Institute of Electronic Engineering and Nanotechnologies "D.GHITU" ASM
Moldavian Physical Society
University of Moldavian Academy of Sciences
University of European Political and Economic Studies "Constantin Stere"
Humboldt Club Moldova

Unterstützt von / Supported by
Alexander von Humboldt Stiftung / Foundation

Humboldt Kolleg
&
Symposium "NANO-*2016*"

Devoted to the 55th anniversary of Moldavian Academy of Sciences and 70th anniversary of the first research institutes in Moldova

NANO-2016
Ethical, Ecological and Social Problems of Nanoscience and Nanotechnologies

11-14 Mai 2016, Chişinău, Moldova

Program

&

abstracts

Kishinev, 2016

Dear Humboldtians, dear Participants,

The Alexander von Humboldt Foundation aims at strengthening regional and interdisciplinary links between the scientists and scholars sponsored by the foundation, establishment of the worldwide contacts, introducing young scientists to the scholarship supported by the Humboldt Foundation and to research in Germany. Following these purposes, we organize the interdisciplinary meeting - Humboldt Kolleg: **Ethical, Ecological and Social Problems of Nanoscience and Nanotechnologies – NANO-2016**. It is the 6th edition of the serie of the Humboldt-Kollegs with LOGO "NANO", and this small jubilee follows a great Jubilee – the 55th Anniversary of the Academy of Sciences of Moldova, and 70th Anniversary of creation of the first research institutes in Moldova.

The central goal of the Kolleg is to bring together professors, lectures, researchers from various universities and institutes, working in an intensive cooperation to share their experience, new ideas and different aspects of the novel, but very rapid developing area – Nanoscience&Nanotechnology.

Three working days of the workshop are planned enabling and promoting group discussions and interactions among participants.

World known experts in the Nano-science area from **12 countries**: Germany, France, China, Poland, USA, Russia, Armenia, Azerbaijan, Belarus, Ukraine, Romania and Moldova will meet together in Chisinau at NANO-symposium. Such representative Forum is an evidence of the achievements of Moldavian researchers in the area of nanoscience and nanotechnology, recognized in the international society.

One of the main results of the meeting should be a rising amount of new talented researchers motivated by this Humbold Kolleg for fruitful collaboration with Germany and other countries.

Wishing you a successful work at the Kolleg and enjoyable stay in Moldova,

Yours sincerely,

Anatolie Sidorenko

Humboldt-Kolleg Director

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GENERAL INFORMATION

Opening Ceremony will be held on Wednesday, 11th Mai 2016, in the Conference Hall-B of the hotel "Vila Verde", other sessions will be held in Conference Halls **A and B** of Hotel "Vila Verde" (str. Grenoble 110 Chisinau, tel 022 288 003).

The overhead projector and PC with Power Point facilities are available for presentations.

Posters form an integral part of the Conference with plenty of time for viewing and discussions in the foyer of the Hotel "Vila Verde". Participants are invited to put their posters on display (height - 100 cm, width – 100 cm), on Thursday, 12.05.2016,, during the coffe-break time at 11:00. The number on the poster boards corresponds to the number of presentation in the Abstract book. Authors are requested to be at their posters during Poster Session.

ACCOMODATION

Participants will live in two Hotels in the center of the city: "Vila Verde" (str. Grenobl, 110 www.vila-verde.md), and "Hotel Klassik" (str. Bulgara 26, www.hotel-stella.md).

REGISTRATION DESK

On Wednesday 11th Mai 2016, from 11:00 till 14:00 – in foyer of the hotel "Vila Verde"; on 12th Mai from 8:00 till 13:00 in foyer of the hotel "Vila Verde".

BADGES

Participants are invited to wear a name badge given at the Registration Desk at all time during the meeting.

CERTIFICATE OF ATTENDANCE

A Certificate of Attendance will be given to each participant at the Registration Desk upon arrival.

MEALS

Breakfast is included in the room price in hotel and will be served in the hotel restaurant. Conference Dinner and coffee breaks for participants will be served in restaurant "Vila Verde".

WEATHER

The weather in September in Chişinău is usually mild and pleasant, temperatures within 20-25°C. However, rains are possible, so an umbrella, light raincoat and comfortable shoes are advisable. For weather forecast please visit websites: http://weather.yahoo.com; http://www.gismeteo.ru

EXCHANGE

The Moldavian Lei (MDL) is the only legal tender in Moldova. Foreign currency exchange is available at the airport, in banks, in some hotels and in exchange offices. To check the exchange rate, please address to: http://www.bnm.org/en

NANO-2016

Ethical, Ecological and Social Problems of Nanoscience and Nanotechnologies

11-14 Mai 2016, Chişinău, Moldova

Program

Wednesday, 11.05.2016

7:00-13:00 **Arrival of participants and registration at the reception desk of "Vila Verde Hotel" (shuttle-bus transfer from "Airport-Chisinau", accommodation in Hotel "Vila Verde"- Kishinev, str.Grenoble 110, Chisinau, Moldova,** tel 022 288 003**)**

14:00 - 14:30 Session Nl - Opening of the Kolleg **(Conference-hall A, Vila Verde) Welcome addresses of President of the Academy of Sciences of Moldova Prof. Gheorghe Duca, Vice-president of the Academy of Sciences of Moldova Prof. Ion Tiginyanu, German Ambassador Excellency Ulrike Knotz, representatives of the A.v.H. Foundation, A.v.H. Foundation, Aword Winner Prof. Ruslan Valiev, President of "Humboldt Club Moldova" Prof. Anatolie Sidorenko.**
14:30-15:00 **Representative of the A.v.Humboldt Foundation.** Alexander von Humboldt Foundation: Aims, structure and programs.
15:00-15:20 **Prof. Ion Tiginyanu.** Nanoscience&Nanotechnology in Moldova –state of the art and perspectives.
15:20 -15:40 **Prof. Sergei Nikitov.** Meta- and Nano- materials: future started today.
15:40-16:00 **Prof.Vladimir Fomin.** Phonon Spectrum Engineering in Rolled-up Micro- and Nano-Architectures.
16:00-16:20 **Dr. Alexander Zhgun.** The rhodopsin molecule applications: from optogenetics to optobioelectronic devices.
16:20-16: 40 **Prof.Thomas Schimmel.** The Salvinia Effect: Perspectives for Novel Bionic Ship Coatings.

16:45-18:00 Round table discussion of presidents of Humboldt Clubs with representatives of the A.v.H. Foundation, with presse-conference and presse-release.

19:00-21:00 **Welcome party.**

Thursday, 12.05.2016
Session 2. Nanotechnologies and human society: technical, philosophical and ethical aspects of the progress
9:00-13:00 (Vila Verde, Hall A)
Chairmen - Prof. Anatolie Sidorenko, Prof. Thomas Schimmel

9:00-9:20 Invited lecture of R. Valiev. Bulk Nanostructured Materials with Superior Properties **for Innovation** Applications**.**
9:20-9:40 Invited lecture of V. Kantser. Two-Dimentional Semiconductor Materials and new Functionalities for Electronic Devices.

9:40-10:00 G. Kharlamova. National security in the current geostrategic perspective: assessment of new technologies and their threats.
10:00-13:00 Reports: Brigitte Baretzky, Boris Straumal, Ashok Vaseashta, Surik Khudaverdyan, Zadkov Victor, Ilarionova Tatiana, Sava Evgeni, Kulik Leonid

13:00 Thomas Schimmel: summing up of the Session.

13:30-14:30 Lunch

Session 3. Ecological problems of nanomaterials circulation and their influence on the environment and human health 14:30-19:00 (Vila Verde, Hall A)
Chairmen. -Prof, Ion Tiginyanu, Prof. Ashok Vaseashta

14:00-14:30 Invited lecture of A.Vaseashta. Nanotechnology Solutions for Monitoring and Improving of Water Quality.
14:30-14:50 Invited lecture of S.Levchenko. Approaches to realization of smart water-grid and monitoring of water quality.
14:50-15:10 Invited lecture of S.Popel. Nanoparticles in the Water Cycle - Properties, Analysis and Environmental Relevance.
15:10-19:00 Reports: Jaskula Marian, Boshkov Leonid, Tishkov Vladimir, Tronciu Vasile, Popa Slava, Bogdevici Oleg, Zasavitsky Efim, Culighina Elena, Potapov Evgeni.

14:30-19:00 Poster session-1. **Presentations of young researchers. Selection of the best poster presentation**

19:00 **Ashok Vaseashta:** summing up of the Session 3 and Poster-1.

19:30-21:00 Free discussion of Humboldtians about ecological problems of vine production. (Vine Testing Club in "Vila Verde")

Friday, 13.05.2016
Session 4. Economical and Social aspects of Nanotechnologies implementation.
15:00-19:00 (Vila Verde, Hall A)
Chairmen - Prof. Zveryakov Mihail, Prof. Popel Sergei

15:00- 15:30 Invited lecture of A. Yakovlev. **Problems of Russian economists in the process of globalization.**
15:30-16:00 Invited lecture of N. Petljutschenko. Ukraine between two Maidans: politics, language and science (Национально-культурный код современной Украины между двумя Майданами: политика, язык и наука).
16:00-19:00 Reports: Firmin Ahoua, Popel Sergei, Zharii Oleg, Abdelhadi Soudi, Levchenko Sergei, Manzura Igor, Makovei Mihai, Abramov Vladimir,

Session 5. Economical and Social aspects of Superconducting Electronics.
15:00-19:00 (Vila Verde, Hall B)
Chairmen - Prof. Kupriyanov Mikhail, Prof. Tagirov Lenar

15:30-16:00 Invited lecture of M. Kupriyanov. Proximity Effect in Multilayer Structures with Alternating Ferromagnetic and Normal Layers.
16:00-16:20 Invited lecture of K. Ivanov. Spin hyperpolarization methods for NMR signal enhancement.
16:20-19:00 Reports: Tagirov Lenar, Klenov Nikolai, Khaydukov Yuri, Sidorenko Anatoli, Kushnir Vasili, Beckmann Detlef, Kusmartsev Feo, Miu Lucian, Semenko Anatolii, Denisov Alexandr

14:30-18:30 Poster session-2, **Presentations of young researchers.**

19:00 Andrei Yakovlev: **summing up of the Session 4 and Poster-2, and nomination of the best presentations.**

20:00-23:00 Conference Dinner in Etno-Restaurant.

