Cretaceous deep-marine siliciclastics; Western Carpathians Flysch Zone, Czech Republic is currently in review process in the journal Geologica Carpathica (IF 0.835). The first scientific friendship took place at the Department of Geodynamics and Sedimentology at the University of Vienna in April 2014. The second scientific friendship is planned in March at Georg-August-Universität in Göttingen (Germany) under the guidance of Prof. Hilmar von Eynatten. The results of provenance and stratigraphic studies will be discussed there and subsequently presented in 31st Meeting of Sedimentology in Krakow (Poland) and in another scientific paper published in the journal with Impact Factor.

Key Words: Sedimentary petrology, sedimentary facies, gamma-ray spectrometry, provenance.



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Author:	Petr Kladivo, Ph.D.
Faculty, Department:	Faculty of Science Department of Geography
Title of Conference Contribution:	State of the future index – global and national concept

First part of the presentation aims to outline the potential development of the Czech Republic by using the State of the Future Index (SOFI), the only index currently used worldwide that focuses, not only on the present (unlike the Human Development Index and others), but also on future development opportunities and threats. Additionally, the work includes the computation of partial indices concentrated on economic, environmental, social, and demographic factors, where the selection of indicators that enter the computations, including their weighting, is the outcome of a survey conducted among regional development and sustainability experts and academics. The next possibilities of the future research (innovations, methods, Future oriented thinking index etc.) will be discussed in the conclusion.



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Author:	Lorenzo De Bortoli, Mgr., Ph.D.
Faculty, Department:	Faculty of Education Department of Biology
Title of Conference Contribution:	Leafing through in the Czech Museums: taxonomy and taphonomy of the Miocene oysters from Carpathian Foredeep in Moravia

During the past year I worked about the project CZ.1.07/2.3.00/30.0041 concerning the paleontology of the Badenian (middle Miocene) oysters in the Carpathian Foredeep in Moravia. As a member of Department of Biology (Faculty of Education), situated in one of the historical buildings of the center town, I collaborate with the supervisor of this project, the doc. Ing. Šarka Hladilová, CSc, specialist in Neogene palaeontology, mostly in invertebrates systematic and taphonomy. In 2014 I visited two important sites referred to the paleontological sciences, the Institute of Paleobiology in Warsaw and the Natural History Museum in Vienna; here, supported by leading scientist of the field Dr. Pisera and Dr. Mandic respectively, I studied the fossil collections and learnt new palaeontological methods on oyster's study. In particular I analysed the shape and structure of the fossil oysters shells in order to determinate their most important features to obtain updated names for the systematic revision. The oysters have been taxonomically determined and taphonomically studied. The Badenian oyster samples analysed come from different Olomouc region localities (Czech Republic) and adjacent areas: (in alphabetical order) Bedřichovice, Blažovice, Borač, Brno, Čelechovice, Černá Hora, Drysice, Hluchov, Kelčice, Kobeřice, Laškov, Lomnička, Luleč, Myslejovice, Olomouc, Ondratice, Opatov, Otaslavice, Pivín, Práče, Přemyslovce, Slatinky, Terežské údolí, Újezd, Vinohrady. The most common oysters assemblage is represented by: *Crassostrea gryphoides*, *Hyotissa hyotis*, *Neopycnodonte navicularis*, *Ostrea digitalina* and *Ostrea* sp. It's remarkable the presence of the intensive bioerosion traces on the valves, caused typically by barnacles, sponges, bryozoans, worms, gastropods and



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bivalves. These organisms have affected the oysters, highlighting structures and furrows along the entire extension of their shells. We can observe reticular, channel shaped and punctuate structures, referable to *Entobia*, *Caulostrepsis*, *Gastrochaenolites* and *Meandropolydora*. I divided the valves in bioerosional zones in order to understand where they are bored. All raw counts for right and left valves bored or encrusted by different organisms; the interior and exterior surfaces of all valves were examined to record the presence/absence of borings or encrusting organisms. Percentages of valves with encrusters and borers present were calculated. Generally *Entobia* is the most represented ichnotaxon (49%), followed by *Caulostrepsis* (25%), *Gastrochaenolites* (23%) and *Meandropolydora* (3%). To test the hypothesis that certain parts of the valves were colonized preferentially and in order to understand if there is correlation between bioerosion and the oyster assemblage, I made a cluster analysis, using the software PAST (2.17c). Preliminary we obtained three main clusters, characterized by 1) prevailing *Crassostrea gryphoides*, 2) uniformly distributed *O. digitalina*-*C. gryphoides* and 3) *Ostrea* spp.; in response to a different morphological valves' features, in these assemblages the degree of bioerosion could represent three types of paleoecological and taphonomical paleoenvironments.

Key Words: Oysters, Badenian, Miocene, Carpathian Foredeep, Czech Republic, taxonomy, taphonomy, bioerosion.



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Author:	Petr Dvořák, Ph.D.
Faculty, Department:	Faculty of Science Department of Botany
Title of Conference Contribution:	3 billion years of cyanobacterial global dominance and the origins of photoautotrophic life on Earth

Cyanobacteria are the oldest oxygen producing, photosynthetic microorganisms on Earth. The most widespread cyanobacteria belong to the genus *Synechococcus* and they inhabit almost all environments, e.g. oceans, freshwater lakes, soils, and hot springs. We used variety of molecular methods to reconstruct evolutionary history of *Synechococcus*. A phylogeny of 16S rRNA sequences and whole genomes of all *Synechococcus*-like cyanobacteria was reconstructed and calibrated by molecular clocks. Furthermore, we sequenced new genome of peat bog *Synechococcus*-like cyanobacterium. We found that the oldest lineage of *Synechococcus* (also the oldest cyanobacterium) derived before more than 3 billion years (Archean era). Although some authors recently proposed origin of cyanobacteria in freshwater environments, we suggest origin in thermal springs, which corresponds with the Archean climate before ca. 3 billion years. Afterwards, cyanobacteria probably radiated to the oceans, and further to freshwater environments. Based on 16S rRNA analysis, we identified 12 polyphyletic lineages in the *Synechococcus*, therefore it is the most enigmatic group within cyanobacteria with exceptionally reticulate evolutionary history. Moreover, we analyzed abundance of horizontal gene transfer (HGT) within orthologous genes among 70 cyanobacterial genomes. HGT is very important evolutionary process shaping cyanobacterial and also other prokaryotic species. Amount of HGT was not correlated with habitat or genome size, but it was significantly negatively correlated with time. These findings were synthesized, together with recent findings considering speciation in cyanobacteria, to the evolutionary model of a serial convergence in cyanobacteria.



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Author:	Daniel Hanley, Mgr., PhD.
Faculty, Department:	Faculty of Science Department of Zoology and Laboratory of Ornithology
Title of Conference Contribution:	Acceptance thresholds and egg discrimination vary by colour

Avian brood parasites lay their eggs in other birds' nests, leaving these host birds to rear their young, and hosts have evolved a range of defenses to avoid rearing these brood parasitic young. One defensive tactic, is evolving fine egg discrimination. Hosts vary in their acceptance of these parasitic eggs from accepting all to ejecting all parasitic eggs. Where a particular host falls on this continuum of accepting parasitic eggs is known as the acceptance threshold, and species vary in how their acceptance thresholds are impacted by egg mimicry. Despite variation both within and between host and parasitic eggs most research has considered these traits as categorical factors (either mimetic or non-mimetic). We examine how host blackbirds *Turdus merula* and American robins *Turdus migratorius* respond to a range of natural eggshell colours. First, we expect that hosts have adapted egg recognition cues specifically to natural eggshell colours. Second, because both species face different types of parasitism risk, we expect that their acceptance thresholds will differ. We illustrate that 1) these species only respond to natural eggshell colours (i.e., they do not respond to eggs that have unnatural coloration), 2) their acceptance thresholds have a continuous gradient from almost always accepted (blue-green) to almost never accepted (brown), 3) the blackbird's acceptance threshold is continuous and gradual while the American robin's rapidly changes from acceptance to ejection close to where the colour of their parasite's egg falls. We illustrate, for the first time, that hosts' have acceptance thresholds that are gradual with respect to colour, which reconciles previously contentious findings, and has broad implications to host cognition.

