

International Conference of Humboldt-Kolleg Series in Kiev, Ukraine

“Humboldt Cosmos: Science and Society”.(H_CS² -Kiev2009)

www.humboldt.org.ua/kolleg

19-22 November, 2009

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Main topic:

Cosmology & astrophysics experience in S² – science&society.

Additional topics:

Mathematical & analytical method implications in S² – science&society.

Geopolitics & economy in Society.

Venue:

**The Kiev Main Astronomical Observatory of Ukrainian National Academy of
Science, Acad. Zabolotnogo str., 27.**

The Taras Shevchenko National University of Kiev, Volodymyrsjka str., 60.

**The Astronomical Observatory of the Taras Shevchenko National University of
Kiev Observatorna str., 3.**

Introduction

***“The Starry Sky Above Me and
the Moral Law Within Me”***

Immanuel Kant

The Humboldt-Kolleg “**Humboldt Cosmos: Science and Society**” ($H_C S^2$ -Kiev2009, www.humboldt.org.ua/kolleg) is organized by the Humboldt-Club Ukraine in close cooperation with the German Embassy, kindly supported by the Alexander von Humboldt Foundation and contributes to “the Days of German Science and Research in the Ukraine”. The Club continues on the series of recent Humboldt-Kollegs organized by Humboldt-Clubs in Poland, Belarus, Moldavia and the Ukraine and follows the best traditions promoting, in particular, young researchers. The Kolleg aims to address multidisciplinary issues of various aspects of S^2 - Science and Society and the scope is not limited, therefore, by the mentioned above main groups.

In the International Year of Astronomy 2009 (<http://www.astronomy2009.org/>) particular attention is, naturally, devoted to Astronomy, Astrophysics & Cosmology, especially, their impact in modern science, technology, economy, philosophy, theology, religion and/or Society. The childhood from Immanuel Kant cited above is brought, thereby, by the International Astronomical Union and UNESCO to a new global level in understanding and exploring by the Society a place in the Universe. Respectively, some of the Kolleg events occur at astronomical places in Kiev: historical – the Astronomical Observatory of the Taras Shevchenko National University of Kiev, and modern - the Kiev Main Astronomical Observatory of Ukrainian National Academy of Science.

Moreover, the invited plenary talks at the first day of the Kolleg opening will discuss the modern status of monitoring problems of the Space, the Solar System and the Earth with the use of the Earth based and the Cosmic Satellite based observatories emphasizing, thereby, the importance of multipoint measurements in space plasma to reveal the multiscale MHD/kinetic nature of nonlinear physical processes controlling the key elements in the chain of solar-terrestrial relations (Prof. Dr. L.M. Zelenyi, Space Research Institute (IKI) of Russian Academy of Sciences), as well as the history of Astronomical observations their place and role in society development (Prof. Dr. B.I. Hnatyk, Astronomical Observatory of the Taras Shevchenko National University of Kiev).

The further scientific program explores such a direction. The parallel Half Plenary Sessions will address I- the composition, the main energy production mechanisms in the Universe and the energy sources fundamentals at the Earth based environment as well as II- various mathematical and analytical methods. Geopolitical and economical aspects will be mainly concentrated on *Kondratyev waves* and modern view on reasons and periodicity of crises, Significance and relationship for the support of projects and individuals in science.

Kondratyev Vladimir
Kolleg chairman

Plenary Lectures

SPONTANEOUS RECONNECTION IN COLLISIONLESS PLASMA THE KEY CHAIN OF SOLAR-TERRESTRIAL RELATIONS

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Complicated magnetic configurations containing numerous magnetic field reversals are widespread in nature. Each of such reversals is supported by corresponding current sheet (CS) which could often have very small thickness comparable to ion skin depth. Particle motion in such sheets has many specific features, because standard guiding center description completely fails especially for ions. The implications of this fact and the emerging chaotic dynamics have been investigated in a series of papers by L. Zelenyi and his colleague from the Max-Planck Institute (Kattlenburg-Lindau) Professor Jorg Buechner.

Since the beginning of Space Age ‘in situ’ investigations of current sheets in the Earth’s magnetopause and magnetotail acquired one of the highest priorities in national space programs and became one of the cornerstones of various international activities, like ISTP, IACG, ILWS, which appeared to be very effective. Intense theoretical efforts were undertaken by theorists all over the world to develop both equilibrium models of current sheets and analyze their stability and further nonlinear evolution. Lack of collisions and smallness of many characteristic scales in comparison with ion Larmor radius made an application of the straightforward MHD approach rather questionable.

One of the most intriguing features of current sheets in collisionless plasma is their ability to accumulate tremendous amounts of magnetic energy (10^{15} J for magnetospheric substorms, 10^{24} J for solar flare associated sheets) and then suddenly sometimes almost explosively release them. We will demonstrate in this talk that such METASTABILITY is a principal intrinsic feature of current sheets in a hot plasma. Very intense theoretical debates of 80-ies and late 90-ies resulted in some consensus that current sheets with the small component of magnetic field normal to their plane become overstable for spontaneous reconnection (i.e. versus the development of ion tearing mode). Analysis of the data of INTERBALL and especially 4-point CLUSTER missions have shown that real current sheets observed in the Earth’s magnetotail very rarely resemble simplistic HARRIS current sheets which have been used for an early stability calculations. Realistic effects (anisotropy, embedding, layering, bifurcations) could be taken into account in a framework of so called quasiadiabatic CS model, which takes into account the drastic difference and dynamic of ions and electrons.

The extensive database of a few seasons of CLUSTER magnetotail crossings provided a convincing demonstration of the ability of analytical/numerical quasiadiabatic models to explain practically the entire variety of observed CS magnetic profiles.

The margin of a free energy to drive spontaneous instabilities is significantly higher for such sheets in comparison with a simple bell-shaped Harris’s ones. Instead of being overstable anisotropic thin CS become METASTABLE and acquire few narrow, but finite

windows of instability, which once started produces at its nonlinear stage irreversible modification of magnetic topology resulting finally to the release of a stored magnetic energy. Satellite observations could verify this concept potentially very important for other applications in space and laboratory plasmas. Location of the site of the initial reconnection onset is still the subject of intense debates. Recently launched THEMIS global satellite network (contrary to CLUSTER it has large separation between spacecraft) hopefully will shed a new light on this long lasting problem of space physics.

This work was supported by HUMBOLDT Foundation and Russian Foundation for basic research (N 07 02 00319) and Russian Ministry of Science program (HIII-472.2008.2). L.M.Z. is grateful for hospitality to the Max-Planck-Institute für Sonnensystemforschung and his German host Professor J.Buechner

ASTRONOMY AND SOCIETY

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IAU (<http://www.astronomy2009.org/general/>) declares: “The International Year of Astronomy 2009 is a global effort initiated by the International Astronomical Union (IAU) and UNESCO to help the citizens of the world rediscover their place in the Universe”. We discuss the history of astronomical observations, their place and role in society development. Especially we analyze the impact of recent results of astroparticle physics on the understanding our place and mission in the Universe. Contemporary astrophysics becomes a unique experimental base for modern theory of fundamental interactions. It deals with energies up to Planck ones (10^{28} eV), which are considerably larger than expected Large Hadron Collider (LHC, CERN) scale 10^{13} eV. Recent discoveries of dark matter and dark energy lead to a new view on the structure and evolution of our Universe: in so called brane cosmology our Universe is only one cell of huge inflationary Multiverse with about 10^{500} other universes. Different universes have different properties depending on the local values of the scalar fields, compactifications, etc. We discuss the anthropic arguments and future of our Universe and terrestrial and extraterrestrial civilizations.

Cosmology & astrophysics experience in S² – science&society

PASSIVE THERMAL CONTROL SYSTEMS FOR SPACE INSTRUMENTS MAKING – SCIENTIFIC BACKGROUND, QUALIFICATION, EXPLOITATION IN SPACE

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Passive thermal control systems (TCS) are one of obligatory system of any space mission, used as on large spacecraft and microsattellites Supporting of required temperature range for space instruments is supported by rational design of TCS with optimal choice of main thermal control components such as multilayer insulation, optical coatings, heat conductive elements, heat insulation supports, thermal conductive gaskets, radiating surfaces and other elements. New ideology in TCS design has come after appearance of new element – heat pipe(s) which is a super heat conductive thermal conductor with constant or variable thermal properties. This gave the possibility to transfer heat fluxes on distances 1-2 m with very small temperature drops (couple grad K) and to regulate the temperature of instruments by passive way. Promotion of this new element into space practice is executed more efficient way if the cooperation of developer and consumer has a stable and international basis. During last 15 years National technical university of Ukraine “Kyiv polytechnic institute”, Ukraine and Institute for space systems (German Aerospace Center, DLR) coordinated mutual efforts in field of the elaboration of passive TCS of new generation and their implementation into international space projects. This way from theory to practice has included the following important steps: elaboration of scientific basis for TCS design, adaption of technological and manufacture lines, TCS design, qualification of Ukraine- made hardware according to European standard ESA PSS-049, implementation of the units into space mission surrounding, the analysis of flight thermal performance of TCS and dedicated instruments during mission flow.

The proposed technical solutions include the following important for space instrument making tasks: passive radiative cooling of CCD of optical systems (temperature -100...-40 °C, power dissipation till 10 W, operation undependably of solar direction), passive cooling of large size CCD of optical systems (temperature 10 ...25 °C, power 20 W), autonomous passive cooling of electronic equipments and components of equipment (temperature 10..40 °C), TCS for microsattelite (mass up to 100 kg, sizes up to 0,7 m, temperature 10 ...25 °C, average power 40 W, peak power 200 W), hardware and methodic of optical properties measurements for thin foils of solar sails, test equipment and method for heat pipe qualification according to European requirements, full qualification program for space components, etc.

The elaborated TCS have been used in world-known international projects OZD, MARS96, BIRD, Solar Sail, TET and now are planned for new Project of DLR

AsteriodFinder. The elaborated thermal equipment has high reliability and works on near Earth orbit more 8 years.

Mutual activity has been supported by DLR, DAAD, DFG, BMBF (German side) and side by Ministry of science and education of Ukraine (Ukrainian side). Subject of this paper to present the possible ways of TSC usage in near Earth and far space missions.

BURNING THE NUCLEAR FUEL

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Nuclear reactions are commonly recognized to give the predominant basic energy source for an evolution of the Universe. Studies of atomic nuclei are crucial, thereby, for learning and exploring such a renewable nuclear fuel. In this contribution we briefly outline some recent advances in studies of nuclide properties important for processes powering the *engines* driving many sites of nature, e.g., life on the Earth, an evolution of stars, galaxies etc.

These are the fusion reactions of light nuclei that give the predominant energy component in stars. Iron gives then the final ash for nuclear reaction sequences at hydrostatic burning. The thermonuclear fusion reactors are the respective counterpart at the Earth based environment. Magnetically confined fusion plasma, or Tokamak reactors (and experimental facility ITER) are viewed as reliable direction for future fusion power plants producing electricity.

Nova and supernova represent promising astrophysical site candidates for synthesis of heavy atomic nuclei and renewing other nuclear components. Magnetization of hot dense astrophysical plasma in vicinity of the neutrino-sphere makes plausible explosion mechanism and can leave its trace in nucleosynthesis [1]. Such spectacular astronomical phenomena yield, in particular, the actinides containing basic fuel for nuclear fission reactors, among others. As we emphasize the efforts towards a better understanding of astrophysical nuclear transmutation problems are important not only for fundamental research, but capable to explore new ideas for nuclear fuel cycle technology. For instance, the problems of high-level toxic radioactive waste might be overcome by, e.g., construction and operation the Transmutation Facilities (e.g., Accelerator-Driven System - ADS) including the nuclear reaction networks similar to those occurred at nucleosynthesis in astrophysical plasmas. Therefore, joint efforts in nuclear astrophysics and nuclear technology would be highly beneficial for both sides, and can provide an opportunity for a contribution to the solution of problems surrounding decommissioning and utilization of spent fuel and the nuclear powerplants themselves, especially, annealing the radioactive toxic nuclear waste, cf. [2] and refs.therein.

1. V.N. Kondratyev, I.M. Kadenko, *Mon. Not. R. Astron. Soc.* 2005. - Vol. 359 - P. 927.

2. V.N. Kondratyev, I.M. Kadenko, *'Nuclide creation and annealing reactor waste in neutron fields.'* - JINR Report E4-2007-157 (JINR Publ., Dubna, Russia, 2008)

REVEALING EXPLOSIVE NUCLEOSYNTHESIS YIELD FROM INTEGRAL DATA

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Relative abundance for the nuclide pair ^{56}Ni and ^{44}Ti , double magic and anti-magic in the Earth based laboratory, is often used for testing the supernova models, cf. [1]. Processing and analysis of the data obtained by the satellite detectors of the space observatory within the INTEGRAL mission for supernova remnants TYCHO, SN1987A and CAS A is represented in this contribution. Particular attention is paid for the fluence of gamma-rays at the energies 67.9 keV and 78.3 keV, corresponding to the radiative transition lines in the decay channel $^{44}\text{Ti} \rightarrow ^{44}\text{Sc}$. The observational data are compared to theoretical predictions for the flux intensity of gamma-lines of ^{44}Sc while taking into account an influence of astrophysical environment on creation and beta-decay of ^{44}Ti in supernova remnants.

1. V.N.Kondratyev, I.M.Kadenko, MNRAS 359 (2005) 927.

VERIFICATIONS OF NUCLEAR LEVEL DENSITY CALCULATIONS WITHIN CLOSED-FORM METHODS

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A level density of atomic nuclei is one of the most crucial ingredients for a reliable theoretical analysis and prediction of the nuclear reaction observables (cross sections, spectra, angular distributions, abundance of elements in the Universe, and other) within statistical models[1].

In this contribution the level densities in spherical and deformed atomic nuclei are investigated using different semi-phenomenological approaches with allowance for quasiparticle and collective excitations. An intrinsic quasiparticle component of nuclear level density is calculated within two variants of the generalized superfluid model[2,3]. An effect of collective states on the temperature of the quasiparticle states is accounted [4]. The best expressions for enhancement factor of nuclear level density due to collective states are found with and without account of a dependence of asymptotic level density parameter a on neutron excess. An effect of collective state enhancement on gamma-emission in neutron-induced nuclear reactions is investigated.

[1] M.Herman, R.Capote, B.V. Carlson, P.Oblozinsky, M.Sin, A.Trkov, H. Winkle, V.Zerkin, *Nucl.Data Sheets*, **108** (2007)2655.

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[3] M.I. Svirin, *Fiz.El.Chas.At.Yad (Particles and Nucleus)*, Dubna, **37**(2006)901.

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MEASUREMENTS AND THEORETICAL CALCULATIONS OF (N, X) REACTION CROSS SECTIONS FOR MEDIUM MASS AND RARE-EARTH ELEMENTS

Dzysiuk N.R., Kadenko A.A., Kadenko I.M.

Taras Shevchenko National University of Kiev, Nuclear Physics Department

Nuclear data measurements can be considered as inseparable part of modern nuclear physics. One of the main requirements for nuclear data to be utilized nowadays and in the future is their reliability which may be considered as an acceptable comparison result of experimental technique application and theoretical calculations. Regardless of the fact that many investigations performed to study (n,x) reactions the problems with incompleteness and discrepancies between existing data still remain. Therefore the cross sections for reactions $^{159}\text{Tb}(n,p)^{159}\text{Gd}$, $^{159}\text{Tb}(n,2n)^{158}\text{Tb}$, $^{159}\text{Tb}(n,\alpha)^{156}\text{Eu}$, $^{74}\text{Ge}(n,\alpha)^{71\text{m}}\text{Zn}$, $^{76}\text{Ge}(n,2n)^{75}\text{Ge}$, $^{70}\text{Ge}(n,p)^{70}\text{Ga}$, $^{175}\text{Lu}(n,2n)^{174}\text{Lu}$, $^{175}\text{Lu}(n,p)^{175}\text{Yb}$, $^{175}\text{Lu}(n,\alpha)^{172}\text{Tm}$, $^{92}\text{Zr}(n,p)^{92}\text{Y}$, $^{94}\text{Zr}(n,p)^{94}\text{Y}$ and $^{176}\text{Lu}(n,\alpha)^{173}\text{Tm}$, which have been measured for incident neutron energy around 14 MeV. The most attention was paid for $^{175}\text{Lu}(n,\alpha)^{172}\text{Tm}$, $^{72}\text{Ge}(n,2n)^{71}\text{Ge}$ and $^{159}\text{Tb}(n,n'\alpha)^{155}\text{Eu}$ reactions, due to lack such data in databases.

All measurements were performed with neutron-activation technique. The samples of natural composition of mentioned above elements have been irradiated with DT – neutrons. Instrumental γ -ray spectra of activation products have been measured with application of two spectrometers based on HPGe and Ge-planar detectors. Modeling approaches were developed to effectively optimize the process of experimental measurements. For that reason detector's and neutron generator's models have been developed, verified and validated to take into account self-absorption, finite's geometry and coincidence summing effects, also the scattered neutron spectrum was calculated. Calculations of corresponding correction factors have been made with application of the MCNP code [1].

Theoretical calculation of excitation functions for reactions investigated in the specified energy range were performed with the Talys-1.0 code [2], influence of model's parameters on calculations results has been studied and features of (n, α) cross section calculations are considered as well.

Reliability of data obtained and correctness of neutron-activation utilization are confirmed by acceptable agreement between some of our results and previous cross-section data published. These data were introduced in the EXFOR database and can be used for verification of nuclear reaction models and other practical applications.

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[2] A.J. Koning, S. Hilaire and M.C. Duijstijn "Talys -1.0", Proceedings of the International Conference on Nuclear Data for Science and Technology – ND2007, May 22-27, 2007, Nice, France

INVESTIGATION OF PHOTONUCLEAR REACTION PRODUCTS ON SILVER AND INDIUM ISOTOPES FOR BREMSSTRAHLUNG ENERGIES ABOVE 34 MEV

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The application of high energy gamma-quanta as projectiles in nuclear reactions has some essential advantages for study of nuclear structure and nuclear reaction mechanisms. Indeed, gamma-quanta do not introduce large angular momentum into compound nucleus and additional contribution to excitation energy of compound nucleus due to a binding energy of projectile is absent. In addition, the precise nondiscrete control of the gamma-quanta energy is possible.

Characteristics of the photonuclear reactions are well studied in the energy region of Giant Dipole Resonance (GDR) and above the pion-producing threshold (PPT). The energy region between GDR and PPT (from about 30 to about 100 MeV) was studied to a smaller extent both theoretically and experimentally. The reason is in the small photonuclear reaction cross sections in this energy region and in limited availability of high intensity quasi monoenergetic gamma ray sources with well controlled gamma-quanta energy. To fill this energy gap in isomer ratios data the values of the isomer ratios for nuclei ^{104}Ag , ^{110}In , ^{108}In as products of the photonuclear reactions $^{107}\text{Ag}(\gamma,3n)^{104\text{m,g}}\text{Ag}$, $^{113}\text{In}(\gamma,3n)^{110\text{m,g}}\text{In}$, $^{109}\text{Ag}(\gamma,5n)^{104\text{m,g}}\text{Ag}$, $^{115}\text{In}(\gamma,5n)^{110\text{m,g}}\text{In}$, $^{115}\text{In}(\gamma,7n)^{108\text{m,g}}\text{In}$ were obtained using bremsstrahlung of the electron linear accelerator LU-40 with energies within (34–90) MeV for irradiation of silver and indium targets. Energy resolution of electron beam was nearly 1% and mean electron current was about 5 μA . Method of the induced activity measurements was used to derive the experimental isomer ratio values. The code TALYS was used to make the calculations of isomer ratios followed by a comparison with experimental data and discussion of results.

FUSION OF DEFORMED NUCLEI: $^{12}\text{C}+^{12}\text{C}$

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Fusion reaction $^{12}\text{C}+^{12}\text{C}$ is very important for astrophysics, because this reaction is related to carbon burning in stars, nucleosynthesis of ^{20}Ne and ^{23}Na , carbon flashes on accreting neutron stars, pycnonuclear reaction in white dwarfs and etc. Due to astrophysical importance this reaction has been measured around and well-below barrier by various experimental groups during last 30 years. The cross section of fusion reaction $^{12}\text{C}+^{12}\text{C}$ has extensively been discussed in the framework of various approximations.

^{12}C is well-deformed nucleus in the ground state, the values of quadrupole and hexadecapole deformation parameters are $\beta_2=-0.40\pm 0.02$ and $\beta_4=0.16\pm 0.03$. However ^{12}C is considered as spherical nuclei in the ground state in previous studies of fusion reaction $^{12}\text{C}+^{12}\text{C}$. We stress that ground state deformation of nucleus play important role for sub-barrier fusion reactions and nucleus-nucleus capture reactions in stars. The interaction potential between nuclei with deformed ground states depends on orientation of incoming nuclei. Due to this nucleus-nucleus fusion cross section at low energy depends on the deformation strongly especially for heavy systems. Therefore it is very important to evaluate the fusion cross section of $^{12}\text{C}+^{12}\text{C}$ in the framework of theory, which takes into account the surface deformation, because accurate the cross section and S -factor values at low energy need for evaluation of various astrophysical scenario of star evolution.

Our model is simple barrier-penetration approach, which takes into account various orientations incoming deformed nuclei, and therefore, various barrier heights, occurred during fusion reaction. We cannot describe the molecular resonances observed for reaction $^{12}\text{C}+^{12}\text{C}$ in the framework of our approach. So our aim to discuss an overall energy dependence of the S -factor and/or cross section, related to off-resonance energies for the quasimolecular states, and evaluate the effect induced by deformation of ^{12}C ground state. Values of fusion cross section and S -factor for $^{12}\text{C}+^{12}\text{C}$ system evaluated in the framework of our approach are well agreed with experimental data.