Saturday, 14.05.2016

Session 5. Nanotechnoscience in Medical, Bio- and Social Area
9:00-11:00, (Vila Verde, Hall A)
Chairmen- Prof. Lacusta Victor, Prof. Tishkov Vladimir
9:00-9:20 Invited lecture of F.Macaev. Docking for a novel class of tryptanthrin analogues against inhibitors of mycobacterium tuberculosis.

9:30-10:30 Round table free discussion "Social and Ethical aspects of Nanotechnoscience".
10:30 Vladimir Tishkov: Summing up and press-release.

11:00 - 23:00 Departure of participants.

Proximity Effect in Multilayer Structures with Alternating Ferromagnetic and Normal Layers

Bakurskiy S. V.[1,2,3], Kupriyanov M. Yu.[1,2,3], Baranov A. A.[3], Golubov A. A.[3,4], Klenov N.V.[1,2,3] and Soloviev I. I.[1,3]

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The character of the penetration of superconducting correlations into multilayer FF…F, FNFN…FN, and NFNF…NF structures being in contact with a superconductor with the singlet pairing potential has been studied theoretically. Analytical expressions for the effective superconductivity penetration depth in such structures have been obtained in the limit of small layer thicknesses. Numerical calculations taking into account self-consistently the suppression of the superconductivity in the superconductor owing to the proximity effect have been performed at arbitrary thicknesses. A simple analytical dependence approximating the spatial variation of the Green's function in a multilayer has been proposed. It has been shown that superconductivity is induced by the generation of two channels existing in parallel, one of which is characterized by the smooth (as in SN sandwiches) decay of the superconductivity, while damped oscillations (as in SF structures) take place in the second one.

Modification of the biomass content and biosynthetic capacity of Saccharomyces cerevisiae CNMN-Y-18 yeast strain under the action of ZnO/MgO and TiO_2 nanoparticles

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The use of microorganisms as producers of nanoparticles involves safe processes from the environmental the point of view and is becoming more and more important in microbial biotechnology. For this purpose, more frequently bacteria, yeasts, fungi, actinomycetes, etc. are used. Therefore, the biologically-made nanostructures offer substantially different properties, such as good adhesion, low toxicity, biocompatibility, making them more valuable for biological applications.

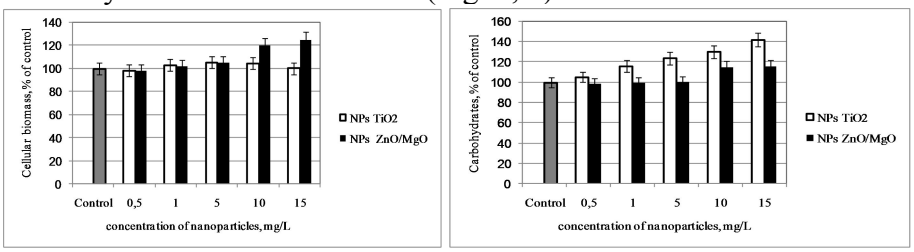
The aim of the work was to assess the action of inorganic nanoparticles on the accumulation of biomass and biosynthetic capacity of the Saccharomyces cerevisiae CNMN-Y-18 yeast strain. For the evaluation of the TiO_2 and ZnO/MgO nanoparticles action, the given compounds were added to the culture medium of YPD, in a concentration of 0.5...15 mg/L.

The experiments have shown that the ZnO/MgO nanoparticles, in a concentration of 10...15 mg/L increases the production of biomass with 20-25% (Fig. 1, a).

The analysis of the results of mannoprotein content in Saccharomyces cerevisiae CNMN-Y-18 biomass culture, at the cultivation of YPD medium supplemented with

nanoparticles, showed a relative stability. At low concentrations of ZnO/MgO nanoparticles, the yeast culture accumulates almost the same amount of mannoproteins, as well as in standard conditions. At the same time, TiO_2 nanoparticles in concentrations of 10 mg/L increase the content of mannoproteins with 23% more than in the control sample.

The results regarding the total polysaccharides from Saccharomyces cerevisiae CNMN-Y-18 show that TiO_2 nanoparticles of 15 mg/L concentration increase the yeast cell biomass carbohydrate content with 42% (Fig. 1, b).



a b

Fig. 1. The influence of TiO_2 and ZnO/MgO nanoparticles on the accumulation of biomass (a) and carbohydrates content (b) in Saccharomyces cerevisiae CN-MN-Y-18 in dependence of concentration.

The studies on the nanoparticle influence on the antioxidant enzymes revealed that the catalase activity increased (with 47%) during culturing the yeasts in medium supplied with ZnO/MgO nanocompound (15 mg/L). The stimulating effect may be explained by the fact that the excess supply of ZnO/MgO may induce oxidative stress, which is expressed by the simultaneous activation of antioxidant enxymes (Fig. 1, b).

Thus, the study on influence of inorganic nanoparticles of the Saccharomyces cerevisiae CNMN-Y-18 yeast has established that both the nanoparticles of titanium dioxide, as well as those of the oxides ZnO/MgO, represent elements having a major influence on increasing the content of mannoproteins, carbohydrates, catalase activity and the accumulation of cell biomass. The stimulative character of studied nanoparticles for the Saccharomyces cerevisiae CNMN-Y-18 strain depends on the applied concentration.

Enhancing magnetotransport properties of ultrathin manganite films by interfacing via Ruddlesden-Popper insertions

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Deterioration of functional properties at the interfaces of perovskite-based doped manganites, like $La_{0.67}Sr_{0.33}MnO_3$ (LSMO), is a common problem that restricts spintronic applications of the manganite thin films [1]. Various mechanisms have been suggested to explain the formation of clamped to the substrate or to the film surface layer with drastically degraded ferromagnetic and metallic properties that are the so-called „dead layer“. The substrate-induced epitaxial strain, which results in the distortion and corresponded spin, orbital, and charge reconstructions at the interface, has been proposed to play a critical role in the dead layer behavior. [2]. Coupling of MnO_6 octahedra with respective substrate octahedra, which is TiO_6 in the case of $SrTiO_3$(100) (STO) substrates, via corner shared oxygen ion and the presence at the same time of lattice constant mismatch is the main reason for the

distortions. The mechanism of octahedra distortion at the surface is similar, but the coupling is formed with uncompleted octahedra of the uppermost MnO_2 monolayer since this termination is more stable for the (100)-oriented film growth. It is clear that disruption of the coupling octahedra in the direction normal to film surface can provide decreasing of the distortions reducing thus the dead layer thickness. Here we report on the dead layer reducing due to artificial MnO_6 octahedra decoupling at the interface and surface of LSMO ultrathin films grown on STO(100) substrate. The decoupling was performed by an insertion of additional SrO monolayers, which form the so-called Ruddlesden-Popper (RP) layered manganite. It is well-known that the RP structure has *n* perovskite blocks (LSMO) sandwiched between double sheets of rock salt (SrO) monolayers. The insertion of two SrO monolayers can completely disrupt all corner shared MnO_6 octahedra along the *c*-axis. For this study 5 nm thick LSMO films with the additional SrO monolayers on surface and interface were grown on STO(100) substrates by metalorganic aerosol deposition technique controlling the epitaxial process by ellipsometry [3]. X-ray diffraction and AFM indicate maintaining of a high structural perfection as well as the surface morphology quality in spite of additional SrO monolayers. Transport property measurements display 10÷15 degrees higher temperature of metal-insulator transition for artificially interfaced LSMO. Magnetic measurements performed with SQUID and MOKE techniques demonstrate both enhanced magnetization and Curie temperature for the interfaced films. Therefore, our study confirms the dead layer reducing due to the decoupling of MnO_6 octahedra by interfacing LSMO films via RP-like insertion.

References:

[1] J.-H. Park, E. Vescovo, H.-J. Kim, C. Kwon, R. Ramesh, and T. Venkatesan, Phys. Rev. Lett. 81, 1953–1956 (1998)

[2] M. Huijben, L. W. Martin, Y.-H. Chu, M. B. Holcomb, P. Yu, G. Rijnders, D. H. A. Blank, and R. Ramesh, Phys. Rev. B. 78, 094413 (2008)

[3] M. Jungbauer, S. Hühn, R. Egoavil, H. Tan, J. Verbeeck, G. van Tendeloo, V. Moshnyaga, Appl. Phys. Lett. 105, 251603 (2014)

Quantum interference in pumped artificially created atomic systems

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We discuss quantum interference effects in pumped three-level ladder-type artificial atomic systems interacting also with microcavities. The required features (i.e., energy levels, dipoles, etc.) can be engineered is such systems. Particularly, we show that quantum interference occurs when both transitions are pumped and the cavity is tuned to one of the external sidebands [1]. In this case, we identify two indistinguishable amplitudes of the atom-field interaction that interfere destructively and, therefore, may lead to the complete cancelation of the cavity field. More precisely, we show that the artificial atom is completely decoupled from the cavity. So that, although it is being pumped, it does not emit any photons in the cavity and the cavity field is described only by its interaction with the thermal vacuum [1].

References:
[1] V. Ceban and M. A. Macovei, JOSA B (accepted, 2016); JETP 121 (5), 793-798 (2015).

The influence of TiO_2 nanoparticles on biosynthesis of β – glucans of *saccharomyces cerevisiae* CNMN-Y-20 yeast.

Chiselița N., Usatîi A., Guțul T.

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Recently, the attempts of using of nanotechnologies in biotechnology for obtaining of bioactive principles from microorganisms have been started. According to special literature, it is known that nanoparticles have both actions as toxic and stimulating on microorganisms that manifests in dependence on composition, size and concentration, their application can significantly alter the physiological processes and biosynthetic status.

Currently a great scientific and practical interest present the basic cell wall yeasts polysaccharides, specifically β-glucans that have an extensive application in various fields. Due to their antiviral and antibacterial, immunomodulatory and antitumoral activity β-glucans of yeasts have a special biomedical significance.

In this context, the aim of the research was to assess the influence of TiO_2 nanoparticles on productivity and β-glucans biosynthesis at *Saccharomyces cerevisiae* CNMN-Y-20 yeast strain, the β-glucans active producer, deposited in the National Collection of Nonpathogenic Microorganisms.