Key Words: Brood parasitism, co-evolution, egg colour, egg recognition.



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Author:	Pavel Bureš, JUDr., Ph.D., DEA
Faculty, Department:	Faculty of Law Department of International and European law
Title of Conference Contribution:	Looking for « right understanding » of Human rights in the case-law of ECtHR

Human rights can be conceived and defined in many ways. One conception (and one way of their protection) is presented by European Court for Human rights which is an organ to give an authoritative interpretation of the European Convention on human rights. An interpretation of specific terms of the Convention (e.g. private life, right to life, family life, right to marry) may evolve in time due to societal changes. The Court is no more looking for the interpretation under the intention of the Contracting parties to the convention, but claims to interpret the Convention in „present-day conditions“. To assess societal changes in European countries, the ECtHR often uses a reference to European consensus which has emerged. A question arises then, whether these societal changes can have this important impact for Court's decision. In other words, whether the Court should rely on these changes and their reflection of what is called European consensus. Even though it seems to be very difficult, it is the author's opinion that Court should look for another way of interpreting and understanding human rights - the way of right understanding of human rights with regard especially to human dignity (dignity of a human being and dignity of human species). It means to assess human rights in an over-all perception, in their totality (and not to protect some partial aspects of human rights).

Key Words: European Court for Human Rights, Evolutive interpretation, European consensus – over-all perception of human rights.



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Author:	Maxim Tomoszek, JUDr. Ph.D.
Faculty, Department:	Faculty of Law Department of Constitutional Law
Title of Conference Contribution:	Essential Core of Fundamental Rights as a part of essential requisites of rule of law and democracy

The research conducted so far in the framework of project POSTUP2 indicates that one part of the concept of essential requisites of democracy and rule of law is represented by the essential core of fundamental rights, which derives from Art. 4 para. 4 of the Charter of Fundamental Rights and Freedoms in connection with Art. 9 para. 2 of the Czech Constitution.

The concept of the essential core of fundamental rights is recognized both in the Czech and international context and is similarly stipulated in other constitutions (e.g. Art. 19 para. 2 of the German Basic Law). Its basis is the limitation of the possibility of limitations of fundamental rights.

In the case-law of the Czech Constitutional Court, the identification of the essential core of a social right is the basis for determination of the type of the test used to decide, whether the limitation of that right is compatible with the Constitution. With other rights, the essential core represents their inviolable content, precluding constitutional acts or even international or European law from infringing them. However, so far no unified and clear methodology of how to determine the essential content was formulated in the case-law of the Czech Constitutional Court.

This paper intends to analyze the concept of the essential core of fundamental rights and its compatibility with the principle of proportionality, and to formulate criteria, which should be taken into account by the Constitutional Court, when determining the essential content of fundamental rights. These criteria could then be used also as guidelines for identifying the exact content of essential requisites of rule of law and democracy, as provided by Art. 9 para.



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2 of the Czech Constitution. The paper will also explore the function of the concept of essential core of fundamental rights in Czech constitutional system with regard to Art. 9 para. 2 of the Czech Constitution and the concept of essential requisites of the democracy and rule of law.

Key Words: Essential core of fundamental rights, rule of law, democracy.



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Author:	Ondřej Svaček, JUDr., Ph.D. LL.M.
Faculty, Department:	Faculty of Law Department of International and European Law
Title of Conference Contribution:	Bashir before the International Criminal Court

Prosecution of incumbent Sudanese President Omar Al-Bashir has become subject of much controversies and attracted considerable attention in theory of international criminal law. Without any exaggeration, it is a touchstone of effectiveness of the International Criminal Court (ICC) as such. Presented contribution analyzes challenges and consequences arising out from arrest and surrender of Al-Bashir to the ICC.

Famous metaphor describes international criminal tribunals as giants without arms and legs which are entirely dependent on the cooperation provided by the States or international organizations. The ICC is not an exception. The crucial issue here at stake is whether the ICC may demand arrest and surrender of serving Head of State which is not a State Party to the Rome Statute. This issue incorporates two aspects which have been used by States as arguments explaining impossibility to enforce decisions issued by the ICC: (a) personal immunity of Head of State and (b) execution of an order to arrest and surrender Head of State.

In the first part, the paper assesses whether the ICC is endowed with jurisdiction over Al-Bashir. The contribution confronts doctrinal opinions with current jurisprudence of the ICC and concludes that neither customary international law nor the UN Security Council (UN SC) resolution(s) have stripped Al-Bashir of personal immunities. Next, despite negative conclusion reached in the first part, the paper analyzes meaning and role of Article 98 of the ICC Statute. Position is drawn again after examination of academic opinions and relevant case-law of the ICC.

Key Words: Sudan, Al-Bashir, International Criminal Court, personal immunity, cooperation.



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Author:	Jana Kučerová, Ph.D.
Faculty, Department:	Faculty of Medicine and Dentistry Department of Biology
Title of Conference Contribution:	Molecular biology of congenital erythrocytoses

Erythrocytosis is a state of increased red blood cell mass, characterized by increased hematocrit, erythrocyte count and hemoglobin concentration. This condition can be acquired through the lifetime for various reasons, including the presence of myeloproliferative disorder, or driven by congenital factors manifesting from childhood usually with mild symptoms.

Erythropoiesis is to a great extent controlled by circulating growth factors, mainly erythropoietin. Erythropoietin production is tied to oxygen sensing in producing kidney cells and to oxygen concentration in organism in general.

Acquired or congenital, erythrocytosis can be caused either by primary defect in hematopoietic progenitors, that respond excessively to the levels of circulating growth factors, or secondary, by an increased level of these factors, for reasons of oxygen sensing defect or actual tissue hypoxia. Rare cases of isolated erythrocytosis in childhood or familial cases point to a possible congenital cause. So far, congenital causative mutations have been found in erythropoietin receptor signaling pathway (EPOR gene), hypoxia sensing pathway (VHL, HIF2A and PHD2 genes) and in oxygen transport within the red blood cells (hemoglobin genes and BPGM), but other genes within these pathways are also among the research interest. Identification of these congenital mutations may not only help diagnosis and assess future risks for patients but also point to possible cure and provide cues for genetic counselling.

In our department we co-operate with Department of Pediatrics to identify these mutations in a group of pediatric patients with congenital erythrocytosis. So far we found causative



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mutations in 4 of them and are investigating a possibly novel combination of mutations in other pediatric patient.

Key Words: Familial erythrocytosis, polycythemia, hypoxia sensing.



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Author:	Lucie Láníková, Ph.D.
Faculty, Department:	Faculty of Medicine and Dentistry Department of Biology
Title of Conference Contribution:	β -Thalassemia Due to Intronic LINE-1 Insertion in the β -Globin Gene

Human genome is flooded with the repetitive sequences capable of moving to new locations, by process known as a retrotransposition (duplication through RNA intermediates that are reverse transcribed and inserted at new genomic locations). There are >500,000 copies of autonomous long interspersed element-1 (LINE-1) in the human genome. Most LINE-1s are inactive with only a subset of estimated 80 - 100 elements, currently functional in any individual. *De novo* LINE-1 insertions into genes such as *factor VIII*, *dystrophin* or *retinitis pigmentosa* demonstrated the mutagenic potential of active LINE-1 elements in the genesis of human disease.

We described a family with β -thalassemia due to the insertion of a full-length LINE-1 element into the β -globin gene and shown that this LINE-1 element retained the capacity for high retrotransposition frequency. This was the first example of an intact, functional LINE-1 causing human disease. We demonstrated that this retrotransposon was inserted in the antisense orientation into the 3' end of intron-2 of the β -globin gene and led to a severe reduction of β -globin gene expression due to aberrant splicing, nonsense-mediated decay, decreased production of full-length transcripts and epigenetic transcriptional repression of β -globin LINE-1 allele. Although mutations in the human globin genes have been extensively studied for a long time, this kind of molecular etiology of thalassemia has not been previously described and our results have the therapeutic implications for diseases caused by the deleterious effects of retrotransposons.