THE ALPHA-NUCLEUS INTERACTION POTENTIAL FOR ALPHA-DECAY AND ALPHA-CAPTURE

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Knowledge of the nucleus interaction potential allows to analyze various reactions between α – particles and nuclei, in particular, to evaluate the cross section for various reactions, which are also very important for different r -processes on the Sun and in nucleosynthesis.

The alpha-decay process involves sub-barrier penetration of alpha-particles through the barrier, caused by interaction between alpha-particle and nucleus. The fusion reaction between alpha-particle and nucleus proceeds in the opposite direction of the alpha-decay reaction. However, the same alpha-nucleus interaction potential is the principal factor to describe both reactions. Therefore, data for both the alpha-decay half-lives and the sub-barrier fusion reactions were used for determination of the alpha-nucleus interaction potential.

The total alpha-nucleus interaction potential consists of Coulomb and centrifugal repulsion parts and nuclear attraction part. These parts form a barrier at small distances between alpha-particle and nuclei. The Coulomb and centrifugal components of the potential are well-known. In contrast, the nuclear part of the potential is less well-defined. There are many different approaches to the nuclear part of the nucleus interaction potential.

We considered alpha-transitions between the ground-state of mother nucleus and ground/excited-states of daughter nucleus. The shape deformation of daughter nuclei and spin-parity effects are also taken into account at alpha-decay consideration.

Note the experimental values of the ground-state spins and parities are known for many nuclei. The number of nuclei with known values of ground-state spin and parity is permanently extended. Due to this our approach became more accurate.

We determined the alpha-nucleus potential and used it to perform calculations of the alpha-decay half-lives as well as for evaluation of the alpha – capture cross sections [1,2].

[1]. V. Yu. Denisov and A.A. Khudenko, ADNDT, in press.

[2]. V. Yu. Denisov and A.A. Khudenko, Phys. Rev. C 80, 034603 (2009).

EFIMOV TRIMERS IN THE FRAMEWORK OF FADDEEV APPROACH

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Method of scattering calculations using differential Faddeev equations with a hard-core interactions is discussed. Numerical results on binding energies of the helium trimers and ultra-cold collisions of ⁴He atom on ⁴He dimer are reviewed [1].

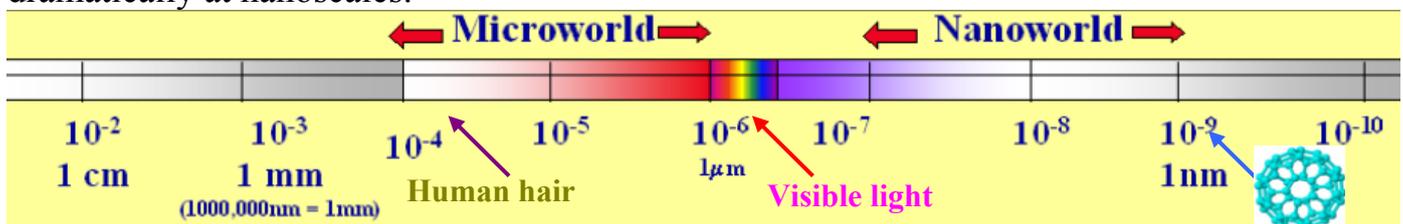
[1] E. A. Kolganova, A. K. Motovilov, and W. Sandhas, *Ultracold collisions in the system of three helium atoms*, Physics of Particles and Nuclei **40**, 206 (2009).

NANOSCIENCE – SMALL SIZE, BIG WORLD

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Nanoscience involves creating and working with objects on a very small scale, however it has the potential to reshape the world around us. The idea of changing the big world by working in the nanoscale was proposed first 50-ty years ago by famous scientist Richard Feynman in his essay “Room at the bottom”. But only in the last few decades science and technology give scientists sufficient skill to enable them to start working directly in this fascinating world. Nanoscience is a rich field of research. Directions of development in NANO include Nano-technology, Nano-electronics, Nano-materials, Nano-bio(techno)logy, Nano-medicine and many other Nanos. A huge range of applications is possible, based on stronger, lighter or smaller materials, or compounds with unusual mechanical, electrical, optical etc. properties. Combining biological molecules with nanomechanical components creates radically new materials. On the other hand, the properties of common materials may be changed dramatically at nanoscales.



In the second part of my talk I will present some interesting physical properties of point contacts. The latter have been used during the last 30-ty years as spectroscopic tool, known as Point-Contact Spectroscopy. However, due to small dimension of point contacts, as a rule of the order of 10 nanometer, they display very spectacular properties promising to be used in electronics and spintronics, in sensor technique as well as for searching new phenomena at nanoscale.

ANOMALOUS PHYSICAL PROPERTIES OF MAGNETIC NANOSCALE BIOMINERALS LOCALIZED IN BRAIN TISSUE

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As is generally known, the organism (brain) of human beings and the organisms (brains) of other animals are containing biogenic magnetite. Biogenic magnetite – is the object of nanomineralogy that has unique magnetic properties. It is known, that biogenic magnetite is the biomineral that ensures the navigation properties of animals (birds, fish, insects, etc.) and takes part in processing and saving of information in the brain tissues. The biogenic magnetite nanoparticles generated by biomineralization process are associated with organic matrix that determines the physical-chemical properties of the magnetic nanoparticles.

The tissues of rat brain, etc. were studied by means of magnetic resonance spectroscopy. New physical phenomena associated with unique properties of the biogenic magnetite localized in brain tissues have been investigated, namely, the room-temperature macroscopic quantum oscillations in nanobiomagnetite of brain tissues have been discovered. The resonance characteristics of such nanobiomagnetite differ essentially from other materials, namely, no one from other known natural or synthetic materials shows room-temperature macroscopic quantum oscillations. Additional coherent zones appear on the outline of the resonance line when microwave power P is more then the critical value ($P > P_{cr} \approx 80$ mW). The increase of the power leads to increasing the quantity of the coherent zones, which characterize the quantum oscillations in the nanoscale particles.

This finding opens wide perspectives for creation of synthetic analogues of the physiological particles as hybrid of mineral and organic matter. Synthetic analogues of biomagnetite open up the following possibilities: they could be used for creation of new systems for storage and processing information that would use the principles of brain functioning; they could help in clarification of functioning and disease mechanisms of the brain and in development of appropriate means for the disease prophylaxis.

MASS SPECTROMETRY OF BIOMOLECULAR CLUSTERS

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Modern desorption mass spectrometry techniques allow measuring molecular masses of large thermally instable organic molecules, including biomolecules. At the same time, despite the wide and successful application of different desorption/ionization methods (beginning from traditional static SIMS and up to matrix assisted laser desorption), a generally accepted opinion about the formation mechanisms of molecular and quasi-molecular ions in these techniques is still to come. One of the interesting features of desorption mass spectrometry is its ability to detect on only ions of separate molecules but also molecular clusters, which comprise two or more molecules bound non-covalently. The formation of such clusters is regular, and (in the case of binary mixtures) their relative intensity can reflect the affinity of

the molecules under investigation. Since the complete theory describing the formation and evolution of such clusters is not yet constructed, the comparative experimental study of cluster formation of different substances using different desorption techniques is still topical. In this communication the data about intermolecular cluster formation in the plasma desorption mass spectrometry (252Cf PDMS) is presented; the comparison of observed clusters with the calculated formation energies is performed.

CORRELATIONS OF MAGNETIC NOISE PROBING STRUCTURE OF QUANTUM DOT ARRAYS

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The quantum confined systems (e.g. nano-crystals, atomic clusters, and/or quantum dots referred for hereafter as QDs) and their assemblies provide an opportunity, e.g., to develop new materials exhibiting a variety of characteristics which are not met in traditional solid state systems. Apart from possible benefits in '*figures of merits*' for technological and therapeutic applications such super-crystals are of fundamental interest for a study of interactions, transport processes and phase features at fairly wide range of various parameters, e.g., coupling constants, densities, Coulomb blockade gaps. In this contribution we consider analytical tools employed in order to specify, quantify and analyze such heterostructures in respect with magnetodynamics.

By making use of the band structure based shell model (BSbS [1]) the quantization of electronic spatial motion is found to bring the sharp step-wise jumps of the QD magnetic response due to the Zeeman splitting in varying magnetic fields. As is shown such moment jumps in conjunction with ferromagnetic inter-dot coupling induce jerky magnetodynamics with sharp discontinuities in the array (de)magnetization process due to avalanche propagation. For a description of such noisy magnetodynamics of QD arrays we employ the randomly jumping interacting moments (RJIM) model [2] including quantum fluctuations due to the discrete level structure, inter-dot coupling and disorder. Magnetic state equation of such a system is demonstrated to exhibit spinodal regions in *{disorder, magnetic field}*-plane and the critical points.

Exploring correlations of noise amplitudes represents then convenient analytical tool for quantitative definition, description and study of self-organized (SO) criticality in magnetic QD assemblies. On an example of 3-dimensional supercrystals we show strong correlations in avalanche size distributions. The linear size of the biggest avalanche makes about half of system length, while mean size attains maximum and diverges in thermodynamic limit. Further implications of proposed tools will allow to specify and study quantitatively the phenomena of SO criticality. The tools might be also employed to quantify a roughness and a disorder in magnetic dot arrays, which are of great importance for advanced electronic devices, nanoscale storage media and magnetic recording technology. In addition, ligand (e.g. oleic acid) stabilized nanocrystals of iron series transition metals with enhanced magnetic

moments represent promising candidates for the magnetically responsive component of macro-molecule beads, significant for advanced therapy.

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CONTROLLED MAGNETIC VORTEX DYNAMICS IN NANOMAGNETS

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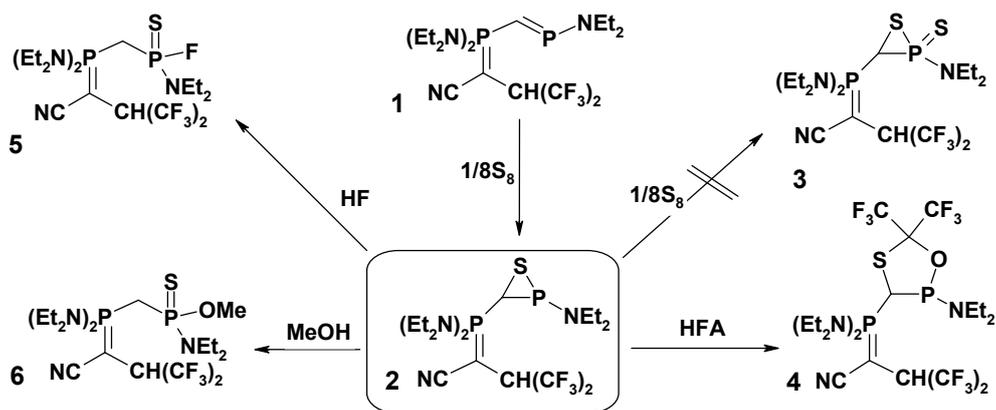
Recent advances in nanotechnology have made it possible to fabricate various low-dimensional systems with complicated geometry. Magnetic nanodisks, rings, stripes, and nanowires are among the most actively studied nanosystems. These nanomagnets have topologically nontrivial ground states: vortex ground state and the ground state with domain walls. The vortex state nanodots has drawn much attention because it could be used for high-density magnetic storage and miniature sensors. One bit of information corresponds to the upward or downward magnetization of the vortex core (vortex polarity). For this one needs to control magnetization reversal, i.e. to flip the polarity of the vortex. The aim of this talk is to demonstrate that vortex dynamics in magnetic nanodots may be effectively controlled by applying alternative magnetic fields and spin-polarized electrical currents. It is shown that the mechanism of core magnetization switching is quite general. It includes a creation of an intermediate vortex-vortex-antivortex state with subsequent annihilation of the original vortex and new-born antivortex. A simple analytical picture of such phenomena is proposed.

THE PROPERTIES OF 1,2 λ^3 -THIAPHOSPHIRANE

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There are only few compounds containing three-membered thiaphosphirane cycle known. These compounds are hardly accessible that is why their chemical properties could not be studied. We have found that 1,2 λ^3 -thiaphosphirane **2** can be easily obtained by the sulfuration of phosphalkene **1**. This allowed us to investigate properties of thiaphosphirane **2**. The three-valent phosphorous atom $\lambda^3\text{P}$ in **2** turned out to be unexpectedly stable towards electrophiles. For example, **2** does not react with sulfur to give 1,2- λ^5 (thioxo)thiaphosphirane **3**. Even such strong electrophile like hexafluoroacetone (HFA) does not oxidize the three-valent phosphorous atom. Instead of this the insertion reaction into the P-S bond was observed to give 1,4,2 λ^3 -oxathiaphospholane **4**. The reactions of **2** with HF and MeOH led to the opening of the three membered ring with the formation of products **5** and **6**, respectively.



SPIN FACTOR IN CHEMICAL REACTIONS INVOLVING FREE RADICALS. SPIN CHEMISTRY

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Many photo and radiation induced reactions in solutions proceed with formation of free radical pairs. These species carrying unpaired electron spin are highly reactive and short-lived in scale of hundreds nanoseconds. Radical pairs are formed in correlated spin state of two unpaired electron spins of the radicals.

We consider the magnetic and spin effects in photo and radiation-induced radical reactions in solution, which arise due to the spin selectivity of the radical recombination process, and due to the fact that every encounter of radicals in solution consists of many re-contacts. Interaction of the radical spins with an external magnetic field and with nuclear spins due to hyperfine couplings significantly affect the singlet-triplet evolution in radical pairs and thereby on the kinetics and yield of the products of their recombination. The phenomena arising from that is a subject of Spin Chemistry. The following examples of the magnetic field effect on the kinetics and yield of chemical reactions will be considered: recombination of biradicals formed upon photolysis of cyclic ketones; recombination fluorescence in alkane solution under radiation exposure, fluorescence of exciplexes formed by photoinduced electron transfer reaction. The spin effect will be illustrated by a magnetic isotope effects in photolysis of dibenzilketone. Formation of non equilibrium nuclear polarization, the so-called chemically induced nuclear polarization, will be illustrated by the example of photo-induced reactions involving biomolecules - amino acids, peptides, proteins. The new highly sensitive methods of magnetic resonance detected by the reaction yield and their applications to the study of short-lived intermediates in radical reactions will be cover.

ACTIVITY OF WATER, OSMOTIC AND ACTIVITY COEFFICIENTS OF TWO- AND THREE-BASIC AMINO ACIDS, THEIR SALTS AND DERIVATIVES IN AQUEOUS SOLUTIONS AND THE QUANTITATIVE DESCRIPTION OF THE BIOMOLECULE SOLVATION

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Ion solvation and specific interactions of ions with protein fragments stipulate the differentiation of ion distribution and the features of biological cells of high organized living body function. Models of such systems needed for the description of separation of proteins by selective precipitation and amino acid transport through biological membranes. Therefore this work is devoted to the determination of activity and osmotic coefficients in binary and ternary solutions of amino acids, their salts and derivatives in wide concentration range and the description of their concentration dependence with the use of Chemical Models. Specific cation and anion effects have been studied for proteinogene amino acids: glycine – ambiphilic amino acid with small non-polar radical and biophysically important polar hydrophilic three-basic amino acids and their salts – histidine, aspartic and glutamic acids, playing important role in affinity on protein. Also solutions of amino acids, in that the reactive groups are blocked: N-Boc-L-histidine and N-Boc-L-histidine methyl ester have been studied. The modeling of the chemical potential obtained experimentally from colligative properties – vapour pressure – has been provided for the systems of aqueous glycine, glutamic acid, L-histidine, L-histidine monohydrochloride, sodium L-glutamate and sodium L-aspartate, calcium L-glutamate, mixtures of glycine with NaCl, glycine with KCl, glycine with NaNO₃, glycine with NaSCN, glycine with NaCOOCH₃, sodium L-glutamate with NaCl, sodium L-aspartate with NaCl, sodium L-glutamate with KCl, sodium L-aspartate with KCl. at 298.15 and 310.15 K. Analytical theories considering short range structural factors by classical Coulombic systems screening at high concentrations have been used for the calculation of thermodynamic properties of multi-particle systems from intermolecular interaction knowledge.

ORGANISATION AND MOLECULAR EVOLUTION OF 5S rDNA IN LEPIDOPTERA

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Genomic regions coding for the 5S rRNA (5S rDNA) belongs to the class of tandemly arranged repeated elements and is present in all eukaryotic organisms. Early, organization and

molecular evolution of the 5S rDNA was studied in numerous groups of plants whereas in animals this genomic regions still remains poorly explored. Especially, very little is known about the 5S rDNA of insects. In order to shed light on the molecular organization and potential application in molecular taxonomy of butterflies, the 5S rDNA of 11 species representing 7 families of Lepidoptera (Nymphalidae, Pieridae, Hesperidae, Lycaenidae, Geometridae, Noctuidae, Pyralidae) was amplified by PCR, cloned and sequenced. Analysis of the obtained data revealed that a typical 5S rDNA repeated unit in the taxonomic group is composed of a 120 bp long coding region (a size highly conserved in all living organisms) and of a variable intergenic spacer, which has a length of 230-300 bp. Also, essential structural changes of the spacer region were found in some species. Short variants of the 5S rDNA repeats lacking nearly complete spacer region or even portions of the coding region were found in all families studied excepting Noctuidae. Apparently, the short 5S rDNA repeats represent non-functional pseudogenes. On the other hand, extremely long (about 1000 bp) 5S rDNA repeats were discovered in *Minois drias* (fam. Nymphalidae). Sequence comparison revealed that the long repeat variants appeared in the evolution as a result of transposition of DNA segments from other genomic regions.

EXTRACTING DATA ON POCKELS EFFECT IN TIN HYPOTHIODIPHOSPHATE FROM PHOTOREFRACTIVE BEAM COUPLING

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Recently the interest is increasing to the optical recording, storage and processing with photorefractive crystals (PRC). Tin hypthiodiphosphate ($\text{Sn}_2\text{P}_2\text{S}_6$) belongs to promising photorefractive ferroelectrics that provide an increased gain factor (about 10 cm^{-1}) and fast response (down to millisecond range) for the red and near-infrared spectrum domain. A low symmetry of this crystal increases the number of independent parameters that describe their nonlinear optical properties. The photorefractive properties of these crystals differ therefore from that for previously known materials. In particular, the observed in $\text{Sn}_2\text{P}_2\text{S}_6$ dependence of the polarization angle of wide-angle photorefractive scattering on scattering angle is unique and has no analogs.

The coupling of two identically polarized waves is possible in any photorefractive. In low-symmetry PRC the orthogonally polarized waves can exchange the energy, too. Gain factors for these two types of coupling are measured $\text{Sn}_2\text{P}_2\text{S}_6$. As an output, the new data on Pockels tensor of $\text{Sn}_2\text{P}_2\text{S}_6$ are extracted from the whole set of measured data. The knowledge of a full set of Pockels tensor components of $\text{Sn}_2\text{P}_2\text{S}_6$ allows of optimizing of the beams interaction geometry for reflecting grating.

EXPERIMENTAL SEARCH FOR DOUBLE BETA DECAY AND DARK MATTER

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Observations of neutrino oscillations manifest the non-zero neutrino mass and provide important motivation for high sensitivity experiments to search for neutrinoless double beta ($0\nu 2\nu$) decay. Investigations of this process could clarify nature of neutrino (Majorana or Dirac particle), measure absolute value of neutrino mass, determine neutrino mass hierarchy, test lepton number conservation. Dark matter remains one of the biggest unsolved mysteries in modern science. Particle physics provides a possible explanation for non-baryonic dark matter in the form of weakly interacting massive particles (WIMPs). The most likely WIMP candidate is the neutralino, predicted by supersymmetry models. It is expected that WIMPs interact with matter producing low energy recoils, which can be detected by ultra-low background detectors. Search for both extremely rare processes require development of detectors with very low radioactive background, high energy resolution, very low energy threshold. While detectors to search for $0\nu 2\nu$ decay should contain certain elements, experiments to search for dark matter require variety of target elements to prove nature of WIMPs events if observed. Development of next generation dark matter and double beta decay experiments is discussed.

Roentgen and Gamma-Ray Observatory VIRGO.UA - the current status

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HUNTING FOR DARK MATTER PARTICLES

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Many independent observations of different classes of cosmic objects indicate that, in addition to ordinary “visible” matter in our Universe there is huge amount of “hidden”, gravitationally-interacting substance, possibly contributing to a “Dark Matter”. Interestingly, the major part of Dark Matter cannot be explained within the Standard Model of elementary particles which poses a serious challenge for particle physicists. On the other hand, several well-motivated extensions of the Standard Model are supposed to contain the viable Dark Matter particle candidate. The overview of the basic properties of the most popular Dark Matter candidates, including neutralinos, sterile neutrinos and axions, as well as the possibilities of their direct detection by existing and planned Earth-located experiments, will be presented. After that, I critically review the existing methods of constraining the parameters of Dark Matter particles using the properties of distant Dark Matter halos, and present the recent robust updates. Finally, I discuss the possibilities for direct and indirect detection of different types of Dark Matter particles in the nearest future.

SMALL-X BEHAVIOR OF PARTON DENSITIES AND THE STRUCTURE FUNCTION F_2 FOR "FROZEN" AND ANALYTIC STRONG-COUPPLING CONSTANTS

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Using the leading-twist approximation of the Wilson operator product expansion with "frozen" and analytic strong-coupling constants, we show that the Bessel-inspired behavior of the structure function F_2 at small values of x , obtained for a flat initial condition in the DGLAP evolution equations, leads to very good agreement with experimental data of deep-inelastic scattering at DESY HERA.

WHAT THE SURFACE TENSION OF QUARK GLUON BAGS CAN TELL US ABOUT THE HISTORY OF THE UNIVERSE?