For the research YPD medium and TiO_2 nanoparticles with sizes of 30 nm in concentrations of 0,5; 1,0; 5,0; 10,0 and 15 mg/l in the aqueous emulsion form were used. As a control was examined variant without nanoparticles. The yeast biomass was collected after 120 hours of cultivation.

Thus, obtained results have demonstrated that the content of yeast biomass has demonstrated a relative stability for the yeast grown in the presence of TiO_2 nanoparticles. The insignificant decrease in biomass content with 3-6% compared to the control was observed at the nanoparticles, irrespective of the used concentration.

Assessing of the β-glucans content in the experimental samples was determined that TiO_2 nanoparticles in the concentrations of 0,5; 1 and 5 mg/l do not influence significantly the content of polysaccharides in yeasts biomass, content of β-glucans oscillating at the control.

The positive effect was registered at the utilization of TiO_2 nanoparticle in concentrations 10 and 15 mg/l, β-glucans content was increased by 7 and 20% respectively compared to the control.

Thus, we concluded that TiO_2 nanoparticles with dimensions of 30 nm at concentration of 10 and 15 mg/l can be used to stimulate the biosynthesis of β-glucans at *Saccharomyces cerevisiae* CNMN-Y-20 strain.

Effect of nano-oxides of certain metals on biosynthesis of extracellular hydrolases of micromycetes

Ciloci A.[1] *, Tiurina T.[1], Gutul T.[2] **, Clapco S.[1], Bivol C.[1], Nicorici A.[2] , Rusu E.[2], Labliuc S.[1], Dvornina E.[1]

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To study the effect of nanoparticles on biosynthesis of extracellular hydrolytic enzymes metal oxide nanoparticles: MgO, ZnO, ZnO/MgO in a ratio of 1:4, TiO_2 and Fe_3O_4 through hydrothermal and sol-gel techniques were synthesized. These nanomaterials were characterized by powder X-ray diffraction (XRD), infrared absorption spectroscopy (FTIR) and SEM-microscopy.

The assessment of the influence of synthesized nano metal oxides, was carried out according to their impact on biosynthesis of the enzyme at micromycetes *Trichoderma koningii*, *Fusarium gibbosum* and *Aspergillus niger* – producers of extracellular protease and amylase.

It was found that the impact of nanomaterials on the synthesis of hydrolases depends on the structure, dimension and concentration of the nanoparticles used as well as on the physiological and biochemical characteristics of the strain and the specificity of action of the enzymes synthesized by them. According to the results of research, ZnO, ZnO/MgO and Fe_3O_4 nanoparticles may be considered as stimulators of biosynthesis of extracellular proteases in micromycetes *Trichoderma koningii* and *Fusarium gibbosum.* However, the degree of their exposure to proteolytic complexes synthesized by two strains was different. In *Trichoderma koningii* strain this compounds increased the enzyme activity of both acid (by 12.1-22.3%) and neutral proteases (by 121.9-188.1%). In *Fusarium gibbosum* strain the stimulating effect caused by the action of nanoparticles was less significant (by 30.5-40.0%) and occurred only for neutral proteases. For the biosynthesis of amylase synthesized by micromycete *Aspergillus niger*, the studied a group of nanoparticles had mostly inhibitory effect (by 14.9-54.8%).

Biotechnological interest present ZnO nanoparticles of 30nm, which in the concentration of 5-10mg/L in the experimental conditions increased the activity of neutral proteases, as the main component of the enzyme complex strains, up to 3 times.

Therapeutic Hypothermia

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Hypothermia is a potentially dangerous drop in body temperature, usually caused by prolonged exposure to cold temperatures. Hypothermia for therapeutic purposes is used for its cooling effect on certain areas of the patient's body, in order to reduce the risk of ischemic tissue injury following a period of inadequate blood supply [1]. Using of this treatment reduces mortality rate from 46.51% to 25.58% [2]. Patients who have been shown to benefit from induced hypothermia include the following:

- Intubated patients with treatment initiated within 6 hours after cardiac arrest (nonperfusing ventricular tachycardia [VT] or VF)
- Patients able to maintain a systolic blood pressure >90 mm Hg, with or without pressors, after CPR
- Patients in a coma at the time of cooling

Patients for whom hypothermia may theoretically carry increased risk include those with the following conditions:

- Recent major surgery within 14 days - Possible risk for infection and bleeding
- Systemic infection/sepsis - Small increase in risk of infection
- Coma from other causes (drug intoxication, preexisting coma prior to arrest)

In addition, hypothermia is inappropriate in patients with a valid do not resuscitate order (DNR).

There are two types of the methods of producing hypothermia: invasive and noninvasive. Non-invasive methods using external sources of cooling applied on the skin cold air, ice packs, cooling beds, or as in our case a special helmet for head with Peltier elements. The use of Peltier cooling elements allow elaboration of a mobile, low size device which can be used in emergency medical services which will reduce the risk of a ischemic trauma of tissues after heart failure or blockage of arteries to embolism.

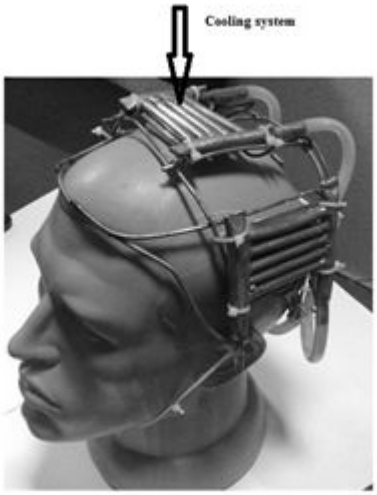

Fig. 1 The location of Peltier elements and cooling system on the human head

References:

[1] Holzer, M., “Mild hypothermia to improve the neurologic outcome after cardiac arrest.” New England J. Medicine. 346, (8) pp. 549-556, 2002.

[2] Ji-Yao Jiang, M.D., Ph.D., Ming-Kun Yu, M.D., Ph.D., and Cheng Zhu, M.D. Effect of long-term mild hypothermia therapy in patients with severe traumatic brain injury:1-year follow-up review of 87 cases October 2000.

Thermoelectric properties of Bi wires in the quantizing magnetic field

Condrea E.[1,2,*], Gilewski A.[2], Nicorici A.[1] and Donu S.[1]

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Presented results on galvano-magnetic measurements are motivated by unusual electronic structure of bismuth which may be strongly modified by the high magnetic field, where various types of magnetic field induced instabilities may occur.

Measurements of the thermoelectric response of Bi wires in quantizing magnetic field up to 35 T have revealed some anomalies in a magnetic field far above the quantum limit of the electrons: a sharp peak at 33 T and some oscillating instabilities in the magnetothermopower dependence in a magnetic field below 20 T. Observed correlation between a simultaneous shift in a magnetic field of the position of the anomalies and of the quantum limit of electrons, when modifying of the electronic structure under strain, allows us to attribute of unidentified peaks to the complex structure of the lowest Landau level of electrons when one of the lowest spin-polarized Landau sublevel of heavy electrons approaches and crosses the Fermi energy level.

The Impact of Fe_3O_4 nanoparticles on the microbial biomass in soils contaminated with persistent organic pollutants.

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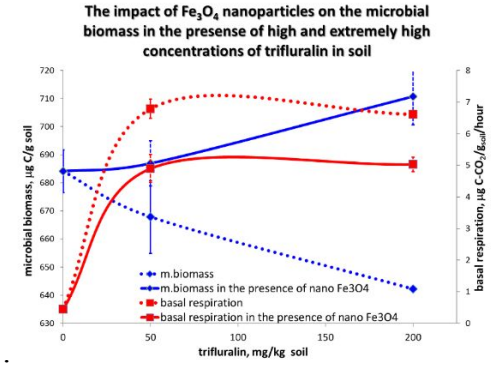
Fe_3O_4 nanoparticles permitted to substantially increase the resistance of the soil microbial biomass to the toxic impact of high and extremely high concentrations of trifluralin. The effect was maximal at the maximal concentrations of the pollutant in soil and consisted in significant increase of the microbial biomass and concomitant decrease of the basal respiration (fig. 1)



Fe_3O_4 nanoparticles were prepared according to the chemical co-precipitation method using iron(II) sulfate and iron(III) chloride in the presence of poly-*N*-vinylpyrrolidone (PVP). The resulting magnetite nanoparticles were characterized by X-ray powder diffraction (XRD) analysis and scanning electron microscopy (SEM).The nanoparticles were introduced into soil in the form of crystal powder in the concentration of 100 mg/kg.

Rolul factorilor cotidieni în declanşarea/menţinerea manifestărilor clinice ale bruxismului