Key Words: β -thalassemia, β -globin, HBB; LINE-1, epigenetic repression.



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Author:	Aleksey Zholobenko, Ph.D.
Faculty, Department:	Faculty of Medicine and Dentistry Department of Chemistry and Medicinal Chemistry
Title of Conference Contribution:	On the mechanism of cardioprotection by the components of silymarin

Silymarin is an extract of Milk Thistle (*Silbum Marianum*) known for its hepatoprotective properties. Recently its ability to protect other organs has also been investigated. It, and its constituent compounds, have been shown to protect several of the major organs, including the heart, from ischemia-reperfusion injury. The aim of this ongoing study is to investigate, and elucidate, the mechanism of this cardioprotection by the compounds that make up silymarin.

Previous work has shown preconditioning and an adrenergic-like effect of dehydrosilybin. Uncoupling by dehydrosilybin has also been observed. As such, this study has relied on the H9c2 cardiomyoblast model to gain further insight into the processes. Oxygraphy of whole and permeabilised cells has revealed that following 1h incubation, the compounds have little effect on the oxygen consumption of H9c2 cells. However, following 24h incubation, quercetin modifies respiratory control ratios; reducing routing control ratio (<0.05). A similar effect to 24 hour incubation is observed following ischemia-reperfusion with the compounds (<0.05) with an increase in the Leak control ratio (<0.01). Oxygraphy of permeabilised cells revealed that dehydrosilybin partially protects complex I from ischemic damage, while quercetin and silybin failed to do so (<0.05). It has previously been shown in *ex vivo* systems and isolated mitochondria that quercetin may interact with ANT. Further investigation revealed that quercetin interferes with inhibition of cell respiration by atractyloside in whole cells. This adds further evidence to the hypothesis that quercetin protects cells against ischemia by uncoupling mitochondria via an ANT dependent mechanism. The results obtained point to disparate mechanisms of cardioprotection by



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quercetin and silybin/dehydrosilybin and hence multiple mechanisms of cardioprotection by silymarin.

Key Words: Ischemia- Reperfusion Injury, silymarin, silybin, quercetin, dehydrosilybin, oxygraphy.



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Author:	Dušana Majera, Mgr., Ph.D.
Faculty, Department:	Faculty of Medicine and Dentistry Institute of Molecular and Translational Medicine
Title of Conference Contribution:	Overcoming the radioresistance of DU145 cell line by combinational approach

Prostate cancer (PCa) is the most frequently diagnosed malignancy in men and the number of PCa cases is constantly increasing. The principal therapeutic approach in treatment of PCa represents radioteherapy alone or with combination of chemotherapy , however big challange of radiotherapy is to overcome radioresistance of tumors in patiens that dont respond to treatment. This is given by the different radiosensitivity of different tumor cells. Based on the existing problems in understanding and treatment of PCa, we decided to investigate and design new and more effective treatment strategies. DU145 cell line is representative model of cell line that is radioresistant even to higher radiation doses and can mimic environment of tumors from patiens that dont respond to radiotherapy. PARPi is known to sensitize some PCa cells to radiation, however we observed enhanced resistance of DU145 cells to PARPi and/or radiation. Resistance to PARPi and irradiation is caused by altered DNA damage machinery and we are investigating the role of candidate molecules in this process. First target molecule is p53 protein, which is mutated in DU145 cell line and is combined with two gain-of-function p53 alleles. This gain-of-function is responsible for Fas-induced resistance. Second molecule is BLM helicase, which we found to be upregulated in this cell line. Mutated p53 can be targeted with SAHA compound, which shows preferential cytotoxicity for mutant p53 and not wild-type p53. We confirmed that SAHA is effective for DU145 cell line cytotoxicity with clonogenic cell survival. We performed sets of experiments where we combined radiotherapy and inhibitors and revealed some combinations that have synergistic effects on cytotoxicity of DU145 cell line.

Key Words: Prostate cancer, Ionizing radiation, Radioresistance, Cytotoxicity, Clonogenic cell survival, PARPi, DU145, SAHA.



INVESTMENTS IN EDUCATION DEVELOPMENT

The conference is organized by project POST-UP II
Project registration number: CZ.1.07/2.3.00/30.0041

Author:	Michal Šiller, Ph.D.
Faculty, Department:	Faculty of Medicine and Dentistry Department of Pharmacology Institute of Molecular and Translational Medicine
Title of Conference Contribution:	Deorphanization of cytochrome P450 4X1 and its role in metabolism of mammalian alkaloids

Cytochrome P450 4X1 belongs to a group of enzymes called as orphans, since their role in human body has not been well described yet. Expression of this P450 form was detected at both mRNA and protein levels in brain, heart, kidney and to the lower extent in liver and skeletal muscles. To this date only one substrate of P450 4X1, endogenous cannabinoid – like compound anandamide, has been identified. P450 4X1 catalyzed epoxidation of anandamide at different sites which led to formation of multiple products. Unfortunately these findings have not been confirmed repeatedly. The aim of this study was to find new unique endogenous substrates of P450 4X1 using principles of untargeted analysis. Untargeted analysis of reaction mixture containing ethanolic extract of bovine brain incubated with P450 4X1 revealed a salsolinol-like compound as a potential substrate of P450 4X1. Salsolinol is an endogenous compound and is formed mostly by condensation of dopamine with acetaldehyde. It exerts multiple effects in central nervous system and is also supposed to participate in a development of Parkinson's disease. Incubation of salsolinol with P450 4X1 led to formation of a metabolite, a dopamine analogue, with opened structure in contrast to parent tetrahydroisoquinoline salsolinol. Metabolite formation was independent on hydrogen peroxide which clearly confirmed role of P450 4X1 in salsolinol oxidation. The reaction mechanism of metabolite formation was suggested and supported by fragmentation experiment using high resolution mass spectrometry and subsequently by incubation of P450 4X1 with salsolinol analogue higenamine. Results of this study have revealed an unique role of P450 4X1 in metabolism of bioactive amines which could possess a clinical relevance.



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Key Words: Orphan cytochromes P450, mammalian alkaloids, untargeted analysis, mass spectrometry.



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The conference is organized by project POST-UP II
Project registration number: CZ.1.07/2.3.00/30.0041

Author:	Pawel Znojek, Ph.D.
Faculty, Department:	Faculty of Medicine and Dentistry Laboratory of Experimental Medicine Institute of Molecular and Translational Medicine
Title of Conference Contribution:	Development and optimization of assays for high content screening platform

In the Institute of Molecular and Translational Medicine screening laboratory we attempt to develop a High Content Screening methodology which uses automated fluorescence microscopy and imaging processing tools to provide detailed knowledge about targets or compounds of interest at the cellular level. For this purpose, we are setting up a robotic station to automatize assays for screening of thousands of new chemical compounds as potential therapeutic targets. Efficient screening process requires that assays we develop must be designed for automated cell plating, addition of compounds, time lapse video-microscopy, absorbance or fluorescence measurements. Each of these methods needs to be separately validated to be able to put it into an automatic assay pipeline. Currently, we have developed assays for automated cell cycle analysis, cell cytotoxicity assay, protein-RNA interaction and genotoxicity. We also have a panel of reporter cell lines which allows us to analyse numerous cell signaling pathways. Our chemical library which consists of more than 100 000 broad diversity compounds will be tested with assays which we developed and optimized.

Key Words: High content screening, assay automatization, robotic station.



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The conference is organized by project POST-UP II
Project registration number: CZ.1.07/2.3.00/30.0041

Author:	Jitka Klugarová, Mgr., Ph.D.
Faculty, Department:	Faculty of Health Sciences Centre for Science and Research
Title of Conference Contribution:	Partial results of the postdoctoral fellow project focused on evidence-based healthcare approach and systematic review methodology

Background: Systematic review (SR), as secondary research is in the context of Evidence-Based Healthcare (EBHC) classified as the most important and valuable type of publication within the level of evidence hierarchy. The postdoctoral fellow project in Health Sciences is focused on the EBHC approach and methodology of the SR.