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In cosmology there are a variety of phase transitions which occur at various times, corresponding to the confinement-deconfinement transition of quantum chromodynamics (QCD). Therefore, an investigation of the properties of quark gluon plasma (QGP) bags may shed some light on a variety of cosmological problems. I present a new phenomenological look at the confinement phenomenon which is based on the old MIT bag model. Equating the free energies of the confining color string and the elongated cylindrical bag, we got something entirely new: the relation between the string tension, surface tension, thermal pressure and bag radius. The found relation allows, in principle, to determine the bag surface tension directly from the lattice QCD simulations. Using this relation it was possible to naturally explain the 'mysterious', as Edward Shuryak called it, maximum in the lattice entropy of the color string. Also we find out that the QGP bag surface tension coefficient is amazingly negative at the cross-over region. The derived relation allows us to estimate the surface tension of QGP bags at zero temperature to be larger than the critical value $(0.178 \text{ GeV})^3$ which, according to E. Witten, may lead to the quark matter survival to present days. Also I briefly discuss the finite width model of QCD matter. This exactly solvable statistical model demonstrates that the large width of the QGP bags not only explains the observed deficit in the number of hadronic resonances compared to the Hagedorn mass spectrum, but also it clarifies the reason why the heavy QGP bags cannot be directly observed even as metastable states in a hadronic phase. The finite width model allows one to estimate the minimal value of the width of QGP bags being heavier than 2.5 GeV from a variety of the lattice QCD data and get that the minimal resonance width at zero temperature is about 600 MeV, whereas the minimal resonance width at the Hagedorn temperature is about 2000 MeV. These large values of the resonance width are responsible for the absence of strangelets, i.e. the droplets of strange matter, and large bags of QGP in cosmic and cosmological experiments.

RATES IN QUANTUM FRIEDMANN-ROBERTSON-WALKER MODEL WITH RADIATION AND CHAPLYGIN GAS: A FULLY QUANTUM APPROACH

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In proposed paper the closed Friedmann-Robertson-Walker model with quantization in the presence of a positive cosmological constant and radiation is studied [1-7]. For analysis of the tunneling probability for the birth of an asymptotically deSitter, inflationary Universe as a function of the radiation energy, a new definition of a “free” wave propagating in strong fields is proposed [8]. On such a basis, a new fully quantum approach for determination of incident, reflected and transmitted waves relatively a barrier is constructed, tunneling boundary condition [9-10] is corrected. A stationary method of determination of penetrability and reflection relatively the barrier with analysis of uniqueness of solution is developed. At the first time non-zero interference between the incident and reflected waves has been taken into account which turns out to play a huge role inside cosmological potentials. For its estimation the coefficient of mixing is introduced. According to the calculations, inside whole region of energy of radiation the tunneling probability for the birth of an asymptotically deSitter, inflationary Universe is very close to its value, obtained in semiclassical approach [11-12], but essentially differs on the estimations obtained before by known quantum non-stationary approach [13]. The reflection from the barrier in the internal region is determined at first time (which is essentially differs on 1 at the energy of radiation close to the barrier height). Here, modulus of the coefficient of mixing is less 10^{-19} for all energies, that points out that *there is no interference between the found incident and reflected waves and this confirms correctness of proposed definition of “free” wave inside strong fields*. The proposed method is easily generalized on the cosmological models with the barriers of arbitrary shape, what was demonstrated for the FRW-model above with included Chaplygin gas [14] (see also [15, 16]). Result is stable for different variations of studied barriers and the accuracy is 11-18 digits for all coefficients and energies below a barrier height.

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BASIC PROPERTIES OF THE EINSTEIN EQUATIONS WITH A RICCI-SCALAR-DEPENDENT COSMOLOGICAL TERM

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Basic properties of the Einstein equations modified by a cosmological Λ -term dependent on the Ricci scalar R are considered. We show that in addition to a nonzero divergence of the energy-momentum tensor of the matter and the consequent cold matter mass nonconservation as the Universe expands, this model suggests a significant modification of the equations for the gravitational potential and particle acceleration in the Newtonian approximation. These circumstances allow the necessary criteria for possible functional dependences $\Lambda(R)$ to be formulated. Nevertheless, by introducing a variable Λ -term, we can look at the problems of dark matter and dark energy anew. In particular, we show that the model in which the cosmological term depends linearly on the Ricci scalar (this corresponds to the approximation of a more complex dependence in the case of low matter densities) makes it possible to satisfactorily describe the rotation curves of galaxies without invoking the dark matter hypothesis and to construct a cosmological model with a variable vacuum energy density, in qualitative agreement with the present views of the early Universe [1,2].

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f(R) – ГРАВИТАЦИЯ И НЕКОТОРЫЕ ПРИЛОЖЕНИЯ

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Важным шагом на пути изучения фундаментальных взаимодействий является исследование динамической генерации фермионной массы и динамическое нарушение симметрии в различных внешних полях, а также при наличии гравитационного взаимодействия [1], которое можно рассматривать как в теории поля и пытаться проквантовать, либо как внешнее взаимодействие.

В данной работе рассматривается расширенная гравитация, в частности $f(R)$ - гравитация, где R - скалярная кривизна. Одним из самых обсуждаемых вариантов таких моделей является R^N - гравитация [2]. Это вызвано целым рядом как физических, так и чисто математических причин. Данное исследование посвящено возможности динамического нарушения симметрии в таких моделях гравитации с использованием формализма уравнений Швингера – Дайсона. Основной акцент данной работы заключается в том, что весь формализм рассматривается не над плоским фоном (пространством Минковского), а над произвольным искривленным пространственно-временным континуумом, т.о.:

$$\tilde{g}_{\mu\nu} = g_{\mu\nu} + h_{\mu\nu},$$

где $\tilde{g}_{\mu\nu}$ - возмущенная метрика, $g_{\mu\nu}$ - произвольная фоновая метрика, $h_{\mu\nu}$ - квантовые поправки.

Подобная постановка задачи приводит к следующим результатам. В случае плоского фонового пространства-времени в модели R^N - гравитации существуют поправки порядка $O(h^N)$ и более высокого. Однако если фоновая метрика является искривленной, то возникают поправки любого порядка и в частности квадратичные поправки $O(h^2)$, которые необходимы нам для написания уравнений Швингера – Дайсона и для исследования возможности динамического нарушения симметрии. Это приводит к важному выводу, что если реальная Вселенная описывается искривленной метрикой, то при построении квантовой теории гравитации необходимо учитывать слагаемые всех степеней по R , т.к. они дают один и тот же порядок по малым квантовым поправкам h .

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TIME AS A QUANTUM OBSERVABLE, CANONICALLY CONJUGATED TO ENERGY, AND FOUNDATIONS OF TIME ANALYSIS OF QUANTUM PROCESSES

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There is presented the review of a lot of papers by V.S.Olkhovsky and also other authors in the study of *time* in quantum mechanics and quantum electrodynamics as an observable, canonically conjugate to *energy*. This report deals with the maximal hermitian (but non-self-adjoint) operator for time which appears in non-relativistic quantum mechanics and in quantum electrodynamics for systems with continuous energy spectra. Two measures of averaging over time and connection between them are analyzed. The results of the study of time as a quantum observable in the cases of the discrete energy spectra are also presented, and in this case the quasi-self-adjoint time operator appears. Then some applications of time analysis of quantum processes (tunneling phenomena and nuclear processes) are also reviewed.

Finally, as a continuation and extension of the exposed results, a scientific program of the future investigations for students, post-graduate students and young researchers is presented.

TO THE MODIFICATION OF METHODS OF NUCLEAR CHRONOMETRY IN ASTROPHYSICS AND GEOPHYSICS

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There are usually taken into account the life-times of the only fundamental states of α -radioactive nuclei in the standard methods of the nuclear chronometry. But there are always present the excitations of the α -radioactive nuclei in the processes of nuclear synthesis in the stars and under the influence of the constant cosmic radiation on the planet surfaces. Between them there are the states with the excited α -particles inside the parent nuclei and so with much smaller life-times. The transitions between different states of radioactive nuclei are accompanied by infinite chains of the α -radiations with the subsequent α -absorptions, the further α -radiations etc inside the large masses of stellar, terrestrial and meteoric substances. Here we present a new quantum-mechanical approach for the description of the α -decay evolution with considering of such excited states and multiple α -radiations and α -absorptions inside the stars and under the influence of the cosmic radiation on the earth surface. It is based on the generalized Krylov-Fock theorem.

Some examples with the simple estimations are presented. They bring to the conclusion that the usual (non-corrected) “nuclear clocks” do really indicate not to realistic values but to the *upper limits* of the decay durations for the α -decay stellar and planet nuclei-chronometers and really they can be 5 orders less than these upper limits.

Further, we include a short review of the experimental German paper showing that the lifetime of the α - radioactive isotope ^{187}Re in a bare (without electrons) atom is less 10^9

times than the lifetime of the usual atom with totally filled electronic shell (it becomes ~ 30 years instead of $\sim 3 \cdot 10^{10}$ years!). And it is known that the stellar matter is in the plasma state with the free nuclei and electrons. So, the nuclei partially or totally are being deprived their electronic shells inside the stars.

Finally, as a continuation and extension of the exposed results, a scientific program of the future investigations for students, post-graduate students and young researchers is presented, taking into account both α - and β - radioactive decays and also the possible modifications of the stellar and cosmic nucleo-synthesis. And all this can influence on our estimations of the universe age and so can have some philosophical and theological meaning.

TO ANALYTIC PROPERTIES OF THE S-MATRIX FOR THE UNKNOWN INTERACTIONS SURROUNDED BY CENTRIFUGAL AND RAPIDLY DECREASING POTENTIALS

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For the cases of the unknown interactions with the unknown motion equations inside a sphere of radius a , surrounded by the centrifugal and rapidly decreasing potentials, there is presented the method of the study of the analytic structure of the non-relativistic unitary and non-unitary S -matrix. The one-channel case and special examples of many-channel cases are considered. Some kinds of the symmetry conditions are imposed. The Schroedinger equation for $r > a$ for the particle motion and the condition of the completeness of the correspondent wave functions are assumed. The connection of the obtained results with the orthodox causality is examined.

Finally, as a continuation and extension of the obtained results, a scientific program of the future investigations for students, post-graduate students and young researchers is presented.

KINEMATICAL AND SPECTRAL PROPERTIES OF ISOLATED AGNs

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The first results of studying the kinematic and spectral properties of some AGNs selected from the new 2MIG catalog are presented. 2MIG (2-Micron Isolated Galaxies) catalog was compiled by Karachentseva' isolation parameter criteria at the basis of 2MASS XSC sample (Karachentseva, Melnyk et al., Bull. SAO RAS, 2009). About 90 galaxies among 3200 isolated galaxies from 2MIG catalog were identified as the active galaxies, i.e. AGNs, of various morphological type (de Vacouler's scale). They are distributed uniformly over the sky, diapason of heliocentric velocities is 750 - 13800 km/s, diapason of angle radii is 16" - 110". Because a study of isolated galaxies for comparison of their properties with galaxies in rich environment is an important key for understanding galaxy formation and evolution.

These first research allowed us to develop algorithm and mask of parameters of the isolated AGNs for estimating environmental influence in case of AGNs with companions.

ВИМІРЮВАННЯ ХАРАКТЕРИСТИК СЦИНТИЛЯЦІЙНИХ КРИСТАЛІВ ДЛЯ КРІОГЕННИХ ЕКСПЕРИМЕНТІВ ПО ПОШУКУ ЧАСТИНОК ТЕМНОЇ МАТЕРІЇ ТА ПОДВІЙНОГО β -РОЗПАДУ

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Останнім часом було проведено багато робіт по покращенню відомих та розробці нових сцинтиляційних матеріалів, які можуть використовуватись у кріогенних детекторах. Ці детектори перспективні для пошуку безнейтринного подвійного бета-розпаду та частинок темної матерії. Для експериментів спрямованих на дослідження подвійного β -розпаду важливо мати в складі сцинтилятора певні елементи, у той час як для експериментів по пошуку частинок темної матерії необхідно мати якомога ширший набір елементів для підтвердження природи сигналу від частинок темної матерії. Тому важливо вивчати сцинтиляційні характеристики різних кристалів при низьких температурах.

Проведені вимірювання сцинтиляційних кристалів CaWO_4 , CaMoO_4 , ZnWO_4 , ZnMoO_4 , PbWO_4 , PbMoO_4 , MgWO_4 , та ZnSe . Для них було виміряно відносну інтенсивність при температурах 7–310 К. Зразки кристалів розмірами $5 \times 5 \times 1$ мм³ розміщувались у оптичному кріостаті та збуджувались α -частинками від джерела ²⁴¹Am. Сцинтиляційні сигнали реєструвались за допомогою фотопомножувача із покращеною чутливістю в зеленому діапазоні спектру. У вимірюваннях використовувався метод лічби фотонів у режимі збігів (multiple photon counting coincidence technique). В результаті отримано наступні значення відносної інтенсивності при температурі T=7 К без корекції на спектральну чутливість фотокатода фотопомножувача: CaWO_4 (100%), ZnWO_4 (77%), ZnSe (61%), CaMoO_4 (46%), PbWO_4 (24), PbMoO_4 (21%), MgWO_4 (15%) та ZnMoO_4 (<5%). Із зразками CaWO_4 , ZnWO_4 , ZnSe , CaMoO_4 , PbWO_4 , PbMoO_4 , MgWO_4 досліджена також кінетика сцинтиляційних сигналів в широкому діапазоні температур аж до температури 7 К.

Mathematical & analytical method implications in S^2 – science&society.

THE OSTROGRADSKY SERIES AND RELATED FRACTAL SETS AND PROBABILITY DISTRIBUTIONS

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A finite or an infinite expression

$$\frac{1}{q_1} - \frac{1}{q_1 q_2} + \dots + \frac{(-1)^{k-1}}{q_1 q_2 \dots q_k} + \dots, \quad (1)$$

where the q_k are positive integers and $q_{k+1} > q_k$ for all k , is called the *first Ostrogradsky series*. It is known that any real number $x \in [0,1]$ can be represented in the form (1).

We study topological, metric and fractal properties of the sets of numbers with certain conditions on the elements of their representation by the first Ostrogradsky series (1). In particular, the conditions for some sets to be of zero resp. positive Lebesgue measure are found.

We also discuss possible applications in the probability theory. In particular, we study a structure of distribution (i.e., content of discrete, absolutely continuous and singularly continuous components) of the random variable with independent differences of elements of the first Ostrogradsky series.

SELF-SIMILAR MEASURES ON LIMIT SPACES OF SELF-SIMILAR GROUPS

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Let G be a group and $\phi: H \rightarrow G$ be a contracting homomorphism from a subgroup $H < G$ of finite index. V.V. Nekrashevych associated with the pair (G, ϕ) the limit dynamical system (J_G, s) and the limit G -space X_G together with the covering $X_G = \bigcup_{g \in G} T \cdot g$ by the tile T (not a tiling in general). We develop the theory of self-similar measures m on these limit spaces. We show that (J_G, s, m) is conjugated to the one-sided Bernoulli shift. Using sofic subshifts we prove that the tile T has integer measure and we give an algorithmic way to compute it. Then the covering $X_G = \bigcup_{g \in G} T \cdot g$ is a perfect covering of multiplicity $m(T)$. In addition we give an algorithm to find the measure of the intersection of tiles $T \cap T \cdot g$ for $g \in G$. We present applications to the invariant measures for the rational functions on the Riemann sphere and to the evaluation of the Lebesgue measure of integral self-affine tiles.

CONTOUR INTEGRAL APPROACH AND RENORMALIZATION GROUP METHOD FOR STUDING SUPERFLUIDY PHENOMENA

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Studying the superfluidity phenomena is one of the most challenging problems of the modern physics. Understanding and satisfactory description of this state of matter will bring new understanding and new insight to many branches of science, especially for cosmology. Theoretical models which describe physical processes in the neutron stars or behavior of the quark matter. Recent experiments connected with electrical activity of superfluid Helium-4 allows to conclude that superfluid may be used for the construction new generation gravity detectors.

Microscopical description of the superfluidity plays fundamental role in the solution of mentioned problems. First achievements in this direction were made by Landau L.D. and Bogoliubov N.N. Phenomenological theory of the superfluidity proposed by Landau describe most of the effects observed in the superfluid Helium but not entirely explain the nature of this effects. Bogoliubov theory of weakly interacting Bose gas was the first step in the construction of the self-consistent microscopical theory of superfluidity.

Our work is mainly devoted to the problem of the Bogoliubov theory modification for the case of strong interaction between the atoms which follows from the experiment. Modern renormalization group techniques used on the basis of contour integral approach allows us to describe the behavior of the strongly interacting Bose system at the temperatures tends to absolute zero.

BIMODULE PROBLEMS FOR ALGEBRAIC GEOMETRY: ADVANTAGEOUS COOPERATION

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Algebraic geometry and matrix problems appeared in different periods of time and for different purposes. While algebraic geometry is a very old and classical area of self-contained study, matrix problems were introduced as the means for solving problems from other branches of mathematics, first of all, the theory of representations. The main tasks here included classification and reduction algorithms. The first steps in their interaction were the applications of matrix problems to some questions in algebraic geometry. However, later on it so happened that these one-way applications turned into mutually advantageous cooperation.

In the first part of my talk I will give some examples of how an interpretation of geometrical problems in the language of matrix problems can deliver elegant and explicit answers. The second part of my talk will cover the inverse application, which is not so direct, but still has some interesting advantages, especially with the development of some algebraic geometry computer systems.

ON MODULAR REPRESENTATIONS OF SOME SEMIGROUPS AND REPRESENTATIONS OF QUIVERS WITH RELATIONS

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Let G be a finite group and P n by m matrix with elements from G and zero. Consider a semigroup R which consists of m by n matrices which have unique nonzero element from G . An operation is defined by following formula: for A, B in R we have $A*B=APB$. Such semigroup is called Rees semigroup.

Ponizovskii in the article [1] gave the criterion when Rees semigroup has finite and infinite representation type over a field which characteristic does not divide the order of the group. We are interested in representation type when $G=C_2$ (cyclic group of order two) over a field of characteristic two. It is so called modular case.

Then we consider a semigroup algebra and study its representations. The quiver with relations are build for the algebra. Semigroups of finite and tame representation type are described.

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SKEW STRONGLY NILPOTENT MATRICES

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A skew symmetrical $n \times n$ -matrix is called strongly nilpotent, provided all its $k \times k$ -submatrices formed by elements of the first k rows and k first columns are nilpotent for all $k=1, \dots, n$. The skew strongly nilpotent $n \times n$ -matrices forms an affine variety $C(n)$.

Theorem. If C is an irreducible component of $C(n)$, then $\dim C = n(n-2)/4$ if n is even and $\dim C = (n-1)^2/4$ for n odd.

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TRANSLATION-INVARIANT OPERATORS AND ABSTRACT DIFFERENCE VARIABLE TRACE

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Let H be a separable complex Hilbert Space, $L(H)$ be a space of bounded linear operators over the H . Let $A \in L(H)$, and B be a self-adjoint (in general – unbounded) operator in H . We say that A is *translation-invariant* relatively the B if A commutes with B . The main examples

of translation-invariant operators are as follows $(A_K x)(\vec{t}) = \int_{R^d} K(\vec{t}, \vec{s}) x(\vec{s}) d\vec{s}$, $\vec{t} \in R^d$, $x \in H$ in the space $H = L_2(R^d)$, $d \in N$, with the kernel, satisfying $K(\vec{t} + h, \vec{s} + h) = K(\vec{t}, \vec{s})$, $\vec{t}, \vec{s} \in R^d$, $h \in R$, where $\vec{t} + h = (t_1 + h, \dots, t_d + h)$, $\vec{t} = (t_1, \dots, t_d) \in R^d$. These operators are translation-invariant with respect to the generator of the group $(U(\tau)x)(\vec{s}) = x(\vec{s} + \tau)$, $\vec{s} \in R^d$, $\tau \in R$, and, in general, they haven't bounded trace [1]. This is a reason that in [1] for these operators it was introduced the concept of *the difference variable trace*.

In the present talk the notion of the *generalized projection trace* is introduced. We prove that the space of operators $A \in L(H)$ with bounded generalized projection trace is not complete. To define the Banach space we construct the expansion $L^+(H)$ of the space $L(H)$. In the general case $L^+(H)$ cannot be interpreted as space of operators (even unbounded) over the space H .

[1] Petrina D.Ya. *Mathematical Foundations of Quantum Statistical Mechanics. Continuous Systems*. Amsterdam: Kluwer, 1995., 624 p.

THE ISOMORPHISM PROBLEM FOR FINITARY INCIDENCE RINGS

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The notion of a finitary incidence algebra was first introduced in [1]. It was shown that the isomorphism problem for such algebras was solved positively ([1], Theorem 5). In the present talk we consider this problem in more general case.

Let C be a preadditive small category. Assume that the binary relation \leq on the set of its objects, such that $x \leq y \Leftrightarrow Mor(x, y) \neq 0_{xy}$, is a partial order. Consider the set of formal sums of the form

$$\alpha = \sum_{x \leq y} \alpha_{xy} [x, y], \quad (1)$$

where $\alpha_{xy} \in Mor(x, y)$, $[x, y]$ is a segment of the partial order. A formal sum (1) is called a *finitary series*, if for any $x, y \in Ob C$, $x < y$ there exists only a finite number of $[u, v] \subset [x, y]$, such that $u < v$ and $\alpha_{uv} \neq 0_{uv}$. The set of the finitary series is denoted by $FI(C)$.

The addition of the finitary series is inherited from the addition of the morphisms. The multiplication is defined by means of the convolution:

$$\alpha\beta = \sum_{x \leq y} \left(\sum_{x \leq z \leq y} \alpha_{xz} \beta_{zy} \right) [x, y],$$

where $\alpha_{xz} \beta_{zy} \in Mor(x, y)$. Under these operations $FI(C)$ forms an associative ring with identity, which is called a *finitary incidence ring of a category*.