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Scopul studiului - analiza indicilor cantitativi ai bruxismului sub influenţa factorilor cotidieni (stres, nicotină, cafeină, alcool). Au fost studiaţi 19 pacienţi cu bruxism şi 19 persoane sănătoase. Influenţa cofactorilor bruxismului a fost cuantificată, în corelaţie cu analiza indicilor bruxismului (dispozitivul portabil *Sleep Guard SG*, SUA). Intensitatea cofactorilor cotidieni la pacienţii cu bruxism se deosebea statistic concludent de intensitatea acestor factori la persoane sănătoase. La pacienţii cu bruxism (n = 19), s-au constatat următoarele: expresia stresului emoţional, conform chestionarului Holmes - 625,8 ± 49,3 un.; consumul de nicotină - 8,5 ± 1,1 ţigarete; consumul de cafeină - 3,0 ± 0,5 cănuţe; întrebuinţarea alcoolului - 1,8 ± 0,3 un. de alcool. La persoane sănătoase (n = 19), au fost evidenţiate următoarele particularităţi: expresia stresului emoţional, conform chestionarului Holmes - 412,5 ± 43,8 un. ($p < 0,001$); consumul de nicotină - 4,3 ± 1,5 ţigarete ($p < 0,02$); consumul de cafeină - 1,5 ± 0,3 cănuţe ($p < 0,03$); întrebuinţarea alcoolului - 0,6 ± 0,3 un. de alcool ($p < 0,01$). Factorii stresogeni provoacă o tensionare importantă a sistemului nervos vegetativ şi a structurilor cerebrale implicate în reglarea activităţii sistemului stomatognat, în special, se modifică excitabilitatea neuro-musculară şi activitatea muşchilor maseteri, care determină intensitatea bruxismului. În viziunea noastră, stresul emoţional în declanşarea/menţinerea bruxismului este asociat cu 3 componente principale: psihoemoţională, psihovegetativă, psihomotorie. Consumul de alcool, conform criteriului de intensitate, ocupă locul doi după stresul emoţional. Folosirea alcoolului la pacienţii cu bruxism (conform datelor de autoevaluare), contribuie la apariţia unui efect de liniştire, relaxare, cu senzaţii subiective de micşorare a tonusului muscular. Toate persoanele studiate afirmau, că consumul alcoolului contribuie la diminuarea stresului din viaţa cotidiană. Bruxismul a fost mai frecvent observat la persoane fumătoare, indiferent de sex în comparaţie cu persoanele non-fumătoare. Rezultatele analizei realizate de noi evidenţiază că consumul de cafeină este de două ori mai mare la persoanele cu bruxism, comparativ cu persoanele sănătoase. Conform datelor din literatură, consumul de cafeină este asociat cu fumatul (corelaţii puternice) şi cu consumul de alcool (corelaţii moderate), date care au fost confirmate şi de rezultatele noastre. Influenţa cafeinei este mai slabă, comparativ cu consumul alcoolului. Analiza integrală a rezultatelor obţinute demonstrează că la pacienţii cu bruxism, intensitatea cofactorilor cotidieni creşte în ordinea: cafeină < nicotină < alcool < stres; numărul de episoade ale bruxismului, durata lor totală creşte sub acţiunea cofactorilor în ordinea: alcool < nicotină < cafeină < stres.

În concluzie, se poate constata că toţi cofactorii studiaţi au o intensitate mai mare la pacienţii cu bruxism, cea mai semnificativă diferenţă a fost observată pentru stresul emoţional şi consumul de alcool. Aceste date într-o măsură oarecare confirmă că diferiţi

cofactori ai bruxismului se manifestă prin intermediul proceselor stresoreactivității și stresorezistenței.

Phonon spectrum engineering in rolled-up micro- and nano-architectures

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The unique properties of nanostructures associated with their low dimensionality give rise to new opportunities for research on efficient thermal-to-electric energy conversion and enhancement of the figure of merit. Efficient engineering of the acoustic phonon energy spectrum is possible in multishell tubular structures produced by a novel high-tech method of self-organization of micro- and nano-architectures [1]. The strain-driven roll-up procedure paved the way for new classes of metamaterials such as single semiconductor radial micro- and nano-crystals and multi-layer spiral micro- and nano-superlattices. The acoustic phonon dispersion is determined by solving the equations of elastodynamics for InAs/GaAs multishell systems [2]. It is shown that the number of shells is an important control parameter of the phonon dispersion together with the structure dimensions and acoustic impedance mismatch between the superlattice layers. The obtained results suggest that rolled up nano-architectures are promising for thermoelectric applications owing to a possibility of significant reduction of the thermal conductivity without degradation of the electronic transport.

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Nano fertilizer based on iron oxides

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Development and application of new types of fertilizers using innovative nanotechnology are one of the potentiallyeffective options of significantly enhancing the global agricultural productions [1]. Metal nanoparticles are wildly used of their effect on plant germination and growth. The distinctive feature of metal oxide nanoparticles is their lower

toxicity in comparison tometal salts and the ability to enhance the physiological and biochemical processes in plants [2].

Encapsulated magnetite nanoparticles (Fe_3O_4)wereprepared according to the methodof chemical co-precipitation in the presence of poly-N-vinylpyrrolidone (PVP) (MW: 8000).The presence of PVP gives possibility of formation encapsulated nanoparticles.

Effect of enscapsulated magnetite nanoparticles (Fe_3O_4) on wheat (*TriticumL.),* pumpkin (*Cucumis melo L.*) and tomato (*Solanum lycopersicumL.*)seeds was studied. Seeds were germinated in Petri dishes on filter paper substrate within seven days, according to GOST 12038-84.The concentration of solution of magnetite nanoparticles was 10-100 mg/L. Maximal effect was achieved using nanoparticles with concentration of 50 mg/L. Plant length and hypocotyl length increased by 43% and 179%respectively in comparison with control sample. Marginal effect was observed at a concentration below 100 mg/L.

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Long-range spin transport in superconductors

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We report on nonlocal transport in superconductor hybrid structures, with ferromagnetic as well as normal-metal tunnel junctions attached to the superconductor. We observe both charge and spin imbalance. In the presence of a strong Zeeman splitting of the density of states, we find signatures of spin transport over distances of several μm [1], exceeding other length scales such as the coherence length, the normal-state spin-diffusion length, and the charge-imbalance length [2]. The relaxation length of the spin signal shows a strong increase with magnetic field, hinting at a freeze-out of relaxation by the Zeeman splitting. Using a combination of ferromagnetic and normal-metal contacts, we demonstrate spin injection from a normal metal, and show a complete separation of charge and spin imbalance [3].

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Spin hyperpolarization methods for NMR signal enhancement

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Nuclear Magnetic Resonance (NMR) is known to be a very powerful spectroscopic method, which has numerous applications in different field of research, ranging from physics to medicine. Magnetic Resonance Imaging (MRI) has also become a standard tool in medical diagnostics. However, a weakness of NMR is its low sensitivity. Essentially this is because the nuclear magnetic moments are very small and, therefore, their interactions with magnetic fields are much weaker than the thermal energy, . This leads to very small population differences between nuclear spin levels (spin polarization), to which NMR signals are directly proportional. Typically, at thermal equilibrium the Boltzmann polarization, , is of the order of 10–5-10–4. The sensitivity of NMR has increased during the last decades, for instance, by using higher magnetic fields, cross-polarization methods, INEPT (Insensitive Nuclei Enhanced by Polarization Transfer) and related techniques, remote detection methods, and cryo-probes. Other promising approaches address the problem of low thermal spin polarization by selective population of nuclear spin energy levels (see Figure 1). Ideally, if we manage to obtain 100% polarized spins (i.e., all spins are prepared in the same state) we gain in signal by a factor of as much as ! These methods, which allow one to prepare strongly non-thermally polarized spins are collectively called “hyperpolarization”.

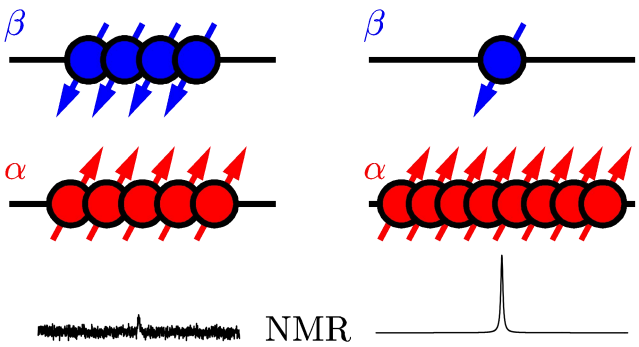

Figure 1. Schematic description of thermally polarized (left) and hyperpolarized (right) spin system. At thermal equilibrium the populations of spin-up, α, and spin-down, β, states differ only slightly and NMR signal is low; hyperpolarization shifts the system from equilibrium enhancing the NMR signal by orders of magnitude.

In this talk, we will review three a hyperpolarization technique named Dynamic Nuclear Polarization (DNP). We discuss the physical principles behind these techniques and their potential applications in NMR and MRI.

In a DNP experiment, the sample is generally doped with an exogenous paramagnetic polarizing agent, and the large polarization present in the electron spin reservoir is transferred to the nuclear spins via microwave irradiation of transitions in the EPR spectrum. Ideally, the resulting NMR enhancement is of the order of , which is about 660 for protons and even more for other important NMR nuclei (here are the electron and nuclear gamma ratios, respectively)! Presently, due to recent progress in hardware, chemistry and physics, DNP methods are widely used. Notably, new DNP strategies have appeared, which have the potential to overcome the existing NMR sensitivity limitations: these are the dissolution-DNP and solid-state MAS-DNP methods. In this talk we will focus on dissolution DNP, which allows one prepare liquid samples with very strong polarization of nuclear spins, and on DNP applications to solid-state NMR spectroscopy. Applications of these promising techniques will be outlined.

Two-dimentional semiconductor materials and new functionalities for electronic devices

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After the discovery of graphene a decade ago a new emerging class of materials - two-dimensional semiconductor materials (2DSCM) – has been developed. The layered structure of a lot of materials (metal chalcogenides, III-VI and II-VI semiconductors, etc.) makes it possible to grow ultrathin, so-called van der Waals heterostructures with very abrupt interfaces and low defect density and paves the way for fabricating multilayered materials with improved functionalities for novel electronic and optical devices. The unique features of 2DSCM , such as their reduced dimensionality, symmetry and appearance of topological insulator states, lead to the appearance of phenomena that are very different from those of their bulk material counterparts and these peculiarities drives new functionalities. The two dimensional nature of these materials also plays an entirely mechanical role as they are inherently flexible, strong, and extremely thin.

The paper overviews several fundamental properties, preparation techniques, and potential device applications of single and few-monolayer-thick of several two-dimensional semiconductor materials. General considerations on fabrication methods and characterization of 2DSCM, its classification and analysis of the main peculiarities are presented in the first part of the paper. In contrast to graphene, the inversion symmetry is broken giving rise to a band gap opening at the K point. Furthermore, they are characterized by a strong spin-orbit interaction that can generate the appearance of the state of topological insulators. Also a strong spin-orbit interaction in combination with the circular dichroism enables selective valley and spin polarization suggesting a variety of optoelectronic and spin-valleytronic applications. Thus they have been intensively studied in the areas of lowdimension electronics, topological insulators, and valleytronics, as well as solar energy harvesting such as photolysis and photovoltaics.

The second part of the paper cover a lot of recent results related to 2DSCM and nanostructures based on layered III-VI semiconductors like GaSe and InSe. Some features of intercalation method of obtaining 2DSCM nanocomposites in the form of Ga, In, Cd and Zn chalcogenide nanolamellars with nanometric sizes by heat treatment III-VI semiconductors single crystalline plates in Zn and Cd vapor are highlighted. Some aspects of structure and morphology characterization of these 2DSCM nanocomposites by different techniques are presented. Optical and photoelectrical properties of III-VI 2DSCM are revealed and a lot of peculiarities related to the transformation of electronic structure in the nanocomposites are analysed in compoarison with bulk counterparts.