Aim: The main aim of this postdoc was to deepen knowledge in the EBHC field and methodology of the SR in excellent worldwide scientific centers, transfer them to our academic environment and publish in high quality scientific journals.

Results: The postdoctoral fellow attended internships in two excellent centers focused on the EBHC and the SR methodology: The Nottingham Centre for Evidence Based Healthcare in United Kingdom and Joanna Briggs Institute in South Australia. The principles of the EBHC approach were transferred to academics and students within seminars and teaching. Six papers were prepared according to the EBHC approach, and submitted in journals with impact factor or peer-reviewed journals. Currently, we are finishing the quantitative SR focused on the effectiveness of hallux valgus surgery. The importance of the EBHC approach and also partial results of this SR were presented in national and international congresses. Presentation of partial result of this SR were awarded as a best oral presentation in an international congress in Singapore. The postdoc also cooperated with the mentor on preparation of project proposals GA CR, Horizon 2020 and 7AMB – MOBILITY.

Conclusion: The EBHC approach and the SR is a very important link between the scientific evidence and their implementation into clinical practice. This postdoctoral fellow project



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enabled to establish a very important international cooperation between Czech, British and Australian University which increased our knowledge and helped us to use it and transfer into our university.

Key Words: Evidence-Based Healthcare, Systematic review, Health Sciences.



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Author:	Sunwoo Lee, Ph.D.
Faculty, Department:	Faculty of Physical Culture Department of Recreology
Title of Conference Contribution:	Development, Reliability, and Validity of a Spiritual Health Assessment Scale (SHAS)

Spiritual health is a powerful variable worth investigating in the context of health outcomes and people's quality of life. Notwithstanding many attempts to analyze spiritual well-being, however, we still do not have a single instrument to accurately quantify the construct of spiritual health. That is, it is necessary to have a reliable and stable instrument to provide a comprehensive assessment which can be applied across different domains and disciplines avoiding religious and culture bias. To develop a Spiritual Health Assessment Scale, we are to (1) construct the structured dimensions of spiritual health; (2) develop a number of measurement items based on current theoretical insights and empirical evidence; and (3) conduct statistical test to determine whether the proposed spiritual health measure is supported in terms of construct validity and reliability.

Based on a comprehensive review of empirical studies on spirituality and spiritual well-being, we theorized five underlying facets of spiritual health which are likely to be associated with people's daily spiritual experience: deeper understanding of self, relation to others, development of meaning of life, transcendence, and a sense of nature. These underlying dimensions of spiritual health provide a better understanding of how people's spiritual health is shaped in different manners by individuals. A questionnaire has been developed to measure different dimensions and aspects of spiritual health. Along with collected data, we employed a series of statistical analyses to examine the internal consistency and validity of the measured variables.

In a continued effort to promote people's health and quality life, a development of a reliable and stable instrument will allow us to systematically investigate human health related to



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spirituality. Professionals can then refer to these specific areas in the spiritual health assessment scale for more detailed evaluation, such as relations to the different health dimensions, as well as an important adjunct to intervention on clinical conditions.

Key Words: Spiritual health, spiritual health assessment scale (SHAS), scale development, quality of life.



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The conference is organized by project POST-UP II
Project registration number: CZ.1.07/2.3.00/30.0041

Author:	Jan Halák, Ph.D.
Faculty, Department:	Faculty of Physical Culture Department of Recreology
Title of Conference Contribution:	Applicability of the phenomenological method in the sport-related research

The goal of the contribution is to present the main results of the collaborative work of dr. Halák and prof. Jirásek, which is centered around the inquiry of the applicability of the philosophical method of phenomenology in the context of sport, experiential education and leisure activities. First, we shall present the results of our analysis of the current use the concept of phenomenology in the context of sport research and explain how this method is very often misunderstood and mistakenly interpreted as a sort of qualitative empirical research. Second, we shall present on the example of Eugen Fink's analysis of play how the phenomenological method can be used correctly on a sport-related phenomenon. Third, we shall present the potential of a specific set of phenomenological concepts for the interpretation of experiential education.

Key Words: Philosophy of sport, phenomenology, play, experiential education.



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The conference is organized by project POST-UP II
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Author:	Jana Sklenaříková, Mgr., Ph.D.
Faculty, Department:	Faculty of Physical Culture Department of Adapted Physical Activity
Title of Conference Contribution:	Inclusion of Students with Special Education Needs in General Physical Education

Students' attitudes and behaviors towards their peers with disabilities are important to their mutual co-existence and development. The purpose was to assess the impact of inclusive environment on the interaction behaviors between students with and without disabilities in general physical education (GPE). We investigated also interactions between students, teachers and students assistance. A design of multiple case study with elementary school age students with moderate disabilities ($n = 3$, with average age 8.5 (± 1.5) years) was used. The GPE included the collaborative learning values, teaching instructions and communication skills served as the independent measure. Dependent measures were multiple interactions between students with and without disabilities. Data to the case studies were collected through a design of mixed methods, containing both quantitative and qualitative data with a chronological writing course of teaching units with the aim to measure the social interactions. Totally 16 observation sessions of inclusive GPE settings were collected on videotapes and analyzed using the Computerized Evaluation Protocol of Interactions in Physical Education (CEPI-PE). This model was designed for observation and recording the interactions of behavior in three main categories: (1) educational, (2) physical and (3) social. All interested students received the parents' consent forms. The mean percentage of combined interaction behaviors between students with and without disabilities in GPE was measured across two instructional conditions, a five-second observation and five-second record partial interval system was applied. The obtained data were analyzed based on percentage mean scores. All three students with physical disabilities maintained high percentage of activities done independently throughout baseline and intervention phase. Qualitative data throughout field



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notes confirmed a positive class climate change and improvement in peer relation culture. With detailed analysis, we reviewed that the advice of qualified teachers during integrated physical education increased the interaction behavior between pupils with special educational needs and other peers without disabilities.

This study indicated that implementation of elements of the inclusive educational strategy into general physical education in the Czech Republic can contribute the successful cooperation between students with and without disabilities. It is important to focus on external elements that contribute to a better understanding of factors involved in increased level of inclusive physical education.

Key Words: Adapted physical activity, inclusion, physical education.



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The conference is organized by project POST-UP II
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Author:	Miriam Palomo Nieto, Ph.D.
Faculty, Department:	Faculty of Physical Culture Department of Natural Sciences in Kinanthropology
Title of Conference Contribution:	Visual contribution to walking: How is it in children with a risk of motor coordination disorder?

Research on fine motor skills have shown that children with developmental coordination disorder (DCD) rely more heavily on vision to perform movements skills than their typically developing (TD) peers. The purpose of the current study was to investigate the contribution of visual information during walking in TD children and children with risk of developmental coordination disorder (DCD_R). 32 children (21 boys and 11 girls, mean age: 8.9, SD: 0.9 years) participated in the study. According to the total test score of the movement assessment battery for children-second version (MABC-2), they were divided into two motor competence groups: sixteen TD and sixteen DCD_R children. They were asked to walk along a 10 meters walkway where the Optojump-Next instrument was installed. Participants walked in the same visual environment. They walked in self-selected speed under four visual conditions: full vision (FV), limited vision 100 ms (LM-100), limited vision 150 ms (LM-150) and non-vision (NV). For visual occlusion in LM-100 and LM-150, participants were equipped with Plato Goggles that shut for 100 and 150 ms, respectively, within each 2 sec. An eye mask was used to cover the participant's eyes in the non-vision condition. The results showed that TD children were significantly faster in speed and they walked with longer steps and strides than DCD_R children regardless the vision condition. Besides, the speed of walking and the step and stride length decrease significantly while the occlusion time increased regardless the level of motor competence. Time variables including stance phase (s), single support (s), load response (s) and pre-swing (s) were significantly different between TD and DCD_R children regardless the visual condition. In addition, only stance phase (s) and single support (s) were also significantly different between the various visual conditions regardless the motor



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competence group. The present study suggests that withdrawing and limiting the vision affect distance, speed and time parameters of the gait cycle in DCD_R more than TD children.