Let R be an associative ring with identity, $P(\preceq)$ an arbitrary preordered set. Denote by \sim the equivalence relation on P , such that $x \sim y$ iff $x \preceq y$ and $y \preceq x$. Define $M_{[x][y]}(R)$ to be an abelian group of row finite matrices over R indexed by the elements of the equivalence classes $[x]$ and $[y]$. Consider the following preadditive category $C(P, R)$:

1. $Ob C(P, R) = P/\sim$ with the induced order \leq .

2. $\forall [x],[y] \in Ob C(P,R)$ define $Mor([x],[y]) = M_{[x],[y]}(R)$, if $[x] \leq [y]$, and $0_{[x],[y]}$ otherwise.

Denote the finitary incidence ring of this category by $FI(P,R)$. Obviously, $FI(P,R)$ is an algebra over R , which is called a *finitary incidence algebra of P over R* .

Theorem 1. *Let P and Q be preordered sets, R and S indecomposable rings with identity. If $FI(P,R) \cong FI(Q,S)$ as rings, then $C(P,R) \cong C(Q,S)$.*

Corollary 1. *Let P and Q be preordered sets with finite equivalence classes, R and S indecomposable commutative rings with identity. If $FI(P,R) \cong FI(Q,S)$ as rings, then $P \cong Q$ and $R \cong S$.*

As a corollary we obtain the positive solution of the isomorphism problem for weak incidence algebras given in [2].

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SOME LÉVY AND LEVY TYPE PROCESSES WITH NANALYTIC CHARACTERISTIC FUNCTION

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The talk is devoted to the transition density estimates of a Lévy process with analytic characteristic function. Using the complex analysis technique (in particular, the steepest descent method), we construct the off-diagonal estimates for the transition probability density. Further we generalize the results for the case of Lévy-type processes. This is a joint work with A. Kulik and R. Schilling, motivated by the results obtained in [1].

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CONSTRUCTING OF THE PERIODICAL SOLUTIONS OF THE SINGULAR DIFFERENTIAL-ALGEBRAIC SYSTEMS AND THEIR APPLICATION FOR ANALYZING OF ELECTRIC CIRCUITS

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At compilation of mathematical models of many applied problems in the theory of electrical circuits, robotics, control theory, etc. we can obtain the periodical differential-algebraic systems of the type

$$B(t)\frac{dx}{dt}=A(t)x+f(t), \quad x, f \in R^n, \quad \text{rang} B(t)=r < n \quad \forall t \in R, \quad B(t+T)=B(t), \quad A(t+T)=A(t), \quad f(t+T)=f(t),$$

with singular matrix near the derivative and subjected to short-time (impulsive) periodical effects

$$\Delta x|_{t=\tau_i} \equiv x(\tau_i+0) - x(\tau_i-0) = B_i x(\tau_i-0) + a_i, \quad 0 < \tau_1 < \tau_2 < \dots < \tau_p < T, \quad \tau_{i+p} < \tau_i + T, \quad B_{i+p} = B_i, \quad a_{i+p} = a_i.$$

We found the structure of the general solution of such type systems, necessary and sufficient conditions for existing solutions of the initial problem. For such periodical problems the monodromy matrix was built and the problem of existing the T -periodical solutions both in noncritical and critical cases was solved. Usage of theoretical constructions for research of periodic modes in electrical circuits is considered.

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ON SOME CANTOR-LIKE SETS RELATED TO Q -REPRESENTATION OF REAL NUMBERS

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We study topological, metric and fractal properties of the sets of real numbers with conditions on using of symbols in their Q -representation (this is a generalization of s -adic expansion).

Let $A = \{0, 1, \dots, s-1\}$. We consider the following sets:

$$1. M = \{x : x = \Delta_{\alpha_1 \alpha_2 \dots \alpha_k \dots}^Q, \alpha_{1+(n-1)l} (x) \in A, \alpha_{1+(n-1)l+j} = c_{\alpha_1+(n-1)l+j}^n \in A, j = \overline{1, l-1}\},$$

$$\|c_{ij}^n\| = \begin{pmatrix} c_{01}^n & c_{02}^n & \dots & c_{0(l-1)}^n \\ c_{11}^n & c_{12}^n & \dots & c_{1(l-1)}^n \\ \dots & \dots & \dots & \dots \\ c_{(s-1)1}^n & c_{(s-1)2}^n & \dots & c_{(s-1)(s-1)}^n \end{pmatrix}, \quad n = 1, 2, \dots$$

$$2. B = \{x : x = \Delta_{\alpha_1 \alpha_2 \dots \alpha_k \dots}^Q, (\alpha_k(x), \alpha_{k+1}(x)) \neq (c_n, c'_{n+1}), \alpha_i \in A\}.$$

It is proved that the sets M and B are nowhere dense fractal sets of zero Lebesgue measure.

We also discuss a transition from s -symbol Q -representation to adjusted s^l -symbol Q -representation.

ABOUT EQUIVALENCE OF TWO A_∞ - STRUCTURES DEFINED ON $\text{Ext}^*(M, M)$

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Let k be a field, A a k -algebra and M a module over A . There are two different ways to define an A_∞ - structure on $\text{Ext}_A^*(M, M)$. The first way is to consider a dg-algebra $B = \text{Hom}^*(P^*, P^*)$ as an A_∞ -algebra, where P^* is a projective resolution of M . After that we can consider minimal model of B $H(B)$ endowed with the standard A_∞ - structure. Besides as a graded vector space $H(B)$ is canonically isomorphic to $\text{Ext}^*(M, M)$. The fact is that all such P^* define the same A_∞ - structure on $\text{Ext}^*(M, M)$ up to A_∞ -isomorphism ([1]). The second way is to consider the projective A - A -bimodule resolution P^* of A , to introduce the structure of A_∞ - coalgebra on it and then to obtain the corresponding convolutional structure of an A_∞ - algebra on $\text{Hom}^*(P^*, \text{End}_k(M, M))$. The latter is the same complex as $\text{Hom}^*(P^* \otimes M, M)$ where $P^* \otimes M$ is a projective resolution of M . Thus its homologies are canonically isomorphic to $\text{Ext}^*(M, M)$, which endows the minimal model of $H(\text{Hom}^*(P^*, \text{End}_k(M, M)))$ with a structure of A_∞ - algebra. We prove, that if $\dim_k A$ is finite, then these two A_∞ - structures on $\text{Ext}^*(M, M)$ are A_∞ -isomorphic.

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SYNCHRONIZATION IN A RANDOM OSCILLATOR NETWORK

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It is a joint work with M.Hassler. Complex networks play an important role in many natural and artificial systems, such as neural networks, power supply systems, the Internet, social networks, and so on [1]. The structure of network is determining dynamics of the coupled elements [2]. We study mean-field-type synchronization, which Kuramoto observed in globally coupled oscillators [3], in a random network.

We consider network with N nodes. At each node i there exists an oscillator, and the phase of the oscillator θ_i is developed as

$$\frac{\partial \theta_i}{\partial t} = \omega_i + K \sum_j a_{ij} \sin(\theta_j - \theta_i),$$

where K is the coupling constant, and a_{ij} is 1 if the nodes i and j are connected and 0 otherwise. Natural frequency ω_i is a random number whose distribution is given by the function $g(\omega)$ (we assume it is smooth symmetric $g(\omega) = g(\omega)$, $g(\omega)$ has finite support, define

$E|\omega| = \int |\omega|g(\omega)d\omega$). We define $P(k)$ as the distribution of nodes with degree k , $Ek = \int P(k)kdk$, $Ek^2 = \int P(k)k^2 dk$. To study synchronization phenomena we introduce order parameter

$$re^{i\psi} = \frac{\sum_{j=1}^N k_j e^{i\theta_j}}{\sum_{j=1}^N k_j}, 0 \leq r \leq 1.$$

Using continuum limit model proposed in [4] we obtain following:

Proposition. *Value of the order parameter is bounded by inequality: $r(1-r) \leq \frac{E|\omega|}{KEk}$.*

Sufficient condition for synchronization in a random network has been studied by author [4]. We show that necessary condition for synchronization is weakened sufficient one.

Proposition. *In our assumptions necessary condition for synchronization is $K \geq \frac{2Ek}{g(0)\pi Ek^2}$.*

Our statement is in complete agreement with contemporary results [5], where several authors have showed by numerical simulations that the onset of synchronization in a random geometric graph takes place roughly at the same value of the order parameter as a random graph with the same size and average connectivity.

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THE DYNKIN TYPE OF A NON-NEGATIVE INTEGER QUADRATIC FORM

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Let $q: Z^n \rightarrow Z$ be an integral quadratic form of the shape $q(x) = \sum_{i \in I} q_i x_i^2 + \sum_{i < j} q_{ij} x_i x_j$,

where $I = \{1, \dots, n\}$, $x = (x_1, \dots, x_n)$. Define $q_{ij} = q_{ji}$, $q_{ii} = q_i$. Let's give some definitions.

Form q is called *non-negative* if $q(x) \geq 0$ for any $x = (x_1, \dots, x_n)$ from Z^n . q is called *positive* if $q(x) > 0$ for any $x \neq 0$.

The integral form q is called *integer* if $\frac{q_{ij}}{q_i} \in Z$ for all $i, j \in I$.

The integral form q is called *unit* if $q_i = 1$ for all $i \in I$.

Integral form q is called *reduced* if there does not exist non-trivial integer common divider of the family of coefficients $\{q_{ij}, q_i \mid i, j \in I\}$.

The form q is called *connected* if there does not exist $J \subset I$ such that $q_{ij} = 0$ for all $i \in J, j \in I \setminus J$.

We say that two integral forms $q, q' : Z^n \rightarrow Z$ are *Z-equivalent* if there exists a Z-invertible linear transformation $T : Z^n \rightarrow Z^n$ with $q' = qT$. Observe that then q is non-negative (positive) if and only if q' is non-negative (positive).

For $\varepsilon \in \{+, -\}$ and $i, j \in I, i \neq j$ we define $T_{ij}^\varepsilon(e_s) : Z^n \rightarrow Z^n$ as the linear transformation given by

$$T_{ij}^\varepsilon(e_s) = \begin{cases} e_s, & \text{if } s \neq i \\ e_i - \varepsilon e_j, & \text{if } s = i. \end{cases}$$

If $q_{ij} > 0$ we call $T_{ij}^+(e_s)$ an *inflation* for q , whereas if $q_{ij} < 0$ we call $T_{ij}^-(e_s)$ an *deflation* for q . Observe that q and $q' = qT_{ij}^\varepsilon$ are Z-equivalent.

Proposition 1. *If q is non-negative, then there is a sequence of inflations and deflations with composition T such that the bigraph of qT comes to a disjoint union of connected unit forms multiplied by some non-negative integer number.*

Remark. *If q is connected reduced non-negative form, then there is a sequence of inflations and deflations with composition T such that the bigraph of qT comes to a disjoint union of connected unit forms.*

Proposition (Ovsienko [1]). *Let $q : Z^n \rightarrow Z$ be a unit form. If q is positive, then there is a sequence of inflation with composition T such that the bigraph of qT is disjoint union of Dynkin diagrams.*

According to previous Proposition 1 result of Ovsienko can be generalized for integer forms.

Proposition. *Let $q : Z^n \rightarrow Z$ be an integer form.*

If q is non-negative (positive), then there is a sequence of inflation and deflations with composition T such that the bigraph of qT is disjoint union of Dynkin diagrams multiplied by some non-negative (positive) integer.

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BRATTELI DIAGRAMS AND RELATED GROUPS

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This is a joint work with Volodymyr Nekrashevych. We classify locally finite groups, which are inductive limits of direct products of alternating groups with respect to block-diagonal embeddings. Also for such groups the normal structure is investigated. This class of groups includes a well known class of simple locally finite groups (so-called LDA-groups). We show that two such groups are isomorphic if and only if the AF-algebras defined by the respective Bratteli diagrams are isomorphic. Then the classical results on classification of AF-algebras can be applied.

d -MP-MODULES AND THEIR LOCALIZATIONS

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Let R be an associative differential ring with the set of pairwise commutative derivations $\Delta = \{\delta_1, \delta_2, \dots, \delta_n\}$, and let M be a differential R -module with the set $D = \{d_1, d_2, \dots, d_n\}$ of module derivations consistent with the corresponding ring derivations.

A differential submodule N of M is called *quasi-prime* if there exists an m -system S of the ring R and an S -system S^* of the module M such that N is maximal among differential submodules with $N \cap S^* = \emptyset$.

A differential submodule N of M is called *differentially prime* if M/N is differentially prime, i. e. if $\text{Ann}_l(K) = \text{Ann}_l(M/N)$ for every non-zero differential submodule K of M/N .

A differential module M is called *d -MP-module* if one of the following equivalent conditions holds:

1. Every quasi-prime submodule N of M is prime;
2. Every quasi-prime submodule N of M is radical;
3. For every prime submodule N of M the submodule

$$N_{\#} \stackrel{df}{=} \left\{ x \in M \mid x^{(i_1, \dots, i_n)} \in N \text{ for all } i_1, \dots, i_n \in \square \cup \{0\} \right\} \text{ is prime;}$$

4. The radical of any differential submodule is a differential submodule.

The properties of d -MP-modules formulated using the operator $(\)_{\#}$, in particular the behavior of prime differential submodules over commutative rings under localizations.

Proposition 1. *Let M be a d -MP-module over R . If \mathfrak{A} is a \wp -prime differential submodule of M , $\wp = \text{Ann}(M/N)$, then $N_{\#}$ is a $\wp_{\#}$ -prime differential submodule of M and $\wp_{\#} = \text{Ann}(M/N_{\#})$.*

Let M be a d -MP-module over a commutative differential ring R , let S be a multiplicatively closed subset of R .

Theorem 1. *A differential module of quotients $S^{-1}M$ is a d -MP-module.*

Corollary 1. *A differential d -module M is a d -MP-module if and only if the localization M_{\wp} is a d -MP-module for each prime differential ideal \wp of R .*

Theorem 2. *If N is a quasi-prime differential submodule of the differential R -module M , then N is differentially prime in M .*

Corollary 2. *If every differentially prime differential submodule of M is prime, then M is a d -MP-module.*

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SPECTRAL GAPS OF THE ONE-DIMENSIONAL SCHRÖDINGER OPERATORS WITH PERIODIC POTENTIALS

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On the complex Hilbert space $L^2(R)$ we consider the one-dimensional Schrödinger operators $S(q)$ with 1-periodic real-valued distribution potentials $q \in H^{-1}(T)$, $T := R \setminus Z$. Investigating case, in particular, includes to itself the case of potentials which are the periodic Dirac δ -functions and periodic measures.

The operators $S(q)$ are lower semibounded and self-adjoint, their spectra are absolutely continuous and have a band and gap structure.

We establish relationship between the regularity of potentials and the speed of decreasing/increasing of the lengths of spectral gaps in the scales of Hörmander spaces $H^o(T)$ of periodic functions or distributions on a circle and the appropriate sequence spaces $h^o(N)$ (see [1] and the references therein).

All results are obtained joint with Prof. V. Mikhailets. The investigation is partially supported by DFFD of Ukraine under grant $\Phi 28.1/017$.

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FREE PRODUCTS GENERATED BY AUTOMATA

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The automorphism group of a regular rooted tree is rich of free subgroups. From the other hand, there are plenty of free subgroups in free products of groups. Hence it is natural to find free products in the automorphism group of a regular rooted tree. It will be presented some results about constructing free products of finite groups acting on regular rooted trees. To obtain such free products finite state automata are used.

WREATH PRODUCTS OF METRIC SPACES

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The construction of wreath product of metric spaces is considered. The isometry group of wreath product of metric spaces is isomorphic as a permutation group to the wreath product of isometry groups of these spaces. The semigroup of contractions of wreath product of metric spaces is isomorphic as a transformation semigroup to the wreath product of semigroups of contractions of these spaces. This construction admits a generalization on

infinite sequences of spaces. Obtained infinitely iterated wreath product of metric spaces one can regard as a generalization of Cantor spaces.

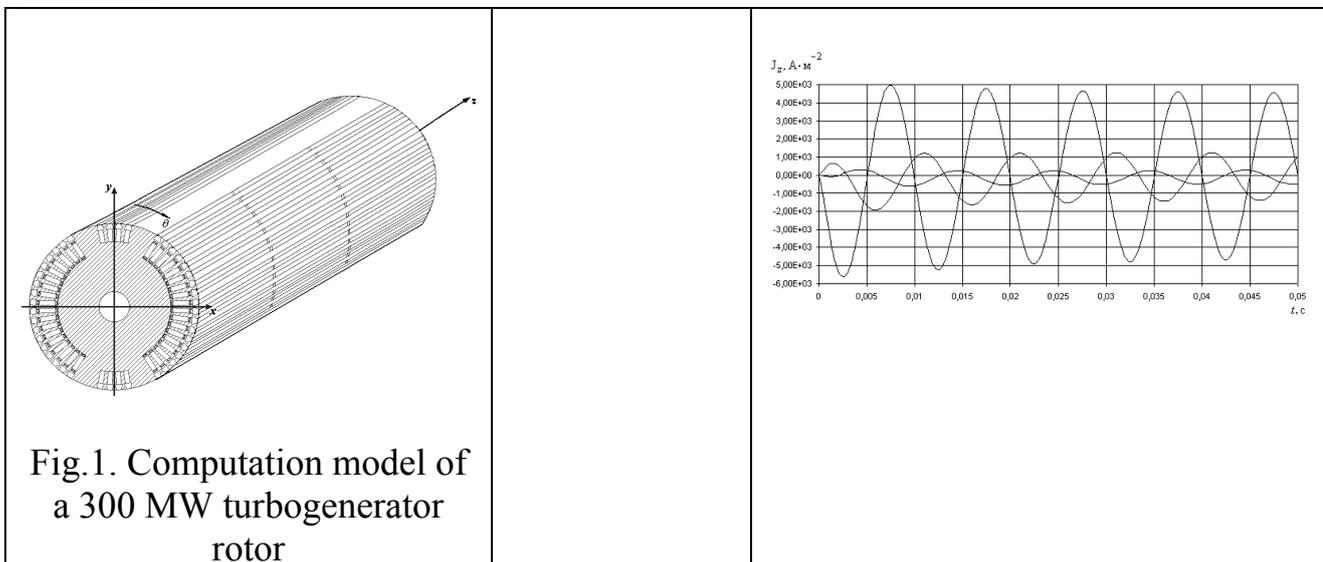
NUMERICAL ANALYSIS OF ELECTROMAGNETIC FIELDS IN 2D AND 3D (INDUSTRIAL APPLICATION: LARGE SYNCHRONOUS TURBOGENERATOR ROTORS)

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At the A.N. Podgorny Institute of Problems in Machinery NASU techniques for the finite element computer simulation of stationary and transient 2D and 3D electromagnetic processes in turbogenerator rotors are developed. Problems of electromagnetic fields and losses calculation in the cross-section and spatial fragments of the turbogenerator 300 MW at various operating conditions (a line-to-line short circuit on two phases of the machine and long-time unbalanced load supply) are solved. Influence of the slot wedge material on electromagnetic processes in the turbogenerator rotor is investigated. It is demonstrated that titanium wedges are preferable in comparison with duralumin ones because utilization of titanium wedges results in essential decrease of eddy currents density and losses in the turbogenerator rotor at all investigated operating conditions.

Computer modelling of electromagnetic field distribution about slot wedges joints by the rotor length is carried out. Principal view of the rotor is presented in Fig. 1, the rotor fragment (slot wedges joints) under consideration – in Fig. 2. Various variants of the rotor design as well as various slot wedge materials are investigated. As examples obtained temporal distributions of the axial component J_z of eddy current density as well as losses Q in selected points of the rotor in the case of duralumin wedges during a line-to-line short circuit are presented in Fig. 3.

Obtained numerical results will be used during computer simulation of turbogenerator rotors thermal, thermo-stressed and vibration state as well as for numerical assessment of their life decrease.