Липосомальные формы антибактериальных соединений нуклеозидной природы.

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Штаммы *Mycobacterium tuberculosis* с множественной / широкой лекарственной устойчивостью, выработавшие резистентность к применяемой схеме терапии туберкулеза стали одной из основных проблем его лечении. Для увеличения эффективности лекарственных средств предложен ряд подходов, в частности, повышение биодоступности малорастворимых соединений. Мы предложили создание фосфолипид-нуклеозидных комплексов, обладающих антибактериальной активностью. Эффективность подобных соединений может возрастать за счет синергизма двух его компонентов: модифицированного нуклеозида и фосфолипида.

Исследования параллельно велись по ряду направлений: 1) Синтез аналогов нуклеозидов, обладающих антибактериальной активностью; 2) Дизайн и синтез больших одноламелярных везикул на основе фосфохолина (БОЛВ-ФХ), и отрицательно-заряженных фосфолипидов (БОЛВ-ФХ-ФЛ); 3) Создание липосомальных форм аналогов нуклеозидов; 4) Изучение эффективности БОЛВ-ФХ и липосомальных форм нуклеозидов на модельной (непатогенной) тест-бактерии *Mycobacterium Smegmatis* и других болезнетворных бактериях.

Нами синтезировали ряд С-5-модифицированных 2'-дезоксиуридинов, содержащих при С-5 положении нуклеинового основания длинноцепочечные заместители. Определение концентрации липида, позволяющего добиться максимального включения нуклеозида позволило использовать для дальнейших исследований комплекс (БОЛВ-ФХ):Нуклеозид в соотношении 20мг/мл:1 мг/мл.

Мы синтезировали БОЛВ на основе трех отрицательно заряженных фосфолипидов (ФЛ): фосфатидной кислоты (ФК), фосфатидилглицерина (ФГ) и кардиолипина (КЛ) - в четырех различных соотношениях ФХ и ФЛ 4:1 2:1, 1:1, 1:2.

Далее был определен цитотоксический эффект для полученных комплексов и соединений на культурах клеток A549 и J774. Цитотоксичность аналогов нуклеозидов была выше или равна 100 мкг/мл. Значения $ЦД_{50}$ для БОЛВ-ФХ превышали 400 мкг/мл. В концентрации 50 мкг/мл эти коплексы проявляли пролиферативный эффект. Для БОЛВ-ФХ:Нуклеозид показано увеличение цитотоксичности по сравнению с нативной формой нуклеозида до значений 50 мкг/мл, что может быть связано с увеличением накопления нуклеозида в культуре клеток. Увеличение количества включенного отрицательно-заряженного фосфолипида (БОЛФ-ФХ-ФЛ) приводило к возрастанию цитотоксического эффекта, в частности для БОЛВ-ФХ-КЛ значение $ЦД_{50}$ уменьшалось от 2000 мкг/мл до 70 мкг/мл.

Комплекс БОЛВ-ФХ-ФЛ в соотношении фосфохолина и отрицательно-заряженного липида 4:1 не подавлял рост Mycobacterium smegmatis, Escherichia coli и Pseudomonas aeruginosa.

Получены комплексы фосфохолин-аналог нуклеозида с высоким содержанием соединения. Возрастание цитотоксичности, показанное для этих структур, свидетельствует об увеличении накопления нуклеозида в клетках. Этот результат подтверждает возможность применения липосомальных форм для доставки малорастворимых соединений в культуры клеток и дальнейшем изучении их эффективности.

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Numerical modeling of detection in the contacts of bismuth-antimony alloy with different materials

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The diode detectors (DD) play an important role in radio technique and electronics. The use of high frequencies (above 1 GHz) stimulated the careful study of diodes with Schottky barrier. These diodes use the quick-acting metal-semiconductor contacts [1].

The further improvement of their parameters was achieved due to fall of the working temperature. This direction was named cryoelectronics [2], it allows to raise the nonlinearity of the current-voltage dependences and improve DD parameters.

In our publications [3, 4 et al.] the numerical modeling of the electrical potential distribution and current passing in the contacts of normal metal or superconductor with semiconductor alloy bismuth-antimony (Bi-Sb) was made.

There were analyzed possibilities to create the diode detectors based on these contacts and working at temperature of liquid helium 4.2 K. The dependences of the current responsivity, the voltage responsivity and the noise equivalent power on the signal frequency were analyzed. The role of contact area was discussed. The contacts of Bi-Sb with different materials were analyzed. The obtained results were compared with literature data. Both DD working at temperature of liquid nitrogen 77.4 K and liquid helium were considered.

The comparison with existent literature data shows the proposed DD can be 10 100 times better. The physical reasons of these advantages were discussed.

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National security in the current geostrategic perspective: assessment of new technologies and their threats

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We report on new approach to National Security strategies emerged in recent years and is very different from its previous versions [1]. These new NSS aimed at addressing internal and external, man-made and natural security problems by means of new technologies. Keeping the policies detection and prevention of known threats, there is a need to reflect a more adaptive, "extraordinary" approach to solve security problems that arise in aspect of new technologies and their threats. The result: the new practical arrangements firmly fixed in the policies and priorities of the budget cycle, so that governments can more quickly identify,

prioritize and plan their activities in terms of security challenges that are constantly changing. Importantly, the new strategy is not just setting out common objectives and principles of safety for defense and security organizations, but also requires consistent effort from the "whole government" and even more - the "whole society". Structure is what a structure does, thus the organization of technology involvement in aspects of national security should disseminate its impact on behaviour of citizens. World is not stable, but flexible. However system of hierarchy can work only in stable world. Thus, flexible system of national security should arrange its approach to why - how - what new technologies and its potential threats could be managed, be stable to shocks [2].

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Towards the creation of SF metamaterials

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The hybrid superconducting/ferromagnet (S/F) heterostructures are intensively studied objects due to the presence of a large number of interesting and promising properties in them [1]. In the last years the focus has shifted to the study of simple S/F bilayers and S/F/S or F/S/F trilayers. At the same time we may expect that properties of a more complex S/F systems, like $[S/F]_n$ superlattices will differ from the properties of their constituent S/F bilayers. Such a difference is expected when the thicknesses of the layers become comparable with the correlation length of superconductivity and magnetism in the respective layers [2-5]. In a sense such superlattices can be considered as metamaterials assembled from “atoms” of S/F bilayers.

In this report we present the first results on the creation and characterization of SF superlattices. The structures are assembled from CuNi/Nb bilayers investigated before in detai [6, 7]. There are several reasons for this choice of materials, like very small but non-vanishing solubility of CuNi and Nb (yielding smooth interfaces), good electrical contact and relatively high superconducting correlation lengths $\xi_{S,F}\sim$ 10nm. Using of polarized neutron reflectometry and SQUID magnetometry we have found long range interlayer coupling of the CuNi ferromagnetic layers which exists in a wide range of thicknesses of Nb-spacers from 1 nm to 15 nm. This coupling arises due to the competition of dipole-dipole interlayer exchange interaction and magneto-crystalline energy. By applying a magnetic field in-plane, the moments of neighbouring CuNi layers gradually turn from antiparallel at remanence to

parallel in saturation. Such a control of the vector magnetic state allows us to generate long-range triplet correlations in the whole system. The magnetic and transport data measured in the vicinity of the superconducting transition for different magnetic configuration will be also present.

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Control of superconducting qubit states by a single flux quantum pulse

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The principal possibility of implementation of the simplest logical operations on picosecond timescale has been confirmed by both analytical and numerical modelling of dynamics of superconducting flux qubit in magnetic field. Individual current pulses, propagating through distributed Josephson junctions and transmission lines of rapid single flux quantum logic have been proved to be an instrument for realization of such an operation. Using of flux-qubit interaction affecting the so-called X-components of the «Josephson atom» Hamiltonian has been shown to be the way of realization of the simplest coherent manipulations on «Josephson atom» states. The methods of approximate analytical (by matrix exponent) and exact numerical research of magnetic moment dynamics in two- and three-level systems have been developed for the cases of both oscillating ($\omega\tau >> 1$) and unipolar ($\omega\tau << 1$) magnetic fields. Developed methods have been used for modelling of the «Write» logical operation on:

a) Josephson quantum bit by individual unipolar magnetic field pulses on picosecond timescale ($\tau \sim 1-10\ ps$),

b) atomic system magnetic moment by oscillating magnetic field on picosecond timescale ($\tau \sim 1-10\ ps$),

c) Josephson quantum bit by oscillating magnetic field on picosecond timescale ($\tau \sim 40\ ps$). Mathematical analogy between quantum and classical magnetic moment dynamics in external magnetic field has been demonstrated within a designations under the conditions on duration of magnetic field pulse, which should be long enough for oscillating field ($\omega\tau >> 1$) and should be short enough for unipolar field ($\omega\tau << 1$). Principal

impossibility of «Write» logical operation implementation has been demonstrated for intermediate values of $\omega\tau \sim 1$.

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Инвайроментальные и медико-биологические факторы в укреплении здоровья человека.

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Аннотация:

1.Вселенная и организм человека имеют общие принципы построения.

2. Человеческий мозг способен воспринимать окружающий мир напрямую кроме известных пяти органов чувств .

3.Окружающая среда в настоящий момент развития технических средств способна нанести существенный вред здоровью человека.

Ключевые слова:-окружающая человека среда, –микролептонные излучения,-торсионное поле, –здоровье человека.

THE ENVIRONMENT AND MEDICAL-BIOLOGICAL FACTORS IN STRENGHTENING

HUMAN HEALTH.

Summary. 1.Universe and human body are created on the common principles.2.The human brain is able to perceive the surrounding world directly without the live senses. 3.The environment is currently developing technical sources capable of causing significant harm to human health .

Key Words :-human environment,-microlepton radiation,-torsion field,--human health.