Key Words: Gait pattern, Vision occlusion, Motor coordination, Coordination disorder, Children, Optojump.



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The conference is organized by project POST-UP II
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Author:	Petr Šťastný, PhDr., Ph.D.
Faculty, Department:	Faculty of Physical Culture Department of Sport
Title of Conference Contribution:	The influence of increased load on lower extremity neuromuscular activity during Farmer's walk and Walking lunge exercise

Our research team performed a pilot measurement in December 2013, to improve measuring procedure. Pilot study showed methodological and technical limits, which I was resolving during my first internship at Ludwig-Maximilians-Universität München, Institute of legal medicine. The intensive consultations with elite biomechanics Dr. Wolfram Hell and Jiri Adamec helped as to perform an appropriate measurement in May 2014.

The first presentation of our results took place at Wingate Congress of Exercise and Sport Sciences (Wingate Institute in Netanya-Israel). Because we received positive feedbacks, we completed our first paper - "*Knee joint muscles neuromuscular activity during load-carrying walking*"; recently published in *Neuro Endocrinology letters* (IF 0.95).

My second internship was realized at University of Connecticut, Department of Kinesiology, where I worked with prof. Richard Bohannon. During this internship, we have started a review article resolving the reliability of hip abductor strength measurement. Another cooperation has been started with expert from Human performance laboratory, where I became acquainted with the whole spectrum of measurement methods in strength training.

Second exhibition of our results took place at 9th International Conference on Strength Training in Abano Terme (Oct. 2014). Thereafter, we submitted the article "*Does dumbbell carrying position change the muscle activity in split squats and walking lunges?*" into *Journal of Strength Training and Conditioning Research*. This article is revised after major revision.

The internship at St Mary's University resulted in cooperation with colleagues from The Jerzy Kukuczka Academy of Physical Education in Katowice. During this period we finished article



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"Gluteus Medius vs. Thigh Muscles Strength Ratio and Their Relation to Electromyography Amplitude During a Farmer's Walk Exercise", which is currently in press for March 2015 in Journal of Human Kinetics (IF 0.81). Thereafter, all I was invited in Academic committee in Journal of Human Kinetics. In current time we are finishing other articles.

Key Words: Gluteus medius, University of Connecticut, Hip abductors, strength training, powerlifting, applied biomechanics, muscles activity, effect of exercise, isokinetics.



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The conference is organized by project POST-UP II
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Author:	Kristína Tománková, Ph.D.
Faculty, Department:	Faculty of Physical Culture Department of Natural Sciences in Kinanthropology
Title of Conference Contribution:	The impact of the percent body fat and body mass index on the plantar pressure distribution during walking in middle aged women

Background: Overweight and obesity leads to serious musculoskeletal problems in reason of movement limitations and force redistribution. Specificity of obese walking is slower walking speed with reductions in step length, step frequency, longer stance phase duration, shorter swing phase, greater period of double support and greater magnitude and rate of rearfoot eversion. Several factors have been associated with increased plantar pressures, however the effects of the body composition on the plantar pressure distribution (PPD) during walking are not well known.

Objective: The aim of the study was to investigate the strength of the selected relationships between PPD parameters for foot each regions and somatic parameters. *Methods:* The study sample comprised 110 middle aged healthy women in age 45-65 years (mean age 54.58 ± 5.27 years, body height 164.3 ± 6.10 cm, body weight 73.1 ± 14.35 kg, body mass index (BMI) 27.5 ± 5.48 kg/m² and percent body fat (PBF) $36.32 \pm 8.04\%$) who were attending University of third age on the Palacký University in Olomouc (Czech republic). The plantar pressure was recorded using of pressure measurement system *footscan 7.x* (RSScan International, Olen, Belgium). Women underwent the basic anthropometric measurement of body weight (kg) and body height (cm). PBF was estimated by multifrequency bioimpedance method (InBody 720, BioSpace, Seoul, Korea). For statistical analysis was used Pearson's correlations coefficient. For next characteristics were included significant correlations with $r > 0.5$.

Results: Among middle aged women was detected only significant relationship between PBF and maximum pressure in midfoot area ($r=0.62$) and other 3 significant associations between



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BMI and PPD parameters: maximum pressure in midfoot ($r=0.67$), maximum pressure in fourth metatarsal area ($r=0.54$) and impulse in fourth metatarsal area ($r=0.55$).

Conclusions: The results proved increasing tendency of the two plantar pressure values (the maximum pressure and impulse) with increasing PBF and BMI with medium effect ($r>0.5$). The most loaded foot regions are midfoot area (longitudinal foot arch) and fourth metatarsal area (transversal foot arch).

Key Words: Plantar pressure, maximum pressure, impulse, percent body fat, body mass index, footscan, multifrequency bioimpedance method.



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The conference is organized by project POST-UP II
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Author:	Jan Šmahaj, PhDr., Ph.D.
Faculty, Department:	Faculty of Arts Department of Psychology
Title of Conference Contribution:	The Importance of Work Motivation and Self-realization

This work is theoretically grounded in self-determination theory of professors Deci and Ryan. In organisational research, work motivation has been the subject of more theories than any other topic; organisational researchers see employee motivation as a fundamental building block in the development of effective theories. Indeed, programs of research guided by expectancy-valence theory, self-regulation and goal-setting formulations, social exchange and justice approaches, and selfperspective have stimulated the development of organisational and managerial practises to promote positive worker attitudes and enhance job performance. For the above mentioned reasons are theoretically including topics as self and self efficacy. Whithin the design specification of the research project we have prepared request for cooperation, that was sent to selected specialists, research-oriented on personality issues under the workplace with a global reputation.

The partial aim was primarily build specific test that will be used for data collection. With the permission of the authors we translated and used the work extrinsic and intrinsic motivation scale. The purpose of the present research was to assess the applicability of this scale by testing its factorial structure and its psychometric properties using different work environments. The present results also support the work extrinsic and intrinsic motivation scale ability to predict positive and negative organisational criteria based on one's work self-determined motivation and work nonself-determined motivation. Work motivation should still be viewed as a multidimensional concept, with six different types of motivation lying along a self-determination continuum.

Key Words: Intrinsic and extrinsic motivation, Socio-motivational characteristics, Motive, Motivation, Personality, Job satisfaction, Psychological concepts of personality.



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Author:	Daniel Klimovský, PhD., PhD.
Faculty, Department:	Faculty of Arts Department of Politics and European Studies
Title of Conference Contribution:	Gender Quotas in Local Politics in Europe: Recent development, actual state and future challenges

Quality of local democracy has been an important political agenda more or less in all European countries for several recent decades. There are many issues linked to democratic phenomenon, and this paper is focused on measures linked to gender issue. Gender issue became a hot political issue just few decades ago. Although several interesting measures aimed at increase of the women's political representativeness have been introduced in the European countries, their outcomes vary a lot.

A main objective of this paper is to analyze as well as discuss both introductions of gender quotas in different local government systems and impacts of these quotas. For the analytical purposes, I deal with the relevant legal provisions. In addition, selected electoral results are taken into consideration too. While the first part of the paper contains a comparative description of different paths, which were taken by the European countries, the second part is rather analytical and relevant international experience and outcomes are compared there. At this point I must stress that the conclusions is of discussion nature, and further research in this field will be needed.

Key Words: Local government systems, democratic innovations, gender quotas, local politics, female politicians, Europe.