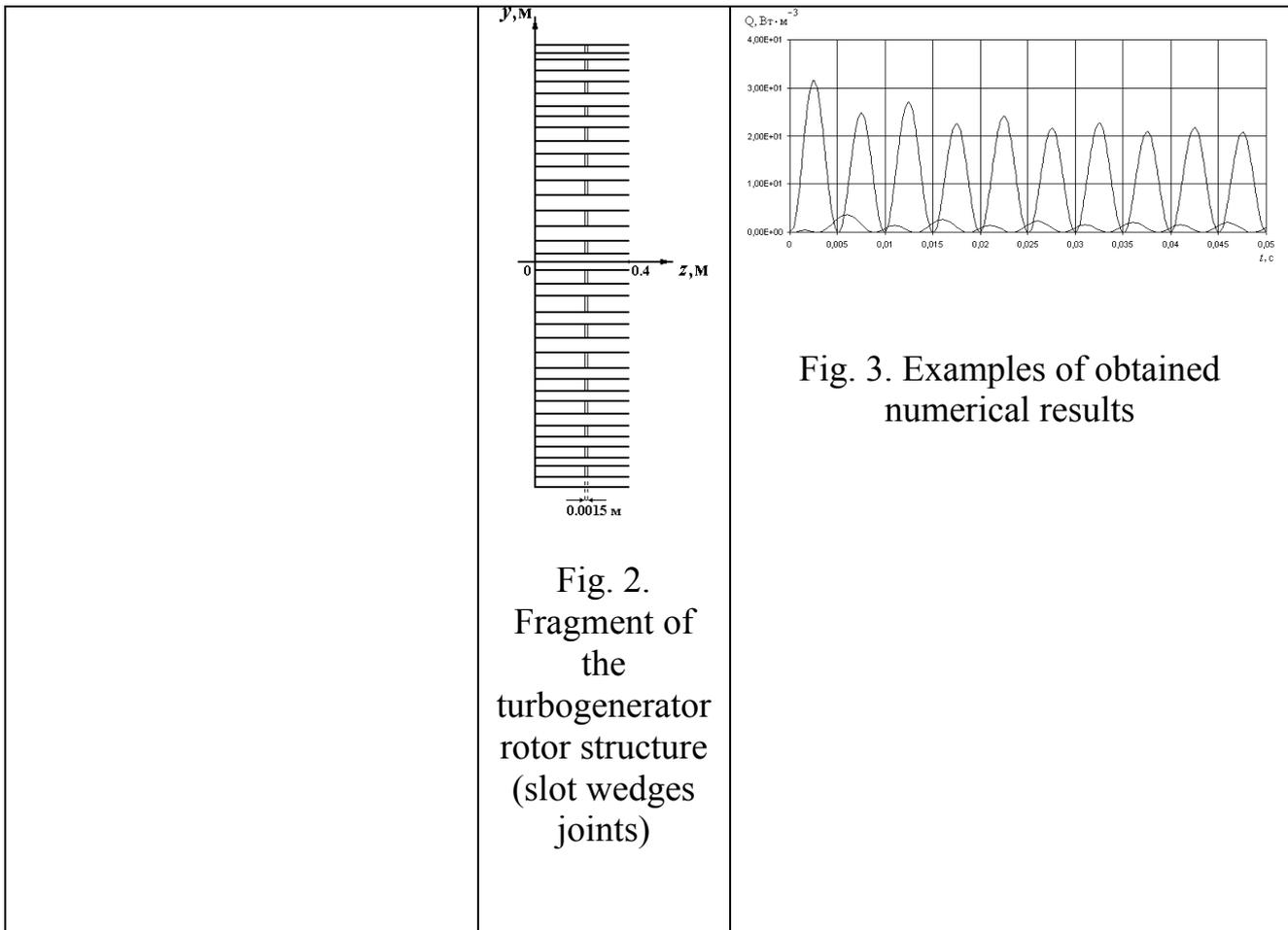


Fig. 2.
Fragment of
the
turbogenerator
rotor structure
(slot wedges
joints)

Fig. 3. Examples of obtained
numerical results

ON A HOMOLOGICAL DIMENSION OF FREE PARTIALLY COMMUTATIVE MONOIDS

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A free partially commutative monoid $M(\Sigma, I)$ is given by the presentation $\langle \Sigma \mid ab = ba, (a, b) \in I \rangle$, where Σ is a finite set and I is a symmetric, irreflexive binary relation over Σ . In [1] A. Husainov conjectured that homological dimension of free partially commutative monoid $M(\Sigma, I)$ does not exceed n , if there are no distinct letters a_1, a_2, \dots, a_{n+1} from Σ such as $(a_i, a_j) \in I$ for all $1 \leq i, j \leq n+1$.

An unoriented graph without loops $\Gamma(M)$ can be assigned to $M = M(\Sigma, I)$ in following way: Σ is the set of vertices and commuting vertices are connected by the edges. The number of complete subgraphs with k vertices in $\Gamma(M)$ we denote by r_k .

We construct a free resolution, which k -th component is a free ZM -module with r_k generators, and with its help prove the Husainov Conjecture:

Proposition 1. Let M be a free partially commutative monoid. The homological dimension of M is equal n if and only if the largest complete subgraph in $\Gamma(M)$ has n vertices.

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ASYMPTOTIC ANALYSIS OF BOUNDARY-VALUE PROBLEMS IN THIN PERFORATED DOMAINS WITH QUICKLY OSCILLATING THICKNESS

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A mixed nonuniform boundary-value problem and a spectral Neumann problem are considered for the second-order symmetric elliptic differential operator with quickly oscillating coefficients in a thin perforated domain with rapidly varying thickness. The leading terms of asymptotics are constructed and asymptotic estimates are proved for solutions of these problems. These results were announced in the Reports of the Academy of Sciences of Ukraine, 10 (1991). New results of this paper are connected with the construction of the asymptotic expansion for the solution to a mixed uniform boundary value problem under additional assumptions of symmetry for the coefficients of the operator and for the thin perforated domain.

КВАДРАТИЧНЫЕ ФОРМЫ ТИТСА И СИЛЬНАЯ (MIN, MAX)-ЭКВИВАЛЕНТНОСТЬ

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Квадратичная форма Титса для конечных частично упорядоченных (сокращенно ч.у.) множеств играет важную роль в теории представлений. В частности, Ю.А. Дрозд доказал, что ч.у. множество имеет конечный тип тогда и только тогда, когда его форма Титса слабо положительна.

В работе [1] В.М. Бондаренко ввел понятие минимаксной эквивалентности ч.у. множеств (сокращенно называемой (min, max)-эквивалентностью), которое, в частности, сыграло решающую роль (как метод) при описании ч.у. множеств с положительно определенной формой Титса и P -критических ч.у. множеств [2]. Напомним это понятие.

Пусть S — конечное ч.у. множество. Определим для его минимального (соотв. максимального) элемента a ч.у. множество $S^+(a)$ (соотв. $S_-(a)$) следующим образом: как обычное множество это то же самое S и при этом отношение порядка на $S \setminus a$ остается прежним., а элемент a становится уже максимальным (соотв. минимальным), причем $a > x$ (соотв. $a < x$) в новом множестве S тогда и только тогда, когда a и x несравнимы в старом S . Ч.у. множества T и S , равные как обычные множества, называются (min, max)-эквивалентными, если существует последовательность ч.у. множеств $P_1=S, P_2, \dots, P_m=T$ ($m > 0$) такая, что для любого допустимого i либо $P_{i+1}=(P_i)_-(y)$, либо $P_{i+1}=(P_i)^+(y)$ для некоторого y .

Мы рассматриваем обобщение этой ситуации на случай ч.у. множеств с инволюцией. Нами определяется понятие сильной (min, max)-эквивалентности ч.у. множеств с инволюцией и доказана следующая теорема, аналогичная соответствующей теореме из [2].

Теорема. *Квадратичные формы Титса сильно (min, max)-эквивалентных ч.у. множеств с инволюцией эквивалентны.*

Формулировка этой теоремы становится более понятной, если воспользоваться двухэтапным определением квадратичной формы Титса для ч.у. множеств с инволюцией [3].

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THE LINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS WITH A PARAMETER

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Consider boundary value problems with parameter $\varepsilon \in [0, \varepsilon_0]$ for the systems of linear differential equations

$$y'(t; \varepsilon) = A(t; \varepsilon)y(t; \varepsilon) + f(t; \varepsilon), \quad t \in [a, b], \quad (1)$$

$$\alpha_\varepsilon y(a; \varepsilon) + \int_a^b \Phi(t; \varepsilon)y(t; \varepsilon)dt = c_\varepsilon, \quad (2)$$

where matrix-functions $A(\cdot; \varepsilon) \in L_1^{m \times m}$, $\Phi(\cdot; \varepsilon) \in L_\infty^{m \times m}$, vector-functions $f(\cdot; \varepsilon) \in L_1^m$, complex matrices $\alpha_\varepsilon \in C^{m \times m}$ and complex vectors $c_\varepsilon \in C^m$, $m \in N$.

The vector-function $y(\cdot; \varepsilon) \in W_{1,1}^m$ is said to be a solution of the problem (1), (2) if it satisfies the system (1) a.e. on $[a, b]$ and the condition (2).

Supposition U. Homogeneous problem with $\varepsilon = 0$ has only trivial solution.

Definition 1. We shall say that a complex matrix-function $G(\cdot; \varepsilon) \in L_\infty([a, b] \times [a, b]; C^{m \times m})$ is a Green's matrix if the solution of semihomogeneous boundary value problem appears in a kind

$$y(t; \varepsilon) = \int_a^b G(t; s; \varepsilon)f(s; \varepsilon)ds, \quad \forall f(\cdot; \varepsilon) \in L_1^m.$$

If such Green's matrix exists, she is determined simply with exactness to the values on the set of measure zero.

Theorem 1. Let the supposition U be satisfied and let the conditions

1) $\|A(\cdot; \varepsilon) - A(\cdot; 0)\|_1 \rightarrow 0, \quad \varepsilon \rightarrow +0;$

2) $\alpha_\varepsilon \rightarrow \alpha_0, \quad \varepsilon \rightarrow +0;$

3) $\|\Phi(\cdot; \varepsilon) - \Phi(\cdot; 0)\|_\infty \rightarrow 0, \quad \varepsilon \rightarrow +0$

hold. Then for any sufficiently small $\varepsilon > 0$ the Green's matrices of problem (1), (2) exist and on the square $[a, b] \times [a, b]$

$$\|G(\cdot; \varepsilon) - G(\cdot; 0)\|_{\infty} \rightarrow 0, \quad \varepsilon \rightarrow +0.$$

These results were got jointly with Mikhailets V. A.

CONNECTION BETWEEN DARLINGTON REPRESENTATIONS AND SI-DILATIONS OF MATRIX FUNCTIONS OF THE CARATHEODORY CLASS

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The intimately connection between second order stationary stochastic processes theory in the Kolmogorov-Wiener conception and the theory of unitary and selfadjoint operators in Hilbert space is well known and was effective used in the development of both theories. The connection between second order stochastic realization theory, based on the Kalman conception, and the passive linear time-invariant systems theory used much less, although the original Kalman's ideas were based on this connection. Development of realization theory for multivariate stochastic processes lead us to a new model of passive impedance system with minimal losses and with stable evolution operator semi group.

We realized an arbitrary passive impedance system with the losses of scattering channels as a part of the conservative transmission SI(scattering-impedance)-system without losses. Stable, *-stable and bilaterally stable passive impedance systems in our model are investigated in terms of transmission matrices (SI-dilations) of the corresponding conservative transmission SI-system. The special attention is paid to the minimal and optimal, minimum and *-optimal bilaterally stable passive impedance systems which are very important for applications in stochastic realization theory.

We consider the problem related to the Caratheodory class of analytical in open unit disk matrix functions $c(z)$ of size p with nonnegative real part. Functions of such type are the transfer functions of passive impedance systems in our model. We study the bi-sided connection between Darlington representations of Caratheodory matrix functions and their SI-dilations.

VARIATIONAL PROBLEMS WITH DEGENERATION AND NONREGULAR UNILATERAL OBSTACLES IN VARIABLE DOMAINS

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We consider a sequence of integral functionals defined on Sobolev spaces. The spaces are associated with a weighted function and a sequence of domains Ω_s contained in a bounded domain Ω of R^n . For the given functionals we study variational problems with constraint sets of the kind $h(x, \nu(x)) \leq 0$ a.e. in Ω_s , where $h: \Omega \times R \rightarrow R$. Our main result provides conditions

under which solutions of the variational problems under investigation converge in a certain weak sense to a solution of a limit variational problem with the set of constraints defined by the same function h . At the same time we show that constraint sets under consideration are represented as sets with unilateral obstacles, and generally speaking these obstacles do not lie in Sobolev spaces. We note that the statement of our main result requires the strong connectedness of the weighted Sobolev spaces, Γ -convergence of functionals and contains the following “exhaustion” condition on the domains Ω_j : for every increasing sequence $\{m_j\} \subset N$, $meas\left(\Omega \setminus \bigcup_j \Omega_{m_j}\right) = 0$, and in general this condition cannot be omitted. We also remark that the same “exhaustion” condition has already been used in [1] for the study of both a convergence of sets of variable Sobolev spaces and the coercivity of the Γ -limit of functionals defined on these spaces.

This is a joint work with A.A. Kovalevsky.

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GROUPS OF AUTOMATA WITH NO CYCLES WITH EXIT

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Let X be a finite nonempty set. This set is called an alphabet and its elements are called letters. An automaton over alphabet X is a tuple $A = \langle X, Q, \varphi, \lambda \rangle$, where Q denotes the set of states, $\varphi: Q \times X \rightarrow Q$ is the transition function and $\lambda: Q \times X \rightarrow X$ is the output function.

Consider the set X^* of all words over alphabet X . Every state $q \in Q$ defines a map $f_q = \lambda(q, \cdot): X^* \rightarrow X^*$. The automaton A is called invertible if all these maps are bijections. The group of an invertible automaton $A = \langle X, Q, \varphi, \lambda \rangle$ is the group generated by the set $\{f_q: q \in Q\}$ ([1]).

A cycle in an automaton $A = \langle X, Q, \varphi, \lambda \rangle$ is a sequence of pairwise different states $q_1, q_2, \dots, q_n \in Q$, $n \geq 1$, such that there exists a sequence of letters $x_1, x_2, \dots, x_n \in X$ which satisfies equalities $\varphi(q_i, x_i) = q_{i+1}$, $1 \leq i < n$, and $\varphi(q_n, x_n) = q_1$. This cycle is called a cycle with exit if there exist i , $1 \leq i \leq n$, and $x \in X$ such that $\varphi(q_i, x) \in \{q_1, q_2, \dots, q_n\}$. In other case this cycle is called a cycle without exit. The group of a finite automaton with no cycles with exit is finite ([2]).

Theorem. Let $A = \langle X, Q, \varphi, \lambda \rangle$ be an automaton with no cycles with exit over binary alphabet, $|Q| = n$ and G be the group generated by this automaton. Then $|G| \leq 2^{2^{n-1}}$.

Theorem. For arbitrary positive integer n there exists an n -state automaton over binary alphabet with no cycles with exit such that the order of the group of this automaton is $2^{2^{n-1}}$.

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CLUSTER EXPANSIONS IN DYNAMICS OF MANY-PARTICLE SYSTEMS

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The evolution of states of many-particle systems is well-known to be completely determined by an infinite sequence of marginal distribution functions as solution expansions of the initial value problem for the BBGKY hierarchy. Under investigation of this hierarchy novel functional-analytical methods have been developed in [1,2,3]. There is a typical problem in the solution construction for infinite-particle systems. It lies in the divergence of integrals with respect to the configuration variables in every term of the solution expansions. Until recently, the existence theorems have been proved for one-dimensional systems in the case of a certain class of short-range interaction potential and three-dimensional case only for hard spheres systems. It is the cluster structure of the solution that allows to regularize its cumulant representation obtained in [4,5] applying to last one the Petrin's method of an interaction region [6]. Due to this method, the structure of the solution expansions guarantees mutual compensation of the divergent integrals in every term of the series. We establish convergence conditions for the series of the solution local in time and prove the existence theorem weakly for the initial data from the space of sequences of functions, bounded with respect to the configuration variables, as Maxwellian distributions with respect to the momentum variables [7].

In statistical mechanics there exist two techniques in the matter of mean value of the number of particles for description of the evolution of many-particle systems, i.e., the evolution of states described above and observables determined by solution of the initial value problem for the dual BBGKY hierarchy. The same problem of the divergent terms in functional for the mean value of observables arises for infinite particle systems in the cases where either observables or states vary in time. The purpose achieved consists in well-defining locally in time such a functional for a one-dimensional system of hard-core particles. To prove the convergence we apply an idea of the method of interaction region and the method of regularization to the solutions of both hierarchies [8]. We also discuss such a problem for several different classes of observables and for an arbitrary time interval.

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**On the exponential mixing property for the family of quantities
that admit cluster expansion.**

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It is shown that for a very general scheme of cluster expansion, appearing in the analysis of the lattice systems in the framework of equilibrium statistical mechanics, the convergence of the series of the cluster expansions imply the exponential mixing property of the corresponding Gibbs measure.

**MULTIFRACTIONALITY:
A MODERN TOOL TO MODEL COMPLEX BEHAVIOR**

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Brownian motion, or Wiener process, had been a popular tool in the last century for modeling randomness in natural and sciences, computer networks and financial markets. However, the lack of memory in this model led many scientists to consider other models, like fractional Brownian motion, which allow for a long memory or/and a long-range dependence.

Nowadays, the new dimensions created by the climate change and the global financial crisis force us to consider more complex models having one or both properties of *multifractionality*, which means that the deepness of memory evolves with time, and *heavy tails*, which means that significant changes are not so extremely improbable, as for Brownian or fractional Brownian motion.

I will discuss in my talk how both properties can be modeled mathematically, current state-of-art for the models and existing challenges.

The results I will present are obtained within the Multifractionality project of Marie Curie Actions program, supported by the Commission of European Communities, grant PIRSES-GA-2008-230804.

ASYMPTOTIC ANALYSIS OF A PARABOLIC SEMILINEAR PROBLEM WITH NONLINEAR BOUNDARY MULTIPHASE INTERACTIONS IN A PERFORATED DOMAIN

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We consider a parabolic semilinear problem with rapidly oscillating coefficients in a domain Ω_ε that is ε -periodically perforated by small holes of size $O(\varepsilon)$. The holes are divided into two ε -periodical sets depending on the boundary interaction at their surfaces. Two different nonlinear Robin boundary conditions $\sigma_\varepsilon(u_\varepsilon) + \varepsilon k_m(u_\varepsilon) = \varepsilon g_\varepsilon^{(m)}$, $m = 1, 2$, are given on the corresponding boundaries of the small holes. The asymptotic analysis of this problem is made as $\varepsilon \rightarrow 0$, namely the limiting problem is found and a convergence theorem is proved without using extension operators. Also, the asymptotic approximation for the solution is constructed and the corresponding error estimate is deduced. It follows from derived results that for applied problems in perforated domains we can use the corresponding homogenized problem, which are more simple, instead of the initial problem with the sufficient plausibility.

MATRIX REPRESENTATIONS OF SEMIGROUPS AND DYNKIN DIAGRAMS

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We study matrix representations of semigroups over any fixed field. Our main results are full classifications of semigroups generated by idempotents with partial null multiplication (abbreviated: IPN-semigroups) that have finite representation type and full classifications of finite IPN-semigroups of tame representation type; here one proves that any infinite IPN-semigroup has infinite representation type.

With each IPN-semigroup we associate a quiver and for any IPN-semigroup we indicate a connection between its representations and representations of the corresponding quiver (which was introduced by P.Gabriel). In term of this quiver we formulate all the criterions, and the main role here is played by ordinary and extended Dynkin diagrams.

We classify the indecomposable representations of all finite tame IPN-semigroups, as well as some infinite ones.

For finite IPN-semigroups we indicate a connection between them semigroup algebras and algebras of pathes of quivers.

ON NORMALITY AND NON-NORMALITY OF REAL NUMBERS

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ON IRREDUCIBLE MODULAR REPRESENTATIONS OF GIVEN DEGREE OF FINITE GROUP OVER COMMUTATIVE LOCAL RING

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It is well known that trivial representation of the first degree is only one irreducible matrix representation of finite p -group over a principle ideal domain of characteristic p .

Theorem 1. *Let G be a finite p -group of order $|G| > 1$ and R be a commutative Artinian local ring of characteristic p^s ($s > 0$, p is a prime) which is not a field. The set of all nonequivalent irreducible matrix R -representations of group G of degree $n > 1$ is finite if and only if one of the following conditions holds: 1) field $R/\text{Rad}R$ is finite; 2) $|G|=2$, $s=1$, $(\text{Rad}R)^2=0$, R is a ring of principal ideals and all polynomials over field $R/\text{Rad}R$ of degree n are reducible; 3) $|G|=3$, $s=1$, $(\text{Rad}R)^2=0$, $n=2$, R is a ring of principal ideals and all polynomials over field $R/\text{Rad}R$ of degree 2 are reducible; 4) $|G|=p$, $s > 1$, $\text{Rad}R=pR$, $n \notin (p-1)\mathbf{Z}$ and all polynomials over field $R/\text{Rad}R$ of degree n are reducible; 5) $|G|=p$, $s > 1$, $\text{Rad}R=pR$, $n \in (p-1)\mathbf{Z}$ and all polynomials over field $R/\text{Rad}R$ of degrees n and $n/(p-1)$ are reducible.*

Lets R be a local integral domain of characteristic p . If R is not a principle ideal domain we can construct irreducible matrix R -representation of finite p -group of order $|G| > 2$ of even degree greater then any fixed number. If any finitely generated ideal of R do not contain the minimum generated system from more than two elements all matrix R -representation of group G of order 2 of odd degree are reducible.

GENERAL KLOOSTERMAN SUMS OVER $Z[i]$ AND THEIR APPLICATIONS

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We consider two type of the general Kloosterman sums over $Z[i]$:

$$K(\alpha, \beta; k; \gamma, \psi) = \sum_{x \in R^*(\gamma, i)} \psi(x) \exp\left(\pi i Sp \frac{\alpha x^k + \beta x^{ik}}{\gamma}\right),$$

where $\alpha, \beta, \gamma \in Z[i]$, ψ is multiplicative character modulo γ ,

$$\tilde{K}(\alpha, \beta; h, q; k) = \sum_{\substack{x \in R^*(\gamma, i) \\ N(xy) \equiv h \pmod{q}}} e_q\left(\frac{1}{2} Sp(\alpha x^k + \beta x^{ik})\right)$$

where $\alpha, \beta \in Z[i]$, $h, q \in \mathbf{N}$, $(h, q) = 1$.

We call $K(\alpha, \beta; k; \gamma, \psi)$ the general power Kloosterman sum and call $\tilde{K}(\alpha, \beta; h, q; k)$ the norm Kloosterman sum.

Our aim is obtain non trivial estimations for $K(\alpha, \beta; k; \gamma, \psi)$ and $\tilde{K}(\alpha, \beta; h, q; k)$.