Реальный мир, в котором мы живем, огромен, реален и познаваем. Материалисты в этом полностью правы. На современном этапе развития науки установлено, что в материальном мире действуют законы ДИССИПАЦИИ – выравнивание скоростей концентраций и температур. Работоспособность в замкнутых закрытых объемах и системах уменьшается, а **энтропия** (стремление к хаосу) возрастает и качество материи снижается. Но людям ведь нужна стабильность и здоровье. Поэтому фактор взаимодействия человека с окружающей средой, начиная от места постоянного проживания и работы до Космических далей приобретает важное значение.

Наша Вселенная состоит их двух главных составляющих: видимой и невидимой, материальной и духовной, находящихся в диалектическом единстве и борьбе противоположностей. Елена Ивановна Рерих в работе «Агни Йога» указывала,что существует Материальный, Тонкий и Огненный Мир.Вселенная и всё существующее в ней построены по одному и тому же принципу, по одной и той же программе- « **Принцип спирального вихря -во всем**». [1. стр74.]

В Мироздании Галактики существуют только двух видов – спиральные и эллиптические (на данном этапе познания). При этом в каждой спиральной Галактике существуют одновременно и левая и правая спираль.(Фото 1-это Туманность Краб). Галактика, в которой мы живем – Млечный путь. Звезды Млечного пути расположены в спиральных рукавах [2. стр.7]

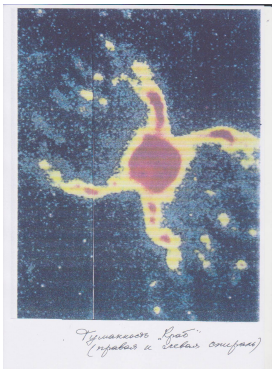

Фото 1

Фото 2

Каждый человек на земле на молекулярном уровне в каждой из 65 триллионов клеток имеет левую и правую спиралевидную ДНК, которые имеют между собой водородную связь. А ведь водород – это основной химический элемент Вселенной. Кроме этого, структура молекулы белка каждой здоровой клетки имеет 8 характерных альфа-спиральных участков, окружающих гем железа (альфа-спираль была открыта лауреатом Нобелевской и Ленинской премий Л. Поллингом). Молекулы белка – длинные цепочки аминокислот – имеют сложную пространственную организацию. Белок имеет первичную, вторичную, третичную и четвертичную структуры (фото 2).

Первичная – отражает аминокислотную последовательность. Вторичная – характеризует способ скручивания цепи (одна из наиболее распространенных моделей – спираль). Третичная – отражает трехмерную конфигурацию скрученной молекулы (та же спираль может быть еще изогнутой). Четвертичная – характеризует взаимоотношение этой молекулы с другими (т.е. как данный «кирпич» лежит в общей стенке, например в структуре гемоглобина). Приборы Нобелевских лауреатов 2002 года американца Фена и японца Танаки это регистрируют.

Характерно, что **вода в организме человека (ее до 70%) способствует формированию структуры белков, а не является пассивной** средой, где находятся молекулы белков. Из белков же построены ткани, в том числе двигатель всего живого – мышцы. Поэтому так важно для здоровья человека сохранение естественной структуры белков и водного баланса.

Пищевод и аорта огибают друг друга в виде пологой спирали [7. стр.8]

Сердце же человека – Солнце организма [1. стр.310]

И когда набухает энергия сердца в любви и преданности, тогда полетит в пространство сияющая спираль. [1. стр310.]

И поэтому каждый из нас носит в себе огонь единый и неизменный для всей Вселенной. [1. стр.345]

Таким образом, организм каждого жителя Земли подобен по структуре и форме общим принципам всей Вселенной. Все происходящие процессы во Вселенной влияют на человеческий организм, улучшая или ухудшая его здоровье. При исследовании влияния солнечного затмения на человеческий организм 20 марта 2015 года было установлено нами, что из 16 систем организма 9 систем получили «удар» - энергия их упала до минимального значения. Исследования проводились с использованием прибора «Рофес», изобретенного в России.

Современная медицина имеет большие достижения в диагностике и лечении различных заболеваний человека. Однако, организм человека анализируется в основном на системном и молекулярном уровнях. По-видимому пришла пора углубленного изучения на атомарном уровне и уровне элементарных частиц, составляющих атом (исследовано их уже около 300). Из всех известных в настоящее время частиц только нейтрино и антинейстрино имеют спиралевидную форму. Так как везде в изученных Галактиках в настоящее время регистрируется нейтринный газ, то он, по-видимому, существует и в человеке.

Известно, что каждый человек имеет излучение, которое регистрируется существующими приборами, работающими на известных законах электромагнитного поля. Однако, многие заболевания, особенно на начальных этапах, эти приборы не способны «увидеть» или «услышать».

В 2014 году в нашей республике Молдова выявлено **9816 кишечных инфекций, вызванных неустановленным возбудителем** [4. стр.19]

По нашим исследованиям причиной этого является неионизирующее микролептонное излучение технических средств, окружающих человека на работе и дома. Излучение «пополняет» энергию **всех патогенных бактерий** организма человека. Поэтому не смогли определить **конкретного возбудителя** инфекции. Это регистрируется приборами с использованием диагностики по методу Лессура. Из-за возбужденного состояния патогенной бактериальной флоры организма и произошла дестабилизация гомеостаза организма. Эндокринная и иммунная системы не смогли выполнить свои функции.

Микролептонные излучения были открыты академиком РАЕН Анатолием Федоровичем Охатриным и о них было сообщено в Докладах Академии Наук СССР в 1989 году [3. стр.867-869] Научную работу А.Ф.Охатрина представил Президиуму Академии Наук СССР еще в 1987 году **научный руководитель Семипалатинского ядерного полигона** академик Академии Наук СССР, лауреат Ленинской и четырех Сталинских премий Михаил Александрович Садовский.

Природная среда демонстрирует и подсказывает человеку пути к сохранению здоровья и даже молодости. Вот на фотографии (фото 3) три клена (г.Кишинев, проспект Мира). Фото 3

Почему на всех кленах листья имеют разный цвет, хотя посажены в один и тот же день? Здесь яркое проявление влияния земных микролептонных излучений. Клен с зелеными листьями «подзаряжается» земным микролептонным излучением торсионного поля положительной полярности и поэтому длительное время имеет листья, хотя соседи давно стоят без них.Существующие приборы, регистрирующие электромагнитные излучения, не способны в данном случае оценить влияние реальных микролептонных излучений. Здесь нужно применение других приборов, работающих на других принципах. Если же человек будет длительное время находиться на месте этого клена, то он тоже будет пополняться энергией и иметь меньше проблем со своим здоровьем и даже омолаживаться. Все известные Святые места (например Почаевская Лавра) расположены в местах, где земное излучение – это микролептонное излучение положительной полярности.

По-видимому приходит время дополнения новых знаний к уже известным. Великий Аристотель в работе « О душе» подчеркивал «Кроме пяти органов чувств никакого шестого чувства (и тем самым нечувствительного источника познаний) – нет» [5. стр.444]

Однако, по-видимому, к осязанию, слуху, вкусу, обонянию и зрению нужно дополнительно прибавить еще кое-что. Выдающийся ученый академик Российской Академии Медицинских Наук В.П. Казначеев в работе «Психобиология Запада и Востока» [6. стр.67] подчеркивал: «Недавнее **открытие атомных трансмутаций и торсионных полей** подтверждают и древнеевропейские работы алхимиков и работы восточных лекарей. ….Управление межнейронными связями и клеточными тканевыми массивами уходит далеко за пределы известных химических и физических градиентов… Клетки могут «объединяться» друг с другом не только в реализации контактного проводникового компьютера, но и полевых компьютеров, когда **нейроны объединяются своими полями без физических контактов».**

Наш организм реально ощущает невидимые для наших глаз неионизирующие микролептонные излучения торсионного поля окружающего нас мира, получая в итоге оздоровление или болезнь. **Человеческий мозг способен воспринимать окружающий нас мир и без пяти органов чувств.**

Наши многолетние исследования подтверждают это. Важнейшими противниками здоровья человека на современном этапе развития являются неионизирующие микролептонные излучения левой поляризации технических средств. **Энергосберегающие лампы спирального типа своим излучением облучают человека на расстоянии до 2-х метров**.

Системы Wi-Fi, декодеры цифрового телевидения изменяют капиллярный кровоток, повышают энергию патогенной микрофлоры организма человека на расстоянии до 15 метров. Мобильные телефоны, компьютеры, микроволновые печи, современные телевизоры имеют вредное для здоровья человека излучение, которое распространяется от источника на 1 - 3 метра. Причиной всего этого является использование в технических устройствах интегральных микросхем, в которых нарушаются законы квантовой механики при их изготовлении. (фото 4) На фотографии с левой стороны-электромагнитное и микролептонное излучение левой поляризации, которое сопровождает электромагнитное..Они излучаются одновременно . С правой стороны-только электромагнитное излучение, которое обеспечивает связь В мобильный телефон установлено защитное устройство «Экран»

Фото 4

Нашей организацией изобретены и запатентованы в Республиках Беларусь и Молдова устройства «Экран», которые позволяют нейтрализовать вредное микролептонное излучение. При этом технические характеристики устройств остаются без изменений. Достоверность и эффективность защитных устройств проверены в Москве в Центре биоэлектромагнитной совместимости Института Биофизики Минздрава России. Проверка осуществлялась с использованием современных технических средств на 113 мышах под личным руководством эксперта Всемирной организации здравоохранения профессора Ю.Г.Григорьева. В г. Кишиневе в НИИ охраны здоровья матери и ребенка проверка осуществлялась по параметрам крови человека. При этом установлено негативное влияние на гематологические показатели крови Регистрируется угнетение уровня Т-клеток на 13%,нарушение баланса иммунорегуляции за счет полного снижения количества Т-супрессоров под действием излучений.Эффективность защитных устройств «Экран» оставляет до 98 процентов.

Ввиду широчайшего распространения технических устройств по миру (прежде всего мобильных телефонов) с вредным для человеческого организма излучением необходимо срочное принятие комплексных мер по данной проблеме. 1 июня 2011 года Всемирная организация здравоохранения **официально** признала после многолетних

исследований в 13 странах по программе «Рефлекс», что мобильники провоцируют развитие онкологических заболеваний мозга. 200 ученых мира обратились в настоящее время в ООН с просьбой принять срочные меры по данной проблеме.