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Author:	Vlastimil Vohánka, Ph.D.
Faculty, Department:	Sts Cyril and Methodius Faculty of Theology Department of Philosophy and Patrology
Title of Conference Contribution:	The Moral and Modal Epistemology within the Material Value Ethics of Dietrich von Hildebrand

The ethics of the German philosopher Dietrich von Hildebrand (1889–1977) systematizes and ranks ethics values that should entail ethical laws. The ethics is “material” in not being formal: certain relatively ethical values and laws are claimed by Hildebrand to obtain and to be known apart from very general – formal – ethical values and laws. Now how are we supposed to know that there are any ethical values and laws at all, and also what they are? Hildebrand says we know this by intuition of their necessity, grounded in their essences. Critics of material value ethics have deemed this reply a sheer drivel – an obscure soft point at the very epistemological and ontological basis of all material value ethics whatsoever (not only that of Hildebrand). But before one jumps to this dismissive conclusion one should understand what exactly Hildebrand means. Yet this understanding has been rarely, if ever, attempted even by the advocates of Hildebrand. In my conference contribution, I present some results of my research into this and related issues. I’ve pursued it by taking a step back and looking closer at Hildebrand’s views in modal epistemology – the theory of knowing what is or isn’t possible or necessary. These views are, surprisingly, best detailed in his remarks about how we know that *natural* (not moral) laws are *not* necessary. Although the remarks have their own problems, as I argue in my papers, at the same time they provide further cues, unstated by Hildebrand himself, for a reply to the latter of the above two questions: how are we supposed to know what ethical values and norms are?

Key Words: Axiological ethics, Ethical intuitionism, Modal epistemology, Laws of nature.



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The conference is organized by project POST-UP II
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Author:	Dana Cibáková, Mgr., Ph.D.
Faculty, Department:	Faculty of Education Department of Czech Language and Literature
Title of Conference Contribution:	Activities to stimulate of cognitive functions

The aim of this paper is to introduce incentive instruments aimed at stimulating cognitive functions. Based on these tools, we have developed their own activities, which we subsequently used in research. Follow the steps recommended in the use of instruments we maintain, thematically and use different types of tasks we have modified the terms of our research. Tools that we introduce and demonstrate how they were used for our research are the Israeli professor David Tzuriela and American professor R. Mogens Jensen. Both professors in the development of these tools are based on the theory of mediated learning R. Feuerstein, and as a result, their own programs, which are aimed at assessing and stimulating cognitive skills. By Professor D. Tzuriela we were inspired by a tool called - Children's Inferential Thinking Modifiability Test. The second instrument, which we modified form used in the research are from a file called MindLadder, namely the types of tasks and Substitutions Logic boards.

Key Words: Reading Literacy, Linguistic Processes, Cognitive Processes, Levels of text Comprehension.



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The conference is organized by project POST-UP II
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Author:	Ivana Lištiaková, Mgr., PhD.
Faculty, Department:	Faculty of Education Institute of Special Education Studies
Title of Conference Contribution:	Drama Therapy in International Context

The conference contribution presents personal experience of the scholar during her visits at drama therapy programs at New York University, and Sesame Institute in Ireland. She presents the structure of the study program, offered knowledge and skill training, as well as the choice of teaching methods. There are cultural specifics of the training, such as financial demands on the students, which influences the spectrum of the students and their motivation. Personal experience is put in the theoretical framework of different drama therapy approaches and their comparison. This theoretical background serves as a platform for research in evaluation in drama therapy. The author presents some results of researches into the methods of evaluation in drama therapy.

Key Words: Drama therapy, approaches in drama therapy, evaluation, research.



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Author:	Tomáš Ligurský, Ph.D.
Faculty, Department:	Faculty of Science Department of Mathematical Analysis and Applications of Mathematics
Title of Conference Contribution:	Piecewise-Smooth Parameter-Dependent Steady-State Problems

Consider the parameter-dependent steady-state problem:

Find $(\gamma, x) \in I \times X$ such that
 $H(\gamma, x) = \mathbf{0}$,

where γ is a parameter varying over an interval of interest $I \subset \mathbb{R}$, x is a state variable belonging to a set $X \subset \mathbb{R}^N$, and $H: I \times X \rightarrow \mathbb{R}^N$. This problem arises typically by discretisation of an equilibrium mathematical model with parametrised data. One is often interested in solution structure of such a problem in diverse scientific as well as engineering fields.

If H is smooth, the problem is quite well understood from the theoretical point of view and a great variety of methods has been constructed for its numerical treatment. On the other hand, models from many applications can be naturally formulated as systems of *non-smooth* equations. For instance, let us mention discretised frictionless and frictional contact problems in solid mechanics. In general, important classes of variational inequalities, complementarity problems and constrained optimisation problems can be reformulated in this way. Nevertheless, the question of continuation or bifurcation of solutions of non-smooth problems is very much open to our knowledge.

In our research, we have been dealing with the case when H is *piecewise smooth*. In particular, we have analysed theoretically local behaviour of the solution set of the problem around a point of non-smoothness, and we have developed techniques of numerical continuation and bifurcation. The obtained results have been applied to discretised plane contact problems with friction.

Key Words: Continuation, local bifurcation, numerical method, steady-state problem, piecewise smooth, contact, friction.



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The conference is organized by project POST-UP II
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Author:	Martina Chvosteková, Ph.D.
Faculty, Department:	Faculty of Science Department of Mathematical Analysis and Applications of Mathematics
Title of Conference Contribution:	Statistical Intervals

Statistical intervals have applicability in many disciplines. The type of interval to be used obviously depends on the underlying problem and application. A confidence interval is usually used to provide bounds for an unknown scalar distribution parameter such as the distribution mean, standard deviation, etc. A prediction interval is used to provide bounds for one or more future observations from a sampled distribution. A tolerance interval is used to provide bounds which contain a specified proportion or more of the sampled distribution with a prescribed confidence. The tolerance interval provides information on the entire distribution.

In our contribution we deal with the statistical intervals in the multiple linear regression model with independent normally distributed errors. The regression model is used to model the relationship between a univariate response variable and one or more covariates. The statistical intervals in the linear regression model are based on a vector of observations. The treatment of a $(1 - \alpha)$ -level one-sided confidence band for 100γ th percentile line is equivalent to the simultaneous $(1 - \alpha, \gamma)$ one-sided tolerance intervals, but there is no connection between the two-sided confidence band for the percentile line and the simultaneous two-sided tolerance intervals. We suggested a new procedure for computing the simultaneous two-sided tolerance intervals in the regression model and a new procedure for determining the two-sided confidence band for a percentile line.

Key Words: Confidence interval, tolerance interval, linear regression.



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Author:	Marco Cerami, Ph.D.
Faculty, Department:	Faculty of Science Department of Computer Science
Title of Conference Contribution:	Dispersion control in high-resolution correlation imaging

During these two year work at the Department of Computer Science of the Palacký University I have focussed my research interests on some theoretical problems related to finite-valued Fuzzy Description Logics.

In 2013 we developed a Fuzzy Description Logic based on the fuzzy logic of a finite BL-chain. The aim of this work is setting the basis for further researches on the field by defining the formalism with a clear semantics, strictly related to theoretical works in the tradition of Mathematical Fuzzy Logic.

All the works published in the recent literature about the computational complexity of reasoning in finite-valued Fuzzy Description Logics proved that the complexity of the languages studied is the same as for the corresponding two-valued languages. So, a question that naturally arises is whether the finite-valued framework really constitutes a different formalism than the two-valued one.

In a latest publication we provided an analysis of the potential sources of non-determinism that can be present in a finite-valued Fuzzy Description Logic and are not present in the corresponding two-valued languages. The aim of this work was finding a difference, in the complexity of the analyzed languages, between the finite- and the two-valued formalisms. However, the languages studied in this work still confirmed a coincidence between both frameworks.

An answer to the question arrived thanks to the collaboration with researchers from the TU Dresden, where I have spent four months of visiting period. In a work, written during this



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visiting period, we finally prove that there is a difference in the complexity between both formalism in a very basic fragment that is common to every description language.