Theorem 1(see, [2], Theorem 3.1). Let p be a Gaussian prime number, $N(p) = p \equiv 1 \pmod{4}$ and let $d = (k, p-1)$. Then

$$|K(\alpha, \beta; k; p)| \leq 2dN((\alpha, \beta, p))^{\frac{1}{2}} N(p)^{\frac{1}{2}}.$$

Theorem 2(see, [2], Theorem 3.2). Let $p \equiv 3 \pmod{4}$, $k \in \mathbb{N}$, $d = (k, p^2 - 1)$. Then

$$|K(\alpha, \beta; k; p)| \leq 2dN((\alpha, \beta, p))^{\frac{1}{2}} N(p)^{\frac{1}{2}}.$$

The case of arbitrary integer $\gamma \in \mathbb{Z}[i]$ can be considered by multiplicative property of the Kloosterman sums.

We denote for $\alpha \in \mathbb{Z}[i]$:

$$m_\alpha = \max_{m > n} \{ \alpha \equiv 0 \pmod{p^m} \}$$

Theorem 3(see, [2], Theorem 4.1). Let $(h, p) = 1$. Then

$$\tilde{K}(\alpha, \beta; h, p^n; 1) \ll (p^{m_\alpha}, p^{m_\beta}, p^n)^{\frac{1}{2}} p^{\frac{3n}{2}}$$

with an absolute constant in symbol “ \ll ”.

Theorem 4. Let $h, p \in \mathbb{Z}$, p be a prime number, $(h, p) = 1$. Then for $n \geq 2$ we have

$$\tilde{K}(a, b; h, p^n; k) \leq f(x) = \begin{cases} 2p^{\frac{3}{2}n+m} \log p^n, & \text{if } (a, b, p) = 1 \text{ and } p^m \parallel k, p \equiv 3 \pmod{4} \\ d^4 \cdot p^{\frac{3}{2}n}, & \text{if } (d-1)^4 < p, d = (k, p-1), p \equiv 1 \pmod{4} \\ d^4 \cdot p^{n+m}, & \text{if } (d-1)^4 \geq p, p \equiv 1 \pmod{4}, m = \left\lfloor \frac{n+1}{2} \right\rfloor \end{cases}$$

Theorems 1 and 2 are applied to study the general Lehmer problem. We use the Theorems 3 and 4 to construct the asymptotic formula of summatory function for $\tau(\alpha)$, $\alpha \in \mathbb{Z}[i]$ with norms in arithmetic progression[1].

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FRACTAL PROPERTIES OF THE CANTOR-LIKE SETS RELATED TO ϕ -REPRESENTATION OF REAL NUMBERS

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Definition. A sequence of real numbers (a_n) with $a_n = a_{n-1} + a_{n-2}$, $n \geq 3$, is called a *Fibonacci sequence*.

The set of all Fibonacci sequences with linear operations on it (addition and multiplication by scalar) is a two-dimensional linear space.

Let $F^1 = \left\{ (b_n): b_1, b_2 \in R, b_n = b_{n-1} + b_{n-2}, n \geq 3, \sum_{n=1}^{\infty} b_n < \infty \right\}$ be a set of convergent

Fibonacci sequences. Then $\langle F^1, +, \lambda(\cdot) \rangle$ is a one-dimensional linear subspace of the space of Fibonacci sequences. Every element of this subspace can be represented in the form:

$$(b_n) = (b\hat{\phi}^{n-1})_{n=1}^{\infty} = (b; b\hat{\phi}; b\hat{\phi}^2; \dots; b\hat{\phi}^n; \dots),$$

where $b \in R$, $\hat{\phi} = \frac{1-\sqrt{5}}{2}$ is a negative solution of the equation $x^2 - x - 1 = 0$.

Theorem 1. Any real number $x \in [-1; -\hat{\phi}^{-1}]$ can be represented in the form:

$$x = \sum_{n=1}^{\infty} \varepsilon_n(x) \hat{\phi}^{n-1} = \varepsilon_1(x) \hat{\phi}^0 + \varepsilon_2(x) \hat{\phi}^1 + \dots + \varepsilon_n(x) \hat{\phi}^{n-1} + \dots$$

(the so-called $\hat{\phi}$ -expansion of real numbers), where $\varepsilon_n(x) \in \{0, 1\}$.

Let $V_n = \begin{cases} \{0, 1\}, & n = 2k - 1, \\ 1, & n = 2k. \end{cases}$ Let $C[\hat{\phi}, V_n]$ be a set of all numbers from interval

$x \in [-1; -\hat{\phi}^{-1}]$ such that the n -th symbols of their $\hat{\phi}$ -expansion take values from the set V_n .

Theorem 2. $C[\hat{\phi}, V_n]$ is a nowhere dense set of zero Lebesgue measure, and the Hausdorff-Besicovitch dimension of this set is equal to $\log_{\varphi^2} 2$, where $\varphi = \frac{1+\sqrt{5}}{2}$.

Corollary. If $V_m = \begin{cases} \{0, 1\}, & m = 2k - 1, \\ 0, & m = 2k, \end{cases}$ then $C[\hat{\phi}, V_m]$ is a nowhere dense set of zero

Lebesgue measure, and the Hausdorff-Besicovitch dimension of this set is equal to $\log_{\varphi^2} 2$.

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AN ANALOG OF STAMPACCHIA METHOD IN THE STUDY OF SOLUTIONS OF NONLINEAR FOURTH-ORDER EQUATIONS WITH A STRENGTHENED ELLIPTICITY

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We consider the Dirichlet problem for nonlinear fourth-order equations of the form

$$\sum_{|\alpha|=1,2} (-1)^{|\alpha|} D^\alpha A_\alpha(x, \nabla_2 u) + a|u|^{\sigma-1} u = f(x) \quad \text{in } \Omega,$$

where Ω is a bounded open set of R^n , $f: \Omega \rightarrow R$, $a \geq 0$, $\sigma > 1$ and $\nabla_2 u = \{D^\alpha u: |\alpha|=1,2\}$. The main structural requirement for the coefficients A_α is the following strengthened ellipticity condition: for a.e. $x \in \Omega$ and every $\xi = \{\xi_\alpha \in R: |\alpha|=1,2\}$,

$$\sum_{|\alpha|=1,2} A_\alpha(x, \xi) \xi_\alpha \geq c \left\{ \sum_{|\alpha|=1} |\xi_\alpha|^q + \sum_{|\alpha|=2} |\xi_\alpha|^p \right\},$$

where $p \in (1, n/2)$, $q \in (2p, n)$ and $c > 0$.

In the talk we discuss the next questions:

(i) dependence of the integrability of solutions to the given problem on the integrability of the function f in the case where $f \in L^t(\Omega)$ with $t > nq/(nq - n + q)$;

(ii) description of the sets of boundedness for solutions to the given problem in the case where $f \in L^1(\Omega)$.

Similar questions are studied for nonlinear equations of arbitrary even order with strengthened ellipticity and integral functionals with strengthened coercivity.

The results are partially published in [2, 3, 4]. Their proofs are based on the development of Stampacchia method proposed in [1] for second-order equations.

This is a joint work with A.A. Kovalevsky.

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THE REPRESENTATIONS OF FOUR PROJECTIONS CONNECTED WITH LINEAR RELATION

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Let H be finite-dimensional Hilbert space. We will consider the collection of orthoprojections P_1, P_2, P_3, P_4 , $P = P^2 = P^*$ in this space. Our talk is dedicated to the description of all possible vectors of generalized dimensions $(\dim(H); \dim(P_1), \dim(P_2), \dim(P_3), \dim(P_4))$, and to the description of all irreducible (up to unitary equivalence) collections of orthoprojections that satisfied the relation: $\alpha_1 P_1 + \alpha_2 P_2 + \alpha_3 P_3 + \alpha_4 P_4 = \lambda I$ where $(\alpha_1, \alpha_2, \alpha_3, \alpha_4)$ is fixed vector from \mathfrak{R}^+ , $\lambda \in \mathfrak{R}$.

MODAL APPROACH TO THE APPROXIMATE CONTROLLABILITY PROBLEM FOR DISTRIBUTED PARAMETER SYSTEMS

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The investigation of controllability problems is a challenging research area in mathematical control theory. It is a well-known fact that wide classes of distributed parameter control systems are not completely controllable in the energy state space. Hence, the notion of approximate controllability appears naturally in the description of reachable sets for infinite dimensional systems.

In this presentation, models of distributed parameter vibrating systems with finite dimensional controls are considered. For an abstract formulation of the controllability problem, we study properties of the flow of a linear control system in Hilbert space. An estimate of solutions of the system is carried out for the class of optimal control corresponding to a subsystem with finite number of degrees of freedom. It is proved that the family of controllers considered solves the problem of approximate controllability for the infinite dimensional system.

Geopolitics & economy in Society.

SOCIO-ECONOMIC INEQUALITIES IN UKRAINE: COMPARATIVE DYNAMICS IN EUROPEAN SPACE

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Dynamics of social systems with changing social order lead to transformation of the inequalities structure and attitudes of population toward them. In terms of constructivist approach to study of inequalities we analyze the following questions: which attitudes toward social and economic inequalities are represented by public opinion; how does perception of social and economic inequalities reproduce structural features of the society; and how do the socio-economic inequalities differs in Ukraine and in European societies. Comparison of the dynamics of social and economic stratification (measured by Jini coefficient) with perception of this dynamics by the people in Ukraine based on the data of Monitoring done by Institute of Sociology National Academy of Science of Ukraine in 1992-2009 lead us to the conclusion about distinction between “objective” and “subjective” factors of socio-economic inequalities’ dynamics in Ukraine in 1990th-2000th. Comparative analysis of the data about inequalities perception and socio-economic situation of people in European Societies based on the European Social Survey data (2004, 2006, 2008¹) demonstrates significant difference between socio-economic inequalities in Ukraine and Western European Societies (Austria, Belgium, Germany, France, Netherlands, United Kingdom), as well as variance between Ukraine and Eastern European Societies (Estonia, Hungary, Poland, Slovenia, Slovakia). Another parameter of socio-economic dynamics in European societies is observed common features in perception of socio-economic inequalities and social justice attitudes among population of post-Socialist European societies that differs them from Western European Societies. Placing Ukraine on the map of European social space gives variance in perception of social justice and social inequalities patterns and let us to demonstrate some trends of socio-economic dynamics in Europe.

CYCLIC RECURRENCE OF AGRICULTURAL PRODUCTION

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Theory of the big cycles of an economical conjuncture directly connected with a name of N. Kondratyev and should act as a methodological basis of any research on revealing of laws of cyclic processes. Studying of the recurrence displays in dynamics of agricultural production

¹ ESS data 2008 on Ukraine is not yet available, so to compare Ukraine with European Societies we used the data from IS NAS monitoring 2008 (appropriate questions)

has a big practical value since some scientists assume that one of the reasons of cyclic fluctuations in economy is the recurrence in the development of agrarian sector. Founder of the theory of external factors which connect recurrence in the economical development with recurrence of the Solar activity where English economist W. Jevons. When it was authentically fixed that occurrence of the sunspots has cyclic character, he assumed that processes on the Sun has an influence on a climate and weather, and as a consequence – on agriculture, and through it – on commercial activity.

Research of the recurrence in agriculture has been carried out in Ukraine, Germany, USA, and other countries. For the definition of the cycle parameters different methodical approaches can be used, namely - linear functions, indicative curves, parabolas, spectral Fourier analysis, mathematical model of a sinusoid, etc.

A few types of the economical cycles are known in the economical theory: N. Kondratyev cycles (50-60 years); S. Kuznets cycles (18-25 years); K. Zhjuglar cycles (10 years); J. Kitchin cycles (2 years 4 months).

We make calculations on revealing of the recurrence displays in productivity of the grain-crops. In the conditions of Ukraine cycles from 17 to 20 years are most accurately expressed, which corresponds to duration of Kuznets cycles. German agriculture is less exposed to influence of the weather factors and therefore cycles of more then 40 years are most accurately traced which corresponds to the duration of the so called long Kondratyev waves.

FORMING ECONOMIC AND INSTITUTIONAL CONDITIONS FOR EFFECTIVE INFORMATION SOCIETY DEVELOPMENT IN UKRAINE

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The process is based on several assumptions; in particular that information society development should become the most important component of the long-term social and economic policy of Ukraine and decisive factors of ensuring its geopolitical competitiveness:

- 1.** the purpose of the information society is to be integrated into the comprehensive development of the human being, creation of conditions for his spiritual and intellectual enrichment, build-up of the national human capital as a basis for the development of social, economic, humanitarian, cultural, and other aspects of social life in Ukraine; first of all in the interests of improvement of individuals' well being, effectiveness of the economy, and strengthening of the state system;
- 2.** development of the information society in Ukraine should become a basis for its accession to the United Europe, where integration processes are ensured by implementation of the Lisbon Strategy based on carrying out "e-Europe+" and "e-Europe Action Plan" programs for the candidate countries;
- 3.** constructive use of experiences of developed countries that have achieved world leadership in this field should become a basis for the policy of information society development in Ukraine;
- 4.** recognition of the importance of information in modern civilization is premised on the necessity of extensive integration of Ukraine into the world processes of creation and use of information technologies as a prerequisite for its transformation into a hightech and competitive nation;
- 5.** It is not sufficient for information society development efforts to deal only with solving problems of transmission, access, processing, and storage of information or information products, and must include the processes of producing information in the form of new knowledge and innovative consumer products;
- 6.** The problem of information society development is first of all connected with intellectualization of work, giving the highest priority to the processes of producing new knowledge, which determine progress in the social and economic development of a country;
- 7.** the setting up and implementation of the Strategy of Information Society Development in Ukraine will become the decisive factor for achievement and long-term support of Ukraine's global social and economic competitiveness

TRANSITION PHENOMENON IN COSMOS OF LANGUAGES

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When addressing a single individual in most languages, choosing between the singular and plural number of second person takes place. The right number of addressing is essential for it determines positioning of the two communicants. The singular number of addressing may be considered as a form of verbal aggression. Hypothesis for the unconscious level involved in the process of applying the singular or plural number to single individual includes situations implying both formal and informal relations. However, the precise role of the subconscious during this process is unknown. Here we show that the universal change-over from single to plural pronouns for the second person occurs in several tongues. We found in comparison studies within a few European languages (Latin, German, Ukrainian, Russian, English, etc.) that a good indication of the general transition from singular to plural addressing a single person is observed. Furthermore, we found that the choice of the addressing number is to be analyzed on the unconscious level, and a state of discomfort or anxiety is a consequence if the individual is addressed in singular. Our results demonstrate how from the biological standpoint this regular change of the addressing form is attributable to the fact that a human being as a creature with a herd instinct feels additional unconscious sense of safety when addressed in plural. We anticipate our assay to be a starting point for more sophisticated linguistic and social studies of the second person plural addressing of one person, e.g. its cultural and migration aspects.

BANKING SECRECY AT TRANSFER OF BAD LOANS IN TERMS OF FINANCIAL CRISIS IN UKRAINE

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During the last years when the Ukrainian economy boomed, the overall volume of loans granted by financial institutions exploded. Now, when financial crisis shortens liquidity, repayment becomes difficult or even impossible, and the percentage of non-performing loans (so called “bad loans”) in banks’ assets grows significantly. For a number of reasons, banks are searching for various ways to get rid of such assets from their balance sheets.

If a closer view is taken it becomes visible that bank loans are not as easily disposable as most other assets are. Besides the usual issues related to transfer of material assets (e.g. pricing, guarantees for validity or legal defects, safeguarding against third party rights etc.), which all apply to bank loans, too, in addition the banking secrecy needs to be observed. It has received increased attendance lately because the NBU repeatedly reminded banks of its importance. Therefore, banks shall abide with regulations on banking secrecy. But does the banking secrecy prevent banks from selling loans to buyers? And if this is the case – are there effective ways by which the transfer nevertheless can be effectuated?

According to the general rule, banks are also entitled to provide other banks and the NBU with banking secrecy information *in volumes necessary for granting loans, bank guarantees*. It appears that most of the information, belonging to the banking secrecy, is covered by such a broad wording. At the same time, banks cannot disclose information containing banking secrecy, which they had obtained from other banks.

The loosening of legislative requirements to banking secrecy is taking place not only in Ukraine, but also globally. On the G-20 level a communiqué has been adopted based on the results of the April 2009 Summit, according to which many countries were “forced” to disclose confidential information on companies and their owners with the purpose of eliminating them from the “black” or “grey” lists of “tax heavens” of the Organization for Economic Cooperation and Development.

Initiated by the crisis, the legislator introduced several amendments to the Bank Law², which broaden the possibilities to disclose data normally protect by banking secrecy.

If viewed from an unbiased perspective, transferring a loan to a new creditor might conflict in a certain limited number of cases with the banking secrecy. The reason is clear: for a valid transfer of claim, the consent of the borrower is not necessary³. All banks in Ukraine are bound by the banking secrecy obligations. However, problems may arise if a bad loan is transferred to a non-banking legal entity.

Surprisingly, the above mentioned legal provisions in the Bank Law do not contain a provision expressly relating to the transfer of a certain loan. However, looking at the definition of the banking secrecy, contained in the CC, unveils that even address data, amount of a loan, interest rate, date of conclusion of loan agreement etc. are considered to be information which is protected by banking secrecy. In other words: all data, which needs

² Law of Ukraine “On Introduction of Amendments to Certain Legislative Acts of Ukraine Regarding Peculiarities of Taking of Measures on Financial Rehabilitation of Banks” No. 1617-VI dated 24.07.2009

³ Art. 516 of the Civil Code of Ukraine No. 435-IV dated 16.01.2003

constitutively to be passed to a assignee in order to effectuate the transfer of a legal position/debt, is protected by the banking secrecy.

Does this mean that banks shall keep the banking secrecy information and not disclose them to anyone else even at transfer/sale of bad assets? It seems to be like this: the Bank Law stipulates what information constitutes the banking secrecy and at which conditions it can be disclosed. And the list of suconditions for disclosure is exhaustive; there can be no other conditions for disclosure of banking secrecy information.

WORLD EXPERIENCE FOR CREATION OF NATIONAL ENERGY EFFICIENCY STRATEGIES AND PLANS (NEESAP). UKRANIAN REALITY

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The necessity to implement energy efficiency measures is now firmly on the political agenda. The G8, IEA member countries and European Union have clearly stated the importance of action on energy efficiency to address energy security, climate change and economic challenges. Responding to the complex challenges of climate change, energy security and economic development involves pulling energy efficiency measures together into a comprehensive, well-analysed plan that incorporates the key strategic elements. This strategic approach to energy efficiency is necessary because of: **barriers** – markets can only achieve a certain level of energy efficiency because of the presence of barriers and market failures; **resource limits** – we need to optimise benefits, minimise costs, avoid wasteful misalignments, and utilise the most effective intervention mechanisms; **lack of policy integration** – energy efficiency policy, given its diffuse connections to the varied aspects of daily life, must be integrated within broader economic, social and environmental policies and directives; **accountability** – strategies provide an opportunity to articulate expectations and assign responsibilities in order to improve accountability.

How the global economic crisis will impact energy efficiency policy and NEESAP funding remains to be seen, but the crisis is likely to affect the resources available to government institutions for energy efficiency programme implementation, energy demand and energy prices. In this context, it is possible that energy efficiency implementation may lose momentum. It is important to consider whether the current crisis will:impede the ability of governments to acquire needed resources; strangle private sector capacity to invest in new technologies; halt less resilient economies from achieving energy efficiency advances and; shift priorities to more essential social and economic functions of the government. Despite these risks, the economic crisis can also be seen as an opportunity with fiscal rescue packages being used to fund energy efficiency programmes and to invest in priority areas. Thus, the traditional role of energy efficiency objectives may be evolving and expanding from climate change mitigation and energy-savings to include options for using energy efficiency to minimise the effects of economic slowdown.

As for Ukrainian NEESAP, Support for energy efficiency over the past years, however, has been inconsistent. The early 2000s saw an increase in incentives to improve energy efficiency and a realisation that many market barriers to energy efficiency required policy attention.

Consequently, governments are more often complementing market-based approaches with greater strategic policy support for energy efficiency measures. Achieving significant energy savings depends on coordinating a myriad of small energy efficiency actions across society. Governments wield significantly more influence across all sectors of the economy than many other actors, and thus can play a key role in setting the strategic direction for energy efficiency. Government strategies must present convincing arguments to a wide national audience as to why energy efficiency should be 1) given a higher priority in energy policy and 2) better integrated into the range of government responsibilities. Any strategy must be complemented by a series of actions to achieve stated goals. On a national level, Ukrainian policymakers should strive to: develop strategic policy capability in energy efficiency – expand synergies in energy efficiency initiatives and between climate change policy, broader energy strategy and energy efficiency policies; identify the national potentials, priorities, and strategic mixes of interventions to ensure best roll-out of interventions; maximise energy efficiency effectiveness by ensuring accountability from energy efficiency agencies and mainstream policy departments; expand a very limited pool of energy efficiency analytical, technical and strategic expertise; contribute to international alignment and cooperation efforts.