Профессор Мартин Бланк из Медицинского центра Колумбийского университета подчеркивает, что» излучение телекоммуникационного оборудования и линий питания оборудования повреждает ДНК в наших клетках».

Так как в нашей организации разработаны теоретические и практические методы по нейтрализации вредных излучений, то Республика Молдова может показать положительный пример многим странам Мира в проведении профилактических и организационных мер по оздоровлению населения Республики, особенно молодого поколения.

Здоровья и Добра!

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Quantum oscillations in topological insulator microwires contacted with superconductor

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Recent efforts to detect Majorana fermions in solid state devices have employed topological insulator (TI) nanowires proximity coupled to superconducting leads (SC) [1,2]. We studied the transverse magnetoresistance of Bi_2Te_3 and $Bi_{0.83}Sb_{0.17}$ TI glass coated microwires contacted with superconducting In_2Bi leads (T_c=5.6 K). The equidistant in transverse magnetic field (up to 1 T) magnetoresistance oscillations at the TI/SC interface have been observed at various temperatures (4.2 k – 1.5 K) both in Bi_2Te_3 and in $Bi_{0.83}Sb_{0.17}$ samples. In Bi_2Te_3 sample with diameter d=16 μm this oscillations exist with period ΔB=18 mT and the sharpness of the FFT peak increases with decreasing temperature. In $Bi_{0.83}Sb_{0.17}$ sample with d=1.7 μm magnetoresistance oscillations are characterized by a period of ΔB=46 mT. The observed oscillations cannot be referred to the Shubnikov de Haas oscillations because of they are not periodic in the inverse magnetic field and their amplitude with increasing magnetic field decreases. Observation of Aharonov-Bohm (AB) effect also hardly

possible in a transverse magnetic field when the sample length $l \approx 2$ mm. Different assumptions about the nature of the observed effect will be discussed.

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Long- and short-range triplet effects in superconductor/ferromagnet multilayers. Matrix calculations

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The precise matrix solution of the linearized Usadel equations (see Ref. 1) for the multilayered superconductor(S)/ferromagnet(F) structures has given for arbitrary magnetization vectors of the ferromagnet layers and an arbitrary layer number. The dependences of the critical temperatures and the critical state functions versus directions of F-layer magnetizations had calculated for the Nb/Pd-like systems. Particularly, it has been shown that the channel for the superfluid triplet electron pairs (without the presence of the singlet component), can be realized in the thin S-layer of the S/F multilayer. It has been established that the variation of the angle between the magnetizations of neighboring F-layers from $\pi/2$ to π implies the infilling of the thin S-layer, which is located between these F-layers, with the singlet electron pairs.

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Analiza fractală a proceselor de reglare vegetativă la pacienții cu bruxism

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Scopul studiului: analiza posibilităților diagnostice a indicilor analizei fractale a ritmului cardiac la pacienții cu bruxism în condiții de influență a factorilor cotidieni ai bruxismului.

Pentru studierea proceselor de reglare vegetativă, am aplicat analiza fractală a ritmului cardiac (indicii SampEn – *sample entropy*; D2 – *correlation dimension*), cu utilizarea *software*-ului specializat, în baza înregistrării ritmului cardiac prin folosirea complexului diagnostic *Polispectr-Ritm* (Neurosoft). Indicele fractal SampEn nu depinde de durata perioadei de investigare, este mai reproductibil în investigații repetate, iar indicele fractal D2 reflectă complexitatea activității sistemului analizat și indirect numărul de parametri, care

reglează acest sistem. Conform recomandărilor existente, durata de înregistrare era de 5 minute. Au fost studiați 19 pacienți cu bruxism și 19 persoane sănătoase.

Am realizat analiza fractală, deoarece ritmul cardiac este foarte variabil în timp, chiar în condiții de confort relativ, ceea ce diminuează informativitatea metodelor tradiționale (analiza spectrală etc.). Analiza datelor obținute a evidențiat modificări mai pronunțate, statistic veridice ($p < 0,05$) ale valorilor SampEn sub influența alcoolului. Deci influența alcoolului în calitate de cofactor al bruxismului poate fi apreciată cantitativ prin monitorizarea indicelui fractal SampEn. Indicii SampEn mai mici reflectă un grad mai mare de regularitate în activitatea sistemului și o predictibilitate mai bună, iar indicii mai mari reflectă un grad mai mare de haos și o predictibilitate mai mică. Alte particularități s-au depistat la analiza indicelui fractal D2 (*correlation dimension*) – toți cofactorii bruxismului studiați (stresul, alcoolul, nicotina, cafeina) au condus la modificări esențiale, statistic veridice ale activității sistemului studiat. De notat, că influența stresului și alcoolului este mai puternică ($p < 0,001$), comparativ cu influența nicotinei și cafeinei ($p < 0,05$). În stare de confort relativ, D2 este egal cu 3,923±0,16, ceea ce denotă că numărul de parametri, care reglează sistemul studiat este între 3 și 4. Se cunoaște, că reglarea ritmului cardiac are loc atât sub influența mecanismelor periferice (simpatic-sinusale), structurilor segmentare (bulbul rahidian), cât și sub influența structurilor suprasegmentare, inclusiv ale celor subcorticale și corticocerebrale. În conformitate cu teoria fractală, aceste nivele de reglare vegetativă, se reflectă în valoarea indicelui D2. În condiții de stres emoțional, are loc centralizarea proceselor de reglare vegetativă, cu implicarea preponderentă a structurilor suprasegmentare și diminuarea rolului reglator al nivelurilor mai inferioare (bulbare, periferice, sinusale). Sub influența stresului emoțional, D2 are valori de 1,805±0,21. Aceleiași particularități se manifestă și sub influența consumului de alcool (D2 = 1,763±0,24). Sub influența nicotinei și cafeinei, modificările indicelui D2 sunt mai puțin exprimate, ceea ce denotă că acești factori au o acțiune mai lejeră asupra gradului de complexitate a sistemului studiat.

În concluzie, se poate constata că SampEn este un indice fractal informativ pentru evidențierea acțiunii alcoolului în calitate de cofactor al bruxismului, iar analiza indicelui D2 reflectă integral complexitatea sistemului studiat și numărul de parametri care reglează sistemul, sub acțiunea diferitor cofactori. Aprecierea diferențiată a acțiunii cofactorilor cotidieni la pacienții cu bruxism se poate realiza în baza analizei fractale a ritmului cardiac, care reflectă integral particularitățile de manifestare cantitativă a episoadelor bruxismului.

Profesiile şi statutul psihoemoțional la persoane sănătoase şi cu bruxism nocturn primar în funcție de vârstă

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Scopul studiului: analiza particularităților bruxismului nocturn primar, în funcție de nivelul stresogen al profesiilor, statutul psihoemoțional şi vârsta pacienților. În total, au fost investigați 100 pacienți cu bruxism nocturn primar şi 30 persoane sănătoase. Nivelul stresogen al profesiilor a fost analizat în concordanță cu recomandările Nishimura (2004), conform cărora profesiile înalt stresogene corespund următoarelor criterii: răspunderea pentru alte vieți; pericol de traumatism fizic; călătorii frecvente asociate activității profesionale; comunicarea constantă în public; activitatea profesională cu nivel permanent de competivitate; activități în condiții de limitare în timp; riscul de şomaj. Conform acestor criterii, am divizat

persoanele investigate în două grupuri: persoane cu profesii înalt stresogene (polițist, militar, pompier, pilot, taximetrist etc.) şi persoane cu profesii mai puțin stresogene (bibliotecar, croitor, coafor etc.). Expresia cantitativă a bruxismului s-a apreciat prin aplicarea *SleepGuard SG5* (SUA), statutul psihoemoțional era determinat în baza VAS (*Visual Analogue Scale*).

Pentru persoanele sănătoase, am stabilit următorii indici: profesii înalt stresogene - 30,0%; expresia stresului emoțional - 3,80 ± 0,35 pt; gradul depresiei - 4,20 ± 0,25 pt; nivelul de anxietate - 3,20 ± 0,39. Analiza grupului în întregime (n = 100) a pacienților cu bruxism nocturn primar, a evidențiat următorul tablou: profesii înalt stresogene - 24,0%; expresia stresului emoțional - 5,71 ± 0,31 pt; gradul depresiei - 5,01 ± 0,39 pt; nivelul de anxietate - 5,61 ± 0,37 pt.

Analiza rezultatelor obținute a evidențiat că expresia stresului emoțional se deosebeşte statistic veridic ($p < 0,01$), cu manifestări mai pronunțate la pacienții cu bruxism nocturn. La fel, nivelul de anxietate la pacienții cu bruxism este mult mai ridicat ($p < 0,001$). Aceste date confirmă teoria etiopatogenezei bruxismului, asociate cu expresia stresului emoțional, dereglările psihoemoționale, în special cu nivelul anxietății stresogene. Analiza pacienților cu bruxism nocturn primar, de vârstă până la 35 ani (n = 70), a evidențiat următoarele date: profesii înalt stresogene - 21,4%; expresia stresului emoțional - 5,99 ± 0,28 pt; gradul depresiei - 4,61 ± 0,41 pt; nivelul de anxietate - 5,82 ± 0,34 pt. În grupa pacienților mai în vârstă de 35 ani (n = 30), au fost constatați următorii indici: profesii înalt stresogene - 30,0%; expresia stresului emoțional - 5,43 ± 0,35 pt; gradul depresiei - 5,42 ± 0,32 pt; nivelul de anxietate - 5,41 ± 0,39 pt.

Analiza manifestărilor bruxismului la persoanele studiate a evidențiat unele particularități importante care corelează cu vârsta pacienților. La persoanele sănătoase (n = 30), au fost evidențiați următorii indici: expresia bruxismului, apreciată conform chestionarului clinic - 0,10 ± 0,05 pt; numărul total de episoade a bruxismului (TNC) - 3,4 ± 0,95; durata totală a episoadelor bruxismului (TCT) - 3,6 ± 0,68 s. Analiza grupului în întregime cu bruxism nocturn primar (n = 100), a evidențiat următoarele: expresia bruxismului nocturn primar, conform chestionarului clinic - 4,85 ± 0,28 pt; numărul total de episoade a bruxismului (TNC) - 50,4 ± 5,96; durata totală a episoadelor bruxismului (TCT) - 86,5 ± 7,93 s. Au fost observate deosebiri statistic veridice ($p < 0,001$) între expresia cantitativă a bruxismului în funcție de vârsta pacienților. La pacienții cu vârsta până la 35 ani (n = 70), s-au constatat următorii indici: expresia bruxismului, conform chestionarului clinic - 5,2 ± 0,32 pt; numărul total de episoade a bruxismului (TNC) - 65,4 ± 5,26; durata totală a episoadelor bruxismului (TCT) - 110,5 ± 8,22 s. La pacienții cu vârsta mai mare de 35 ani (n = 30), au fost evidențiate alte particularități: expresia bruxismului, conform chestionarului clinic - 4,4 ± 0,24 pt; numărul total de episoade a bruxismului (TNC) - 35,4 ± 6,44; durata totală a episoadelor bruxismului (TCT) - 61,5 ± 6,91 s.