Key Words: Fuzzy Description Logic, Mathematical Fuzzy Logic, Finite t-norms



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Author:	Natsaran Saichana
Faculty, Department:	Faculty of Science Department of Chemical Biology and Genetics
Title of Conference Contribution:	A radical SAM enzyme PqqE from <i>Methylobacterium extorquens</i> AM1 is unusually tolerant to dioxygen

Pyrrroloquinoline quinone (PQQ) is an aromatic, tricyclic *o*-quinone that serves as a cofactor for a number of prokaryotic dehydrogenases. *Methylobacterium extorquens* AM1 is an aerobic facultative methylotroph known to secrete PQQ into the culture medium. Genes encoding the components of PQQ biosynthetic pathway in this bacterium are *pqqABC/DE* and *pqqFG*. To elucidate the molecular mechanism of PQQ biosynthesis, we are focusing on PqqE which is believed to be the enzyme catalyzing the first reaction of the pathway. PqqE belongs to the radical *S*-adenosyl-L-methionine (SAM) superfamily, in which most, if not all, enzymes are very sensitive to dissolved oxygen and rapidly inactivated in the presence of O₂. In this study, PqqE from *M. extorquens* AM1 is markedly O₂-tolerant. It was efficiently expressed in *Escherichia coli* cells grown aerobically and purified under atmospheric conditions. The purified PqqE was found to be functional as it showed reductive SAM cleavage activity and could be stored in a refrigerator at least for several days in the presence of 10% glycerol without losing substantial activity. The nature of its cofactor was further investigated by site-directed mutagenesis of the conserved Cys-residues believed to be the binding sites of Fe/S clusters. It is expected that PqqE from *M. extorquens* AM1 serves as a convenient tool for studying the molecular mechanism of PQQ biosynthesis, avoiding the necessity of establishing strictly anaerobic conditions.

Key Words: *Methylobacterium extorquens* AM1, PqqE, PQQ, radical SAM.



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Author:	Sanja Ćavar Zeljković, Ing., Ph.D.
Faculty, Department:	Faculty of Science, CRH Department of Protein Biochemistry and Proteomics
Title of Conference Contribution:	Synthesis of natural and synthetic aromatic strigolactones

Strigolactones (SLs) have been recently recognized as a new family of phytohormones. They have been suggested to act as long distance branching factors that suppress the growth of preformed axillary shoot buds, thereby fulfilling the characteristics of a new group of plant hormones. However, SLs were known for almost 50 years as germination stimulants of the parasitic plants *Striga* and *Orobancha*, and later, as stimulants of hyphal branching of symbiotic arbuscular mycorrhizal (AM) fungi. Isolation and identification of germination stimulants is extremely difficult due to the minute amounts present in the root exudates (estimated production of stimulant per plant is 15 pg per day). As the natural stimulants are difficult to obtain and their total synthesis is very elaborate, and synthetic analogues with simpler structures, GR24 and thia-GR24, have been prepared. The use of Stobbe condensation of benzaldehydes with dimethyl succinate, Friedel-Crafts acylation, and subsequent reduction with sodium borohydride followed by acid-catalyzed lactonization gave aromatic ABC lactone. This core structure was later formylated and subsequently treated with bromobutenolide to obtain synthetic SL analogues. Thia-analogue was prepared in similar manner, involving thionation step prior coupling with D-ring.

Moreover, using same strategy, a naturally occurring strigolactones solanacol has been prepared. This synthesis presents shorter and more efficient way than those present in literature. Oxidation at C4 of ABC lactone was accomplished using *tert*-butylhydroperoxide in the presence of manganese(III) acetate, giving the ABC scaffold with a C4 keto group. Remarkably, no oxidation of the methyl groups at the A-ring was observed. Attachment of the D-ring was performed by formylation of the ABC scaffold with the C4-keto group and



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subsequent treatment with bromo butenolide to give the keto derivative of solanacol. Selective Luche reduction of the oxo group gave the C4 syn alcohol, which is inverted into the C4 anti epimer by a Mitsunobu procedure to give the desired (racemic) solanacol in a good overall yield.

Key Words: Strigolactones, GR 24 analogues, Solanacol, Synthesis.



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Author:	Saima Imran, Ph.D.
Faculty, Department:	Faculty of Science Department of Cell Biology and Genetics
Title of Conference Contribution:	The Expression of Aryl Hydrocarbon Receptor (AhR) Target Genes in Brain Cell Lineages Using Human SHSY5Y, Neural Stem Cell And Human Induced Pluripotent Stem Cell Differentiated Matured Neurons.

Aryl hydrocarbon receptor is mainly known as the mediator of toxicity of certain xenobiotics. In addition the role of this receptor in environmental pollutants-mediated toxicity, it has been reported in many physiological processes, like immunity, differentiation or apoptosis. The mechanism of expression and regulation of AhR and its targeted genes in human brain cell lineages is still needed to be discovered in detail. Keeping the significance of this nuclear receptor in view, we monitored the inducible expression of AhR targeted genes, namely CYP1A1 and CYP1B1 in response to the treatment with TCDD, which is the most potent and widely accepted activator of AhR. We used three different models for this purpose, human neuroblastoma cell line SHSY5Y differentiated to mature neuron-like cells, human neural embryonic stem cells (hESC), differentiated into matured neurons, oligodendrocytes and astrocytes and human induced pluripotent stem cells (IPSCs), differentiated into matured neurons.

Key Words: AhR, CYP1A1, CYP1B1, Neuroblastoma, hESC, IPSCs.



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Author:	Zoila Gándara Barreiro, Ph.D.
Faculty, Department:	Faculty of Science Laboratory of Growth Regulators
Title of Conference Contribution:	New 9-deaza analogues of cytokinins as tools to study mechanism of cytokinin receptor activation

Cytokinins (CKs) act in plants as signalling molecules at very low (nanomolar) concentrations and their interaction with a specific receptor represents a crucial step leading to conversion of the signal into a specific biological response. CK signalling system is a two-component signaling (TCS) pathway comprising of the CK receptor and the down-stream proteins. The function of Arabidopsis histidine kinases (AHKs) as CK receptors was proved by heterologous complementation of HK-dependent pathways in yeast (Inoue et al. 2001; Ueguchi et al. 2001; Suzuki et al. 2001) and bacteria (Suzuki et al. 2001; Yamada et al. 2001) engineered to express HKs.

With the aim to provide novel information on functional architecture of ligand-binding domains in this class of receptors we wanted to compare activity of natural CKs with their 9-deazapurine analogues. The main aim is to clarify potential role of N9 interaction within the AHK binding site to activate the receptor.

Key Words: Cytokinin, N9-deazapurine, ligand specificity, AHK, receptor.



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Author:	Helena Saldanha, Ph.D.
Faculty, Department:	Faculty of Science Department of Analytical Chemistry
Title of Conference Contribution:	Mass spectrometry in evaluation of seed dormancy levels in legumes

Timing of seed germination is one of the key steps in plant life cycles. Germination is driven by ability of a seed to develop in appropriate conditions. However, not only convenient conditions ensure development of all present individuals in a given set of seeds. The property describing the percentage of seeds which remain inactive in appropriate conditions is dormancy. Dormancy level is a key factor for effective production in crops.

The objective of this study was to develop an effective methodology to distinguish dormant legume types (wild) from non-dormant (agriculturally utilizable) ones based on chemical analysis and to find what compounds are responsible for dormancy. Matrix assisted laser desorption ionization mass spectrometry appeared to be a useful technique to directly study the chemical composition of pea seed coat, first of all the upper-most layer (i.e. hydrophobic cuticle). On the other hand, ultra-performance liquid chromatography/mass spectrometry of seed coat extracts allowed estimation of the average composition of the seed coat.

Principal component analysis of the raw data obtained by both techniques allowed resolution of dormant from non-dormant samples. A number of m/z values (signals in MS spectra) appeared to have significantly different intensities in dormant and non-dormant genotypes and thus contribute to their segregation. Among the signals galocatechin dimer and trimer and hydroxylated fatty acids (e.g. hydroxy and dihydroxyhexacosanoate) were unambiguously identified and suggested to be markers of dormancy.

Key Words: Dormancy, legumes, markers, mass spectrometry, principal component analysis, seed coat.



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Author:	Pavla Kučerová, Mgr., Ph.D.
Faculty, Department:	Faculty of science Department of Analytical Chemistry
Title of Conference Contribution:	Fibre syringe electrodes for direct desorption to injection space of gas chromatography/mass spectrometry

The coupling of electrochemistry to chromatographic techniques and mass spectrometry is a quickly growing research field in analytical chemistry. Especially coupling of electrochemistry to liquid chromatography mass spectrometry (LC/MS) is expanding to the different research areas including the simulation of metabolism reactions for pharmaceuticals. While only a limited number of published studies is focused on coupling of electrochemistry and gas chromatography mass spectrometry (GC/MS) for investigation of oxidation products or the simulation of metabolism reactions.