DAS WISSENSCHAFTLICHE UNIVERSUM VON ALEXANDER VON HUMBOLDT

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Alexander von Humboldt (1769–1859) wohnte in der Zeit der wichtigen Änderungen und Entwicklungen in der Wissenschaft. Das war die Übergangszeit von der Wissenschaft als Summe der Kenntnisse, einen gesamten Weltlexikon, bis zur Spezialisierung der einzigen Wissenschaften. Alexander von Humboldt baute die Brücken zwischen den beiden Wissenschaftsparadigmen. Aber als einzigartiger und hochbegabter Forscher hat er seine eigene wissenschaftliche Umwelt geschaffen, deren Wirkungen an der modernen Wissenschaft noch eine riesige Bedeutung haben. Seine Forschungsinteresse schließen fast alle damaligen wissenschaftlichen Beiräume der Naturwissenschaften wie Geographie, Geologie, Physik, Chemie, Mineralogie, Botanik, Zoologie, Ozeanographie und Astronomie, als auch manchen Sozial- und Geisteswissenschaften, unter anderen Wirtschaftsgeographie, Ethnologie und Demographie. Manche von diesen Forschungsrichtungen hat es wesentlich entwickelt oder sogar begründet, wie z.B. Pflanzengeographie, Hydrographie oder Klimatologie. Alexander von Humboldt war auch der bedeutendste Autor und Anreger thematisch spezialisierten Karten und Atlanten seiner Zeit. Humboldts Physikalische Geographie, eine einzigartige und nie wiederholte Kombination vom sieben Forschungsbereichen schaffte einen „neuen Wissens- und Reflexionsstand des Wissens von der Welt“ (Ottmar Ette). Dieser Gesamtschau der wissenschaftlichen Welterforschung ist 1845-1862 unter dem Titel „Kosmos“ in fünf Bänden erschienen. Natürlich sind manche Ideen von Humboldts in den insgesamt mehr als sechs hundert Bänder veröffentlichten Wissenschaftswerken bis jetzt etwas veraltet, aber meisten von seinen Studien haben der

Welterforschung seiner Zeit einen neuen Impuls im vielen der genannten Bereichen gegeben und bleiben bis jetzt aktuell. Genau so wichtig war seine humanistischen Ideen, vor allem Kampf gegen Sklaverei. Alexander von Humboldt hat alle sieben Forschungsbereiche aufklärerisch als Mittel betrachtet, um den Menschen, vor allem den Unterdrückten Hilfen zur Verbesserung ihrer Lebenssituation bereitzustellen. Zu Humboldt wichtigen und immer noch sehr aktuellen Ideen gehören auch die Notwendigkeit von der wissenschaftlichen Kooperation und Netzwerken als auch der Popularisierung der wissenschaftlichen Erkenntnisweisen, die diesen maßgebender Forschungsreisender und Mäzen der Neuzeit gleichzeitig den Vordenker der modernen Wissenschaft machen.

DECISION SUPPORT SYSTEMS FOR IMPROVING ECOLOGICAL SAFETY IN THE BLACK SEA

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The Black Sea is a watershed for the 11 states, as well as the largest biological resource and its environmental safety is a pressing issue dealt with by many research institutes and centres. Hydrosulfuric zone of the North-West region of the Black Sea, as well as contamination of sewage and storm water that comes from the river flow due to shortage of capacity cleaning stores (more than 273 thousand m³/day) salvo emissions and agricultural activities that cause low assimilative capacity of the Black Sea basin. The most dangerous pollutant for the aquatic environment are oil and oil spills which for a long time have been violating the ecological balance of marine ecosystems, causing enormous economic losses and sometimes to the human losses.

The structures of decision support system (DSS), providing more efficient environmental monitoring and decision-making in emergency situations when a liquid cargo is transported in marine terminals, are given in this presentation.

Method of evaluating environmental performance, based on an analysis of the results of a comprehensive assessment of the negative impact of the oil transfer process on the ecological state of harbour water environment in normal and emergency situations, was improved. This method takes into account the direct and indirect negative factors, including a random function of accidental damage, and provides a prediction of environmental protection activities. The algorithms and software for creating the best environmental protection measures at seaports, which are based on the method of dynamic programming and takes into account a minimum of ecological and economic costs at every step of optimization, are developed.

The solution of the task of rational choice of options and schemes dealing with emergencies with oil spills in real time is based on the adjusted models of dynamic behaviour of oil pollution in the aquatic environment, taking into account the wind and wave disturbances and the characteristics of waters, sea ports and source of the oil spill.

On the conditions of dangerous situation there is a high probability of a different kind of uncertainty and the source of certain parameters accident, due to deteriorating weather conditions, insufficient high-level software and equipment seaports. The algorithm for the

formation of multiple alternative solutions on the oil spill response in the case of uncertainty is based on Bayesian approach, fuzzy logic and solution of conflicting situations. The simulation results are under discussion.

DIE UKRAINE: EIN LAND ZWISCHEN OST UND WEST IN DER ZEIT DER GLOBALISIERUNG

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Die Sicht auf die Ukraine als ein Land zwischen Ost und West ist in den letzten Jahren überaus populär geworden. Laut Zbigniew Brzezinski (der ehemalige Nationale US-Sicherheitsberater und der jetzige außerpolitische Berater der US-Präsidenten Barack Obama) ist die Ukraine ein „geopolitischer Dreh- und Angelpunkt“. Die geographische Lage und damit die strategische Bedeutung des noch jungen, erst seit 1991 unabhängigen Landes erschließt sich durch einen Blick auf die Karte: Das wirtschaftlich wichtige Transitland Ukraine liegt zwischen zwei geopolitischen Machtpolen, nämlich Europa bzw. dem so genannten „Westen“ in Form der EU und der NATO als „Brückenkopf“ der USA in Eurasien auf der einen, und einem nach dem Zerfall der UdSSR geopolitisch wieder zunehmend selbstbewusst agierenden Russland auf der anderen Seite. Die USA und die Länder der NATO sind dabei – obzwar unter größtmöglicher Rücksichtnahme auf Russlands Selbstachtung – „die geopolitischen Grundlagen zu zerstören, die Russland die Hoffnung lassen könnten, sich in der Weltpolitik den Status der Nummer zwei zu erwerben“. Die Fragen des NATO-Beitritts und der Energieversorgung Europas sind dabei eng verzahnt. In der Ukraine liegt der größte Teil der Infrastruktur, die Russland mit Europa verbindet – von Pipelines bis zu Hochspannungsleitungen. Die Industrie und die Landwirtschaft der beiden Länder sind tief verflochten. Die russische Schwarzmeerflotte ist im ukrainischen Sewastopol stationiert, weil es dazu keine vernünftigen Alternativen gibt. Gemäß dieser Position mit hohem Konfliktpotential wird jede innen- und vor allem außenpolitische Entscheidung Kiews von Moskau und den Staaten des Westens kritisch beäugt und im Sinne der jeweilig tangierten Interessen gewertet.

ECONOMICAL CRISES AND CYCLIC FLUCTUATIONS

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One of key signs of market economy is its recurrence, which are the periodic fluctuations of economical activity expressed in more or less regular repetition of recessions and lifting's of manufacture sector.

Recurrence of the economical development – is the continuous fluctuations of market economy when manufacture growth is interchanging by recessions and increasing of business activity changing to a fall. Recurrence is characterized by the periodic launches and fallings of the market conditions. The periods of increasing of economical activity are characterized mainly by the extensive development, and the periods of recession are the beginning of the intensive development. Therefore, cycle is a permanent dynamical characteristic of market economy, which is necessary for its development. An economical cycle is the form of the market development.

Modern science knows more than 1380 types of recurrence, but only four types are used in the economic:

The Kitchin cycles, with duration from 2 to 4 years. The main features: size of the stocks - of GNP fluctuation, inflation, employment and commercial cycles.

The Zhunglara cycles, with duration of a cycle of about 7-12 years, the main features - an investment cycle – of GNP fluctuation, employment inflation.

The Kusnets cycles are the 16-25 years cycles, the main features - the income - immigration - housing construction - cumulative demand-income.

The Kondratyev cycles with 40-60 years cycle duration. The main features - Technical progress, structural changes.

A starting point of economical cyclic movement is the crises itself. Business cycles and crises are not exists beyond the connection with objective conditions. Each cycle and crisis reproduces that economical condition where it develops. But any cycle or crisis can be characterized only after some time. The forms of the modern cycles manifestations are also changing. It is expressed: by the synchronization of cyclic movement in the country that limits the possibilities of softening of the crisis processes by the export expansion; by increasing of cyclic crises and reduction of the cycle duration; by the relative reduction of the crises depth; by instability of phases of revival and lifting; by the change of the indicators of scales and depths of the crises.

In the modern crises such economical parameters, as prices, salary, employment which earlier helps to overcome manufacturing disproportions are less active. In the modern conditions such factors as exchange rates, interest rates, monetary weight size and the public debt, which are still flexible can be used to restore the proportionality. Mobility of these economic parameters makes the mechanism of self-adjustment of market economy more flexible.

Complicated interlacing of the different crises forms undoubtedly creates additional difficulties for studying of relevant factors influencing them, and for search of an exit from crisis situations. However in all cases crisis is not an absolute deadlock for the market system economical development. The reason for that is the ability of the crises situation to involve

the objective and subjective factors which provides creation of necessary conditions for its more or less fast overcoming. Connection of the self-regulation mechanisms and government market regulation assumes potential and real possibilities for any crisis overcoming, despite its obvious negative consequences.

COMPETITIVENESS AND INFORMATION SYSTEMS: STRATEGIC IMPACT OF THE INTERORGANIZATIONAL INFORMATION SYSTEMS

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Today companies act in an increasingly dynamic and complex environment, they have more difficulties making forecasts and in adapting themselves to the continuous changes in their environment. In order to be able to compete in this kind of world, it is necessary to innovate at an extraordinary speed, continuously improving the products, services and processes. Therefore, there is a need for a review the role of information technology and information systems (IT/IS) in gaining the competition advantages.

This study focuses on the role played by interorganizational information systems (IOIS) in enhancing competitiveness of firms in manufacturing sector.

The model developed here identifies a few important building blocks of competitive advantage such as Cost Leadership, Product Differentiation and System Integration. It uses the idea that the new era of hypercompetition dramatically changes the competition paradigm. It is possible to win in hypercompetition market by mastering the art of dynamically repositioning oneself not as separate business unit but as part of extended enterprise with the central focus on customer. The drivers are the system economics and the overall system supply chain, which provide the engine for sustainable competition advantage.

This model based on classic model of Competitive Advantage by Michael Porter (1985) and idea of Total Customer Solutions and Extended Enterprise by Arnoldo Hax (2001).

In this way, the basic sources of cost leadership due to the effective use IOIS are reduction in transaction costs, reduction in inventory levels and reduction in material costs.

Further, IOIS allow to differentiate products not only through unique features that the customer values but also with the help of total customer solutions and deep customer relationship that allows to develop value propositions that bond to each individual customer.

Clearly, that customized products and customized relations are possible only in case of using IS/IT at all levels in the value chain which includes the extended enterprise — the firm, the customers, the suppliers, and the key complementors. IOIS enable multiple organizations to collaboratively design, develop, build, and manage products through their lifecycles.

The total customer solutions suppose to provide a coherent composition of products and services aimed at enhancing the customer ability to create their own economic value. It redefine the ways to capture and serve the customer by putting together the overall set of corporate capabilities complemented by proper external parties that enhance product offering. System integration means the integration of business processes of two or more independent organizations through the exploitation of the IT/IS capabilities (Kim, Umanath 2004) and has

purpose to remove the asymmetry in an informative exchange between business partners. Successful system integration requires an atmosphere of trust where all the members of supply chain agree to cooperate and to honor the commitments they have made to each other. For example, firms can integrate their systems with those of their supply chain partners to coordinate demand forecasting, resource planning, production planning, replenishment, shipping, and warehousing. They can work jointly with suppliers on product design and marketing.

WIDESPREAD MODELS OF EXPLANATION THE SOCIETY

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The mankind always wanted to know as much as possible about itself. In particular people always found explanations of what society is – how it works and develops. On the certain level of developing the society a set of social sciences appears. Eventually explanations produced by social sciences became to play an important role in functioning the society. But it is possible to say that these explanations never were good enough to avoid serious social crises. There are a lot of reasons for this situation. But maybe one of these reasons nowadays consists in preference of political and economical explanations and underestimation of sociological ones. I am far away from the assertion that sociology can give absolutely appropriate explanations for every social phenomenon but I suppose that wider presence of sociology in public discourse can cause more thorough examination of social reality on the public and official levels. This statement is the initial point for the research concerning to the question of how different social sciences are presented in public discourse – what (and/or “whose”) explanations of the society and its problems and phenomena are the most popular. This research can be provided on the materials of content-analysis of mass-media. So we could find out whether political and economical explanations are the most widespread. And maybe it would be possible to approach to the answer the questions of why this (or some other) situation exists and should it be revised or not.

HUMANISIERUNG DER STRAFBARKEIT: PROBLEME DER THEORETISCHEN BEGRUENDUNG UND PRAKTISCHEN ANWENDUNG IN DER UKRAINE

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Als das neue Strafgesetzbuch der Ukraine (StGBU) im Jahre 2001 vom Parlament der Ukraine angenommen wurde, war die ukrainische juristische Öffentlichkeit der Meinung, dass StGBU den Anforderungen und Standards des Europarates entspricht. Aber seitdem hat

das Parlament der Ukraine mehrere Male StGBU-Änderungsgesetze getroffen, z.B. 2008-2009 gab es solchen fast 20. Unter diesen Änderungsgesetzen gibt es solche, die eine wesentliche kriminal-politische Bedeutung haben. So wurden vom StGBU-Änderungsgesetz vom 5.04.2008 zum Zweck der Humanisierung der Strafbarkeit im verschiedenen Umfang ca. 80 StGBU-Artikel geändert.

Es ist wichtig zu betonen, dass auf dem Entwurfsstadium dieses Gesetz keine theoretische Begründung hatte und es an öffentliche Besprechung und fachliche Begutachtung von seinen wichtigsten Punkten mangelte. Dies könnte Grund dafür sein, dass es in der Praxis momentan mehrere Probleme seiner Anwendung entstehen.

So wurde Art. 188 StGBU durch das Gesetz vom 5.04.2008 abgeschafft, durch den die rechtswidrige Aneignung von Stromnetzen, Kabelfernmeldeleitungen und ihrer Ausrüstung bestraft waren (für den qualifizierten Tatbestand war die Bestrafung mit Freiheitsstrafe bis zu fünfzehn Jahren mit Beschlagnahme vorgesehen). Offenbar war das aufgrund des Tatgegenstandes ein spezieller Tatbestand der rechtswidrigen Enteignung. Die Entscheidungen des Obersten Gerichtshofes der Ukraine zeugen davon, dass die erste Instanz öfters den Täter aufgrund der Tatentkriminalisierung von der Haftung entlässt und die Strafsache nicht überprüfen lässt, wie das eigentlich im Einführungsgesetz zum Gesetz von 5.04.2008 vorgesehen ist.

Auch wurden vom Gesetz von 5.04.2008 die Normen eingeführt, die Strafzumessung für Vorbereitung und Versuch einer Straftat regeln. Jetzt hängt das Strafmaß in solchen Fällen vom Maß der in der Sanktion vorgesehenen härtesten Strafe (nicht mehr als $\frac{1}{2}$ oder $\frac{2}{3}$ entsprechend). Die Gerichte zählen öfters $\frac{1}{2}$ oder $\frac{2}{3}$ von 15 Jahren (maximaler Frist der Freiheitsstrafe) in den Fällen, wo es in entsprechenden StGBU-Artikeln um lebenslange Freiheitsstrafe als härteste Strafe geht. Diese Strafe hat aber keinen Fristabmas, was bedeutet, dass die Täter unbegründet von der Strafe entlassen werden. In einigen Fällen korrigiert solche Fälle der Oberste Gerichtshof bei der Revision.

Eigentlich sind die genannten Fälle nicht die einzigen, die bei der praktischen Anwendung des StGBU-Änderungsgesetzes von 5.04.2008 entstehen. Der Gesetzgeber hat unser Meinung nach nicht begründet, was er als Gegenstand der Humanisierung meint. Hier sei zu erwähnen auch, dass es im StGBU eine Amnestie-Norm existiert, die als Ergebnis ihrer Anwendung die Haftentlassung vom unbestimmten Personenkreis für praktisch alle Tatarten hat. Solche Amnestieakte (-gesetze) trifft das Parlament traditionell (noch seit den Sowjetunionzeiten) ein Mal im Jahr und aufgrund dieser werden jährlich mehrere Tausende, manchmal Zehntausende Personen enthaftet.

Über die Inkonsequenz des Gesetzgebers in Humanisierung zeugt auch die Abschaffung durch Gesetz vom 24.09.2008 des Art. 320 des Gesetzbuches der Ukraine über Ordnungswidrigkeiten (OWiGBU). In diesem Artikel ging es darum, dass im Falle des gesetzgehorsames, positiven Benehmens der Person, bei der als Folge einer Ordnungswidrigkeit der Führerschein für bestimmte Dauer entzogen wurde, könnte diese Person vor Gericht ein Ersuch einreichen über vorfristige Aufhebung der OWiGBU-Strafe. Jetzt aber hat die Person bei 3-jährigen Führerscheinentlassung die ganze Frist durchhalten.

Wir sehen als aktuell eine komplexe Forschung des Haftungszwecks im ukrainischen Strafrecht mit Einbezug von jungsten kriminal-politischen Tendenzen in dieser Richtung in der Welt aufgrund von rechtsvergleichenden Arbeiten zum diesen Thema. Damit kann auch eine echte Annäherung des ukrainischen Strafrechts an Standarde des Europarates erreicht werden.

BETWEEN ‘Common Values’ AND Competing Universals – THE PROMOTION OF THE EU’S COMMON VALUES THROUGH THE EUROPEAN NEIGHBOURHOOD POLICY

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The aim of my report is to discuss the position of common values in defining the EU’s identity by using the European Neighbourhood Policy (ENP) as an example. It is argued that the notion ‘common values’ is used by the EU institutions as both a universal and as an EU concept, which highlights the abstract nature of these values. This abstraction is also reflected in the way in which Russia has recently aimed at developing its own set of values to be adopted by its neighbouring countries. The abstraction of values means that in practice their meaning in the context of ENP is decided by the Commission through the implementation of Action Plans. The central position given to the promotion of common values requires that the ENP be reformulated so as to guarantee the participation of the neighbouring countries in the formulation and implementation of the ENP objectives.

First, I will focus on the position of the EU’s common values in the ENP context by, first, exploring the question relating to the role of common values in defining the EU’s identity. By the EU’s common values I understand principles of legal and political nature, which are claimed to lay down a foundation of the contemporary identity of the EU and its Member States and, therefore, legitimise the future evolution of the EU as a regional political and economic center based on universally respected democratic values. I argue that such values can be both ‘common’, ‘shared’ and ‘universal’ only if they are in fact abstract in nature. This abstraction makes it possible to use the same argumentation both for inclusive and for exclusive purposes, as has been the case in the debate over limits of the EU’s enlargement.

Second, I will look how the EU’s ‘common values’ function externally within a specific EU’s external policy – the ENP. It will be argued that the abstraction of ‘common’ or ‘shared’ values within the ENP results in a policy that formally promotes jointly shared values but which, in practice, amounts to the EU’s own reading of them. This is largely due to the lack of any appropriate legal and institutional mechanism for fostering a genuine debate on the meaning common values between the EU and ENP countries. In the end, this policy could constitute a considerable challenge to the credibility and attractiveness of the ENP in eyes of the neighboring countries.

UKRAINISCH-RUSSISCHER GASSTREIT 2009 ALS GEOPOLITISCHER KONFLIKT (COMPUTERGESTÜTZTE INHALTSANALYSE)

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In der modernen Geopolitik spielen nicht nur politische, sondern auch wirtschaftliche Konflikte eine wesentliche Rolle. Diese Konflikte sind Elemente der politischen Kommunikation und des Mediendiskurses. Die Beleuchtung geopolitischer Konflikte in den Printmedien bildet einen der Forschungsschwerpunkte der angewandten Politikwissenschaft. Die Anwendung formalisierter Methoden für die Analyse der Medientexte erleichtert die Arbeit und trägt wesentlich zu objektiven und validen Ergebnissen bei. Eine solcher Methoden ist die computergestützte Inhaltsanalyse. Als Forschungsmaterial für diesen Artikel dienten 80 Zeitungartikel aus *Frankfurter Allgemeine Zeitung, Süddeutsche Zeitung, Frankfurter Rundschau, Stuttgarter Zeitung* (Januar 2009).

Die zentrale Kategorie unserer Forschung (*Gaskonflikt*) wurde in 5 Subkategorien eingeteilt „*Partizipanten*“, „*Gegenstand*“, „*Ursachen*“, „*Folgen*“. Für qualitative und quantitative Analyse wurden *Text Analyzer i MAXQDA* angewandt. Die zentrale Kategorie „*Gaskonflikt*“ wird in den untersuchten Texten mit den Deskriptoren „*Gasstreit*“, „*Gaskrise*“, „*Gaskonflikt*“, „*Gaskrieg*“ beschrieben. Die Gesamtzahl der Lexeme in den untersuchten Texten beträgt 4675.

№	Deskriptor	Frequenz
1	<i>Gasstreit</i>	56
2	<i>Gaskrise</i>	21
3	<i>Gaskonflikt</i>	8
4	<i>Gaskrieg</i>	4

Danach wurden die Texte mit den genannten Kategorien kodiert. In unserer Untersuchung haben wir folgende Codes: *Titel des Artikels, Etappen des Konflikts, Gegenstand des Konflikts, Partizipanten des Konflikts, Folgen des Konflikts, politische Figuren*. Nach der Kodierung wurde mit dem Programm *MaxqDa* qualitative Inhaltsanalyse durchgeführt.

Die Verbindung von verschiedenen Typen der Inhaltsanalyse (Frequenz der Lexeme, Themenanalyse, Bewertungsanalyse) und Anwendung von Computerprogrammen für die Textanalyse ermöglichte es, den ukrainisch-russischen Gaskonflikt in der Berichterstattung deutscher Presse komplex zu untersuchen.

ALEXANDER VON HUMBOLDT – THE FIRST ECOLOGIST

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Contemporaries named Alexander von Humboldt “Aristotle of 19 centuries”. He has made the essential contribution to many sciences: “physics, chemistry, meteorology, geology, botany, zoology, physiology and comparative anatomy, geography, history, archeology and the politician “ (Engelgardt, 1891). Now it is possible to list and some more after the appeared sciences, for example, volcanology, geophysics, oceanography, speleology, limnology, hydrology, psychology and ecology at which sources he was (Shadrin, 2009). Someone can ask: “whether Alexander von Humboldt today is actual?” I say "yes" and I will try to show it in this presentation, first of all on an example of ecology.