We applied a novel technique of oxidation products analysis using GC/MS. The technique utilizes an adsorption of oxidation products on working electrode surface. Graphite or platinum fibre syringe electrodes were constructed for direct desorption to injection space of GC/MS. The main advantage of the technique is its simplicity. The fibre serves as working electrode in three-electrode system. An electrochemical active compound is oxidized using controlled potential electrolysis and the adsorption of the oxidation products is highly desired. The adsorbed products are subsequently identified without any pretreatment by GC/MS. Conditions of the electrolysis has to be optimized to achieve both the sufficient electrochemical conversion and the highest products adsorption. A presence of an organic solvent commonly inhibits the adsorption therefore the aqueous media are more efficient for the technique. We proved the technique on electroactive compounds with a known electrochemical behaviour.

Key Words: Gas chromatography, Mass Spectrometry, Electrooxidation, Adsorption, Desorption, Fibre syringe electrode.



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Author:	Malte Kokoschka, Dr. rer. nat.
Faculty, Department:	Faculty of Science Department of Physical Chemistry
Title of Conference Contribution:	TMADB a QM-benchmark database for druglike Platinumcomplexes

A benchmark database containing quantum mechanical data on geometries and dissociation energies of druglike platinum complexes was developed, which allows the assessment of the accuracy of different computational methods. Such accuracy assessments are important to allow a proper choice of the computational method in the theoretical characterization of the interaction between druglike platinum complexes and biomolecules. Of importance is not only the calculation of benchmark and reference data, but also the development of the appropriate database structure and useful query mechanisms. Both points will be addressed in the talk.

Key Words: DNA, Cisplatin, Cytotoxic Platinum complexes, Cancer Chemotherapy, QM, SQM, DFT, MD, benchmark.



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Author:	Manoj B. Gawande, Ph.D.
Faculty, Department:	Faculty of Science, RCPTM Department of Physical Chemistry
Title of Conference Contribution:	The Rise of nanomaterials – Advanced Synthesis and catalytic applications

Sustainable nanomaterials have attracted great attention as highly functionalized nanocatalysts in diverse forms including solid-supported nanocatalysts, graphene materials, and core-shell catalysts among other nanostructures. Technology advancements in last decades have allowed the development of increasingly sustainable heterogeneous catalysts; catalytic materials can now be prepared with greater precision via nanotech-enabled processes. Metal supported nanoparticles which often serve as active catalytic components can be synthesized in an environmentally friendly manner with well-defined sizes, shapes, crystal facets, structure, and composition. Our recent activity pertaining to the development of novel nanomaterials-based methodologies will be highlighted including the use of supported metal and metal oxides and related nanostructures



Key Publications- Gawande *et al.* *Account of Chemical Research* 2014, 47, 1338–1348; *Chemical Society Reviews* 2013, 42, 3371–3393; *Green Chemistry* 2013, 15, 1895–1899,



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DOI: [10.1016/j.ccr.2015.01.001](https://doi.org/10.1016/j.ccr.2015.01.001).

Key Words: Sustainable Nanomaterials, Magnetic Nanocomposites, Core-shell Nanomaterials, Graphene-Supported Nanocatalyst, Catalytic Applications.



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Author:	Žofie Sovová, Ph.D.
Faculty, Department:	Faculty of Science Department of Physical Chemistry
Title of Conference Contribution:	Are current stratum corneum lipid matrix model able to describe the system on molecular level?

Stratum corneum (SC) is the uppermost layer of epidermis of mammals, birds and reptiles. It prevents uncontrolled water loss and acts as a barrier to penetration of exogenous substances into body.

According to the generally accepted brick and mortar model, SC is composed of nonviable cells (bricks) embedded in a lipid matrix (mortar). In contrast to well studied phospholipid mammalian plasma membrane, SC lipid matrix (SCLM) is composed mainly of ceramides, cholesterol and free fatty acids. It is almost anhydrous and is at physiologically relevant temperature in the rigid gel phase.

Several models of SCLM have been proposed based on various experimental data. These models differ not only in arrangement of SC lipids but also in the necessity of certain lipid class for its proper architecture.

We have tested stability and geometry arrangement of these models by coarse-grained (CG) molecular dynamics (MD) simulations. This is an challenging issue, because no CG simulation of any highly ordered system that is not able to adopt lamellar fluid phase has been reported. Development of new methodology was needed.

Our simulations showed, that two out of four models are not able to preserve lamellar arrangement and one other shows considerably different geometry than proposed. Only one model preserved the proposed architecture and geometry over the whole 40 μ s MD simulation. Interestingly, this model was proposed independently by two groups using different experimental techniques.

Key Words: stratum corneum, molecular dynamics, coarse grain, lipid, force field.



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Author:	Marek Rác, Mgr., Ph.D.
Faculty, Department:	Faculty of Science Department of biophysics
Title of Conference Contribution:	Formation of electronically excited species and their role in ultra-weak photon emission

Ultra-weak photon emission originates from the relaxation of electronically excited species formed in the biological systems such as microorganisms, plants and animals including humans. Electronically excited species are formed during the oxidative metabolic processes and the oxidative stress reactions that are associated with the production of reactive oxygen species (ROS). The review attempts to overview experimental evidence on the involvement of superoxide anion radical, hydrogen peroxide, hydroxyl radical and singlet oxygen in both the spontaneous and the stress-induced ultra-weak photon emission. The oxidation of biomolecules comprising either the hydrogen abstraction by superoxide anion and hydroxyl radicals or the cycloaddition of singlet oxygen initiate a cascade of oxidative reactions that lead to the formation of electronically excited species such as triplet excited carbonyl, excited pigments and singlet oxygen. The photon emission of these electronically excited species is in the following regions of the spectrum (1) triplet excited carbonyl in the near UVA and blue-green areas (350–550 nm), (2) singlet and triplet excited pigments in the green-red (550–750 nm) and red-near IR (750–1000 nm) areas, respectively and (3) singlet oxygen in the red (634 and 703 nm) and near IR (1270 nm) areas. The understanding of the role of ROS in photon emission allows us to use the spontaneous and stress-induced ultra-weak photon emission as a non-invasive tool for monitoring of the oxidative metabolic processes and the oxidative stress reactions in biological systems in vivo, respectively.

Key Words: Reactive oxygen species, singlet oxygen, triplet excited carbonyls, ultra-weak photon emission.



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Author:	Vít Procházka, Ph.D.
Faculty, Department:	Faculty of Science Department of experimental physics
Title of Conference Contribution:	Crystallization of amorphous iron-based alloys

Kinetics of the crystallization process of Fe-based metallic glass is studied to fine details during heat treatment under external magnetic field by means of Nuclear forward scattering (NFS).

Nuclear Forward Scattering is a physical experimental method based on observation of Mössbauer effect. Incident radiation is scattered by nuclei ensemble exhibiting hyperfine splitting and the delayed photons are acquired to resulting interferogram. This interferograms provide information on valence state and magnetic and structural ordering as Mössbauer spectroscopy.

Thanks to the enormous intensity of synchrotron radiation the resonant photon flux NFS is a powerful tool for in-situ experiments. Amorphous Fe-based alloys are under interest mainly as a soft magnetic materials offering decrease of energy losses in electric transformers. Magnetic properties are strongly coupled to the atom arrangement in the material. Overcoming critical temperature causes partial reordering of the atoms and nanocrystals grow in the amorphous matrix. The crystallization process of Fe-based alloys were investigated with respect to applied weak magnetic field. The onset of crystallization starts earlier when low magnetic field ($0.652 \sim T$) is applied. Not only the onset of the crystallization accelerated but the final state of the annealed alloy is also affected by the applied weak external magnetic field. Based on reported results, the amorphous alloys were modified by deposition of magnetic layer which boosts the crystallization. Such modification can leads to number of application as magnetic sensors and microelectronic devices.

Key Words: Nuclear resonance scattering, mettalic glasses, amorphous alloys.



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