Alexander von Humboldt and main principles of modern ecology

As the first ecologist he the basic purpose saw as «nature comprehension as whole and gathering of illustrations on interaction of natural powers»; “In variety of the nature to see its unity ... to allocate and investigate particulars, but not to be lost in them, remember about high appointment of man, understand the spirit of the nature hidden under an external cover”.

Principles following from his works:

1. Unity of a life on the Earth, general interrelation between alive creatures and abiotic nature, acting as integrity.
2. “The local description of the nature differs from the general” – necessity of multilevel and multiscale approach in ecological research and understanding (a place, a landscape, a planet). He used a complementarily principle in modern science before Niels Bohr.
3. Interrelation of the live and inorganic nature: it should be considered not only direct influence abiotic environment on biota, but also the reverse – biota on environment.

HISTORY OF GEOSPHERIC – THE BIOSPHERIC APPROACH

Humboldt’s geospheric – the biospheric approach is key approach in modern synthesis of natural science is opinion of G. Zavarzin, W. Krumbein and other well-known scientists.

In 1826 A.Humboldt in the second edition of " Pictures of Nature ” has entered concept lifesphere (die Lebensspäre) that is identical to concept biosphere. Term rather popular now "noosphere" was entered by in 1927 the mathematician and philosopher E.Lerua and the French paleontologist, the anthropologist, philosopher Tejjar de Sharden, but A.Humboldt much earlier, - 1845, a Russian translation 1848, - used similar concept “intellectsphere”.

LIFE IS AROUND PLANET

“Where the sight of the researcher of the nature – everywhere a life or life germs,”- wrote Alexander von Humboldt in 1802. He was one of the first who study life in extreme environment.

VOLCANISM AND A LIFE

They are topics, which interested him all time. Some his conclusions, ideas are alive now.

EARTH MAGNETIC FIELD

Alexander von Humboldt was one of pioneers of studying of variability of a magnetic field; he the first has fixed a magnetic storm.

Modern science, being differentiated on separate specialized branches, possesses much more detailed knowledge on concrete questions, but whether we have lost something from that

integrity of understanding of the nature which A.Humboldt possessed? Any system, a science – not an exception, evolves, passing repeatedly three consecutive stages: differentiation, specialization and integration at new level. Now the science approaches to a new stage of integration when insufficiency reductionism is realized more strongly and more strongly. In this connection value of ideas and A.Humboldt's works increases. In 2019 250 years from the date of its birth will be executed. Possibly, it is necessary to declare A.Humboldt's decade - the reopening, recomprehensions of him and his ideas, having organized a fan of the international projects for this purpose.

"WIE SOLLEN WISSENSCHAFTLICHE UNTERSUCHUNGEN ORGANISIERT WERDEN"

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Wissenschaftliches Arbeiten ist eine exklusive und individuelle Tätigkeit. Originelle Ideen, besuchen nicht wissenschaftliche Kollektive, sondern werden in einem individuellem Kopf geboren und werden schließlich untrennbare „Kinder“ ihres Schöpfers. Gleichzeitig sind Wissenschaftler, wie alle anderen Menschen auch, untereinander verschieden. Ihre Tätigkeit kann nicht nur von reinem Interesse an Erkenntnis, sondern auch von Karrierestreben oder sogar von Eitelkeit oder Ehrgeiz motiviert werden. Infolgedessen können unter Wissenschaftlern Beziehungen entstehen, die ihre intellektuellen Fähigkeiten behindern. Dazu muss auch erwähnt werden, dass aktuelle Untersuchungen, insbesondere im naturwissenschaftlichen Bereich, beträchtliche Mittel erfordern. Es stellt sich somit die Frage, an wen und wie diese Mittel verteilt werden sollen. Um maximale Effektivität zu erreichen braucht man eine Organisation der wissenschaftlichen Untersuchungen, die unerwünschte Beziehungen zwischen Wissenschaftlern untereinander nivellieren und gleichzeitig wissenschaftliches Arbeiten katalysieren.

Unter Berücksichtigung des bisher Gesagten kann man eine Hauptbedingung formulieren: Wissenschaftler sollten finanziell und administrativ unabhängig voneinander sein. Ein zentralistisches, senkrecht organisiertes System entspricht nicht diesen Bedingungen und ist nicht effektiv. Wissenschaftliche Institutionen sollten nicht aus großen Abteilungen mit senkrechter Hierarchie, sondern aus einer möglichst großen Zahl von Laboratorien unter Leitung finanziell unabhängiger Professoren bestehen. Ihnen untergeordnet könnten nur an ihrer Dissertation arbeitende Doktoranden und Post-Doktoranden sein, die sich weiter wissenschaftlich qualifizieren wollen.

Administrative Unabhängigkeit besteht dann, wenn die Position eines Arbeitsgruppenleiters zeitlich nicht kündbar ist. Das bedingt, dass diese Stelle einem Wissenschaftler erst nach sorgfältiger und mehrstufiger Auslese der Bewerber angeboten werden kann. Im Idealfall sollten es Personen sein, für die Wissenschaft Lebensinhalt ist und nicht einfach ein Mittel für eine bestimmte Karriere oder einen materiellen Zweck.

FINANCIAL CRISIS PHENOMENA: ANALYSIS, SIMULATION AND PREDICTION. ECONOPHYSIC'S APPROACH

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With the beginning of the global financial crisis, which attracts the attention of the international community, the inability of existing methods to predict the events became obvious [1]. Creation, testing, adaptation of the models to the concrete financial market segments for the purpose of monitoring, early prediction, prevention and notification of financial crises is gaining currency nowadays.

Econophysics is an interdisciplinary research field, applying theories and methods originally developed by physicists in order to solve problems in economics, usually those including uncertainty or stochastic processes and nonlinear dynamics. Its application to the study of financial markets has also been termed statistical finance referring to its roots in statistical physics. The new paradigm of relativistic quantum econophysics is proposed [2].

We developed and implemented econophysical methods, the most important of which are considered in the work [3]. Among the others the following can be named:

- multifractality spectrum research. The change of multifractal spectrum's width indicates the systems complexity. When the crisis is approaching the spectrum width decreases in the pre-crisis period and restores itself during the post-crisis one.
- system's entropic indexes dynamics estimation. In this case different types of the entropy are calculated. The analysis of their dynamics gives an opportunity to keep track of the system's complexity and makes it possible to construct the crisis' precursors.
- conduction of the (cross-) recurrence analysis. We managed to develop a tool for the computation of the number of measures, based on the recurrent points. The calculation of these and some other measures in the movable windows of a given width makes possible to get the information about the crisis phenomenon.
- time series irreversibility research. Quantitative characteristics are brought in, which allow to analyze the appearance and relaxation of the so-called crisis "bubbles". The method is important in the determination of the recession's duration and depth.

Other methods and approaches of the crisis management such as complex Markov chains, game models, agent-based technologies, neural networks etc. are also discussed [4].

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INFORMATION COSMOLOGY

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We consider different aspects of information from philosophical and sociological to mathematical and physical points of view and make their connections to cosmology. The concepts of Norbert Wiener, Claude Shannon, V.M.Glushkov, Carl von Weizsäcker, John Wheeler are examined.

We make also connections between information and modern physical theories, such as string theory, loop quantum gravity theory, and holographic theory.

Loop quantum gravity (LQG) theory shows that space consists of discrete elements, and depending on dimensionality, the finest ones have size of approximately Planck length ($1,6 \cdot 10^{-33}$ cm), or its square or cube. And that in turn allows calculating space entropy, particularly entropy of black holes. Black holes draw researchers' interest due to their anomaly, such a strong concentration of matter and energy, that space-time curvature even causes its own gaps.

String theory, which predicts effects of general relativity theory at large distances, as well as effects of quantum mechanics over short distances, shows that any information that gets into a black hole is not lost irretrievably, but is accumulated in some internal structure, so called D-Brane's. That is equivalent to principle of information conservation in the universe.

In addition, starting in 1993, the holographic theory is being developed. This theory proves that information capacity (entropy) of any system depends not on system's volume, but on its surface area, exactly as a hologram, which render 3D image on a plane.

On the basis of holographic theory and string theory Juan Maldacena developed 5-dimensional model (4 space dimensions plus time) of the universe, in which the edge is usual 4-dimensional space-time, which is described by quantum field theory.

On the basis of holographic idea and discreteness of space one can conjecture, that all processes in nature are processes of information exchange, and the surface area that restricts some system is a measure of capacity of channel, which information flows through from past to future.

Therefore the idea of John Wheeler, that "everything is information" is not far from truth probably. And having learned the means of information control, people can build, for example, quantum computer, which regards space-time as a quantum network, where information flows through network's evolving web.

THE AGENT-DYNAMIC MODELLING OF THE SHADOW ECONOMY

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The aim of the present work is the study of the shadow economy dynamics based on the agent-dynamic approach proposed recently.

The agent-dynamic model consists of two subsystems:

- a dynamic “processes-products” subsystem (the economic environment);
- a multi-agent subsystem of the “elementary cybernetic objects” (ECO) of various types.

The model development includes three stages:

- single-agent model (characterizing the government policy only);
- two-agent model - representing interaction between state and officials;
- three-agent model – for study the “state – official – owner” interaction.

The single-agent model is the dynamic subsystem, consisting of m processes, which produce n products (the extension of the von Neumann model) + one agent (representing the state).

The state agent (A-State) influences the processes using three instruments:

- the pricing policy;
- the development policy;
- the tax policy.

Two-agent model examines the “official-state” interaction using the “game with the nature” approach.

The A-official agent can apply one of two strategies:

- A1 – take the bribe;
- A2 – refuse bribe expecting the audit.

The A-State agent, in turn, has two options:

- П1 – to perform a check-up of the official (random with given expectation);
- П2 – to collect taxes minimizing supervision expenses.

The main point of this model is to find a strategy maximizing the risk-benefit ratio.

Within three - agent model we observe the agent’s behaviour under the condition of the interests conflict. The aim of the A-State agent is to maximize the budget revenues. The A-Official’s main aim is to maximize his own income minimizing the risk of dismissal. The A-Owner aim is to maximize his business profit.

The main results of the present study are:

- the agent-dynamic model of the shadow economy proposed in the present paper;
- the developed algorithms of the A-State agent, A-Official agent and A-Owner agent behaviour;
- the implementation of these algorithms in the agent-dynamic economic modelling “ECO-dynamics” environment, developed in the Economic Cybernetics Dept. at the Odessa State Economic University.

DEUTSCHE ERFAHRUNGEN IM BEREICH DER ERBRINGUNG VON VERWALTUNGSDIENSTLEISTUNGEN IM VERGLEICH ZUR UKRAINE

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Die Verbesserung der Erbringung kommunaler Verwaltungsdienstleistungen ist eine der zentralen Aufgaben der Verbesserung der Verwaltungstätigkeit von Behörden der lokalen Selbstverwaltung der Ukraine.

Die Übernahme deutscher Erfahrungen in diesem Bereich könnte ein Schlüssel zur Schaffung neuer Möglichkeiten für die Entwicklung der lokalen Selbstverwaltung in der Ukraine sein. Die Frage der Erbringung administrativer Dienstleistungen im deutschen Verwaltungssystem gilt als besonders relevant. Insbesondere interessant ist in dieser Hinsicht die Tätigkeit von Bürgerämtern..

Zum Beispiel, in den Berliner Bürgerämtern wurden Aufgaben gebündelt, welche häufig oder in regelmäßigen Abständen wiederkehren und zu deren Erledigung die Bürgerinnen und Bürger möglichst ohne lange Wartezeiten von einem kompletten Mitarbeiter fachgerecht beraten wird. Der Ursprung der Berliner Bürgerämter liegt in der Bündelung von Aufgaben aus der Bürgerberatung und dem Sozial- und Wohnungsbereich. Der inhaltliche Schwerpunkt der Berliner Bürgerämter liegt in der Beratung, Auskunft, und Information entsprechend der persönlichen Lebenslage des Ratsuchendes. In jedem der Bürgerämter sind insgesamt 18 Standardprodukte anzubieten. Einige Bezirke bieten in ihren Ämtern darüber hinaus aber auch weitere Leistungen an.

Im Gegensatz zu Bürgerämtern in Deutschland werden z.B. im „Transparenten Büro“, Vinniza (Ukraine) 112 administrative Dienstleistungen einschließlich der Registrierung und innerer Dienste erbracht. Dienstleistungen bieten 38 Einheiten des Stadtrates und 9 staatliche Genehmigungsbehörden.

Wir dürfen annehmen, dass diese eine relativ geringe Zahl der Verfahren, die Bürgerämter in Deutschland geleisten, ist mit der Einführung in diesem Land bei der Erteilung von Genehmigungsunterlagen für die deklarierende Prinzip verbunden. Zum Beispiel haben in vielen Bundesländern die meisten Unternehmen nicht die Erlaubnis zur Arbeitsaufnahme zu erhalten.

Daher ist es klar, dass die Suche nach grundsätzlich neuen Ansätzen zur Lösung der Optimierung der Erbringung von Verwaltungsdienstleistungen und zur Übernahme deutscher Erfahrungen sollten sich nicht auf quantitativen Kennzahlen zu konzentrieren, sondern auf organisatorische Verfahren zur Bereitstellung dieser Dienstleistungen und zur Verbesserung der Qualität der Dienstleistungen für Bürger und Unternehmen durch den Einsatz des deklarativen Prinzips und auch moderner Informationstechnologien.

JOINT UKRANIAN-GERMAN-MOLDAVIAN ARCHAEOLOGICAL SURVEYS IN THE LOWER DANUBE AREA

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A joint Ukrainian-German-Moldavian research project is carrying out for last tree years in the Northwest Pontic region. The project is connected with the study of historic-cultural situation in the region in the Late Copper Age and the beginning of the Bronze Age (the 4th millenium BC). Major objectives of the project are related to investigation of peculiarities of cultural development in the region, social structure and subsistance strategies of ancient societies, cultural contacts, and interelation between environment and human society. Research works have multidisciplinary character and embrace several kind of activities including excavations, processing of archaeological finds as well as analysis of geological, paleobotanical, palinological and archaeozoological samples. Preliminary results of researches demonstrate that in the period in question the region was occupied by a highly developed farming culture with strong Balkan roots. It was presicely in this period that simultanesly a new type of pastoral economic activities was finally introduced into the steppe area. This event resulted in the appearance of complex hierachical society which is exemplified by the Usatovo site near modern Odessa.

OBSERVATION OF POWERFUL SOLAR TYPE III BURSTS IN THE DECAMETER RANGE

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In the present work powerful solar Type III bursts (whose fluxes are larger than $10^{-19} \frac{W}{m^2 Hz}$ at decameter wavelengths) are discussed. Obtained data for 153 bursts in July 2002 and for 230 bursts in August 2002 are investigated. Observations were carried out at frequencies 10-30 MHz using the radio telescope UTR-2 (Kharkov, Ukraine). The main characteristics of these Type III bursts were analyzed - frequency drift rate, duration and flux. The different functional dependences of these parameters on frequency are considered. The great difference between the observational and well-known empirical dependences of drift rate via frequency is determined. We note that values of drift rates are almost the same at low frequencies (10-15 MHz), but they are differed about 2 times at high frequencies (20-30 MHz) and depend on the location of active region on solar disc. It is pointed out that the derived duration via frequency dependence is not so steep in comparison with generally accepted.

GAMMA-RAY SPECTRA INDUCED BY INTERACTION OF FAST NEUTRONS WITH ATOMIC NUCLEI

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Measurements of the cross sections of neutron-induced reactions is of particularly importance for the investigation of different nuclear reaction mechanisms, nuclear structure and characteristics of excited nuclear states. In this contribution the measurements of prompt γ -rays induced by the interaction of 14.1 MeV neutrons with cadmium, iron and bismuth were performed [1, 2]. Time-of-flight method based on pulse neutron generator was applied for separation of prompt γ -rays from source neutrons, background and rescattered γ -rays. The flight path between the neutron source and 15x10 cm NaI(Tl) detector was equal to 172 cm which provides reliable separation of prompt γ -rays from neutron and γ -ray background. Measurements have been performed in circular geometry.

Differential cross sections were unfolded from amplitude \square -spectra by using different regularization procedures. The best result was obtained by regularization algorithm on the compact set of limited variations. The detector response function was based on analytical approximation of the bremsstrahlung experiment with correction both on Monte Carlo simulations and detection of 4.43 MeV \square -rays from neutron inelastic scattering on carbon. Cross section errors are estimated by using the combination of multiple randomization of initial \square -spectra with subsequent regularization procedure. It was assumed that errors of the amplitude instrumental spectra are distributed in accordance with Gauss distributions due to

the effect of large number of external factors measurement. Cross section errors were found to be 10-15%.

Experimental results were compared with theoretical calculations performed by the use of Empire code [3]. Sensitivity of calculated cross sections to characteristics of excited nuclei (nuclear level density, radiative strength function, γ -ray multipolarity and optical potential) were analysed.

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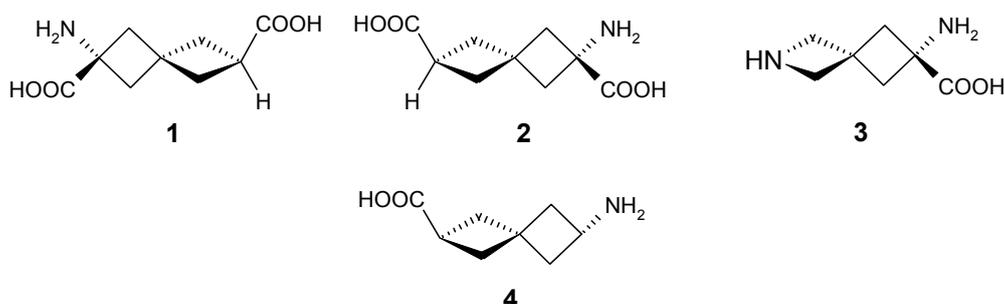
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SYNTHESIS OF CONFORMATIONALLY RESTRICTED NATURAL AMINO ACID ANALOGUES BASED ON SPIROCYCLIC SCAFFOLDS

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A library of isomeric spirocyclic amino acids **1-4** – natural amino acid analogues – has been designed. Within the compounds in this library, mutual orientation of the aminocarboxylate moiety and the carboxylic group, as well as the distance between the functional groups are varied, therefore, compounds **1-4** can be used in medicinal chemistry as probes for receptors and inhibitors for enzymes. The rigidity of the spirocyclic scaffolds might be beneficial for the biological activity: if the functional groups are fixed in space exactly as needed for efficient interaction with a receptor, the efficiency of the interaction can be higher than for the analogous conformationally flexible ligands.

Syntheses of compounds **1-4** are elaborated. Studies towards synthesis of other members of the library will be presented.



DYNAMICS OF STRUCTURE OF AGGREGATE EMPLOYEE AND PRODUCTION IN UKRAINE

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During the period from 1991 to 2009, a number of changes happened in Ukraine which influenced and continue to have a significant impact on our society. Having got an economic independence, Ukraine has begun to integrate into the global division of labour, as a result the chaotic changes happened in the structure of production. Last one began to adapt spontaneously to the challenges of the external market and the domestic demand, which lead to changes in the structure of the aggregate employee.

Analysis of changes in the structure of the aggregate employee in Ukraine showed that in heritage of the Soviet Union in our country the structure remains where the dominant role played medium skilled worker. Training workers for the industries was carried out independently of the dynamics of the industry. Thus, during the period of independence the proportion of low and medium skilled workers has decreased. Otherwise the preparation of specialists with higher education and scientific degree has increased almost 3 times compared to 1991. This increased the gap between the level of training of the specialists and their functions. It may be noted that in the real economy a reduction of the number of highly skilled workers is observed while in the service sector the opposite trend is noted first of all at the expense of workers in education, culture, health, trade, catering, transport and communications.

Analysis of the sectoral structure of economy of Ukraine showed that still dominates the production of goods. Despite its decline in the period from 75 to 61%, the bulk of workers were involved in this sector. In the structure of industrial production a declining trend has been in high-tech industries, in consequence of that a share of low skilled workers increases. The share of industrial production decreased by means of increasing the share of services (nearly 1.5 times the level of 1991). In transport, communications, trade and catering, financial and other services large masses of highly skilled professionals are involved to prepare which our training system of employers is oriented. The most dynamic of these are communications, trade and transport. The least changes underwent a share of agriculture.

Changes of vocational qualification structure of the aggregate employee are derived from changes in the structure of production. They correspond to it with some error, which is determined by the time delay that is a lag, whose magnitude depends on the reaction rate of the labor market (mobility, training systems), migration and integration of Ukraine into the global economy. Only through the active industrial policies of the state one can change the course of current trends.

**MATHEMATICS BETWEEN RESEARCH, APPLICATION
AND COMMUNICATION.**

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"Wir müssen wissen, wir werden wissen" (We must know, we shall know). This inscription on the gravestone of the German mathematician David Hilbert expresses the conviction that mathematics is the source of all knowledge, and that the pursuit of knowledge is the only driving force for mathematical research.

"Mathematik - Motor der Wirtschaft" (Mathematics - engine of economy) is the title of a recently published book with contributions by the heads of leading international companies, saying that mathematics as a tool is the driving force of our modern economy.

Although both positions have a very different view on mathematics – pure versus applied - they agree on the importance of mathematics as a science. This fact stands in contrast to the observation that even educated people often show off their ignorance in mathematics and that it seems impossible to communicate mathematics to a broader public.

I shall discuss these issues and develop my personal point of view. At the same time I try to communicate some piece of my own research as a "pure" mathematician and how this research is related to arts as well as to applications.

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