Concluzie: factorul vârstei este un indice important pentru optimizarea diagnosticului bruxismului nocturn şi manifestărilor psihoemoționale asociate.

Approaches to realization of smart water-grid and monitoring of water quality.

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Light-induced charge separation dynamics in polythiophene/fullerene composite probed by pulse EPR spectroscopy

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Despite the significant progress in OPV power conversion efficiency, the mechanism of light-induced charge separation in bulk heterojunction OPV devices is still unclear. During charge separation process the intermediate state called charge transfer (CT) state is formed. Due to low dielectric constant of organic materials the estimated coulomb attraction in CT state is much larger than room temperature thermal energy. The mechanism helping CT state to separate into free charges still remains the challenge. To solve this problem the knowledge of structure and properties of charge-transfer state is required.

We studied a light-induced CT state in composite of conductive polymer P3HT and fullerene derivative PC70BM by out-of-phase electron spin echo (ESE), known to be a powerful tool for spin-correlated radical pairs studies. Recently this method was applied to another benchmark composite P3HT/PC60BM [1]. The out-of-phase ESE signal generated by two microwave pulses was observed under the laser pulse irradiation of the composite at low temperature 65K. Interspin distance distributions within the charge transfer state were obtained from modeling the dependence of out-of-phase ESE on the delay between the microwave pulses at different delays after laser flash TDAF=300 ns; 1.3 μs; 3.3 μs. The magnetic-dipolar interaction parameters of the radical pair P3HT+/PCBM- were determined from quantum chemical calculation, thus charge delocalization over P3HT chain was taken into account. The average distance between charges increases with TDAF increase; also the distribution becomes significantly broader with larger distances prevailing at longer TDAF values. Such behavior is presumably caused by two simultaneous processes: diffusion of the radicals from the polymer/fullerene interface and geminate recombination of radical pairs with small distances between radicals.

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Ionic liquids derivative of 1h-imidazole as novel antioxidative compounds with potential biological activity

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Reactive oxygen species (ROS), such as superoxide and hydroxyl radical control many biochemical processes, for example, vascular tone; these radicals can even be messengers in a phenomenon dubbed redox signaling. But when there is an imbalance between their production and the cell ability to detoxify the reactive intermediates, the so-called oxidative stress takes place. It has been identified and proven to be the root cause of more than 70 chronic degenerative diseases such as heart disease, cancer, stroke, diabetes, Alzheimer's dementia, Parkinson's disease. It can be provoked by different unfavorable factors, including grave ecological situation. Among the most important antioxidant compounds containing in plants two classes attract attention grace to their structural diversity – these are phenols (effective inhibitors of chain reactions) and terpenoids (having bactericide, antiviral, antiseptic properties). However, terpene phenols as the products of mixed biogenesis can be found out in nature more frequently, for example, Probuquol, Ionol, Emoxypine, α-tocopherol, vitamin K1, co-ensyme Q10. It was proved they dispose not only of antioxidant properties, but also manifesting as radioprotectors, hepatoprotectors, antiphlogistic and tumoricidal compounds. Ionic liquids derivative of 1*H*-imidazole are a relatively new class of compounds that have been receiving increased attention in recent years as "green" designer solvents that may potentially replace many conventional volatile organic solvents in reaction and separation processes. These specific compounds are organic salts that are liquid over a wide range of temperatures near and at room temperature. Ionic liquids have no measurable vapor pressure; hence, there has been considerable interest in using them in place of volatile organic solvents that can emit problematic vapors.

Novel 1*H*-imidazole derived hydroxyl functionalized dimers and molecular hybrids of different natural terpenoids, which have very high antioxidant properties have been developed and investigated. In order to determine the reaction stoichiometry, different molar ratios, expressed as moles of antioxidant per mole of DPPH▪, were tested, ranging from 0.1 to 10. For each molar ratio, the remaining concentration of DPPH▪ at the plateau was determined and graphed, and EC50 was read on the graph as the molar ratio which reduces half of the initial DPPH▪ concentration, was determined from the graph. A lower EC50 value is associated with a stronger DPPH radical scavenging capacity under the same testing conditions. These results for clarity were also expressed in terms of antiradical power (ARP) calculated as ARP=1/EC50 in which larger ARP values represented a larger scavenging capacity. The number of reduced DPPH▪ molecules per one molecule of antioxidant was defined as $\sigma = 1/ (2 \times EC50)$. The results obtained for EC50, σ and ARP of the studied compounds were compared to those of ascorbic acid (control).

Trends in the properties of these liquid compounds are discussed.

Docking for a novel class of tryptanthrin analogues against inhibitors of mycobacterium tuberculosis

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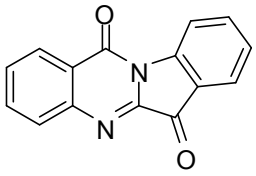
Tuberculosis (TB) is a bacterial infection caused by *Mycobacterium tuberculosis* that has affected one third of global population. In 2013, around 9 mln people became infected with TB, and 1.5 mln died from this disease, of which 360000 were HIV co-infected [Global report, 2014]. Emergence and wide spread of multidrug resistant tuberculosis (MDR-TB) along with extensively resistant tuberculosis (XDR-TB) aggravate the problem, since few new medicines and therapeutic schemes have been approved to combat the resistant forms. Eastern European and central Asian countries have the highest levels of MDR-TB, reaching 35% of new cases and 75% of previously treated cases in some settings [Global report, 2014]. Therefore, there is a constantly growing demand in new highly active and effective therapeutics to combat TB and its resistant form.



Tryptanthrin

Tryptanthrin (**TRPN**) is a naturally occurring compound from the class of tryptophan-derived alkaloids produced by different plants (*Couroupita guianensis, Isatis tinctoria, Polygonum tinctorium, Strobilanthes cusia, Wrightia tinctoria*) and fungi (*Candida lypolitica*). Antimycobacterial activity of **TRPN** and its derivatives was for the first time reported [Baker, W. R., & Mitscher, L. A. (1995). U.S. Patent No. 5,441,955]. The study identified two most promising compounds with high *in vitro* activity against MDR-TB strains, which, nevertheless, showed little efficiency *in vivo*. Later [Tripathi, A., Wadia, N., Bindal, D., Jana, T. Indian J. Biochem. Biophys. 2012, 49 (6), 435-441] performed molecular docking analysis of TRPN and its analogues with enoyl-acyl carrier protein reductase (**InhA**) of *Mycobacterium tuberculosis*. The study showed good affinity between the alkaloid and its two analogues to the ENR binding site with free binding energy of -7.94 kcal/mol and inhibition constant (Ki) of 1.50 μm. Hwang et al [Hwang, J. M., Oh, T., Kaneko, T., Upton, A. M., Franzblau, S. G., Ma, Z., ... & Kim, P. Journal of natural products. 2013, 76(3), 354-367] have also performed a study of multiple **TRPN** analogues that resulted in determination of two compounds with highest activity in studies *in vitro* and improved bioavailability *in vivo* as compared to **TRPN**, which, however, did not demonstrate efficacy in acute murine tuberculosis following 4 weeks administration in doses of 400 mg/kg.

Interestingly, **TRPN** was found to be able to reverse the drug resistance towards certain anticancer agents in breast cancer cell lines. Another important set of TRPNs'

activities are immune-modulator effects: down-regulation of interleukin-4 production by Th2 cells, inhibition of nitric oxide and prostaglandin E2 synthesis in macrophages, inhibition of interferon-γ and interleukin-2 production by mouse spleen cells and Peyer's patch (PP) lymphocytes *in vitro*, inhibition of indole amine 2,3-dioxygenase, significant reduction in the levels of TSLP, IL-4, IFN-γ, IL-6, TNF-α, chemokine, and caspase-1 in atopic dermatitis (AD) skin lesions, suppression of the histidine decarboxylase levels with consequent reduction of histamine levels in AD model. **TRPN** and its derivatives were proposed as immunotherapeutic agent to treat cancer, either alone or in combination with other anti-cancer therapies (e.g. chemo therapeutic agents, mAbs or other immune modulators), as well as for the treatment of BCG, cholera, plague, typhoid, hepatitis B infection, influenza, inactivated polio, rabies, measles, mumps, rubella, oral polio, SARS, yellow fever, tetanus, diphtheria, hemophilus influenzae B, meningococcus infection, and pneumococcus infection.

Let us consider the affinity and interaction of the synthesized inhibitors against **InhA** of Mycobacterium tuberculosis **Mtb**. Earlier analogues of natural alkaloids of TRPN, which have anti-tubercular activity against MDR-TB (multi-drug resistant tuberculosis), were *in silico* investigated by molecular docking. Results show that TRPN and its analogues have exhibited good affinity to the binding site of **InhA** (ENR), and free energy binding to active site of **InhA** is changing in the limits of -6.44 ÷ -7.75 kcal mol^{-1}. Inhibition constant is changing between 2.07 and 19.15 μm. As a continuation of the researches on docking, we have studied the ligand-receptor interaction of the compounds synthesized with the binding site of **InhA**. 3D-crystallographic structure of the target protein **InhA** was retrieved through Brookhaven PDB under the accession code **4U0J**. The resulting values of docking energy and stabilization energy are given in Table X . As it is seen from the data in the table, binding affinity changes in the limits of -5.5 and 9.4 kcal mol^{-1}. The range of the stabilization energy (E2) changes is wide enough and equals to 1.5 ÷ 6.9 kcal mol^{-1}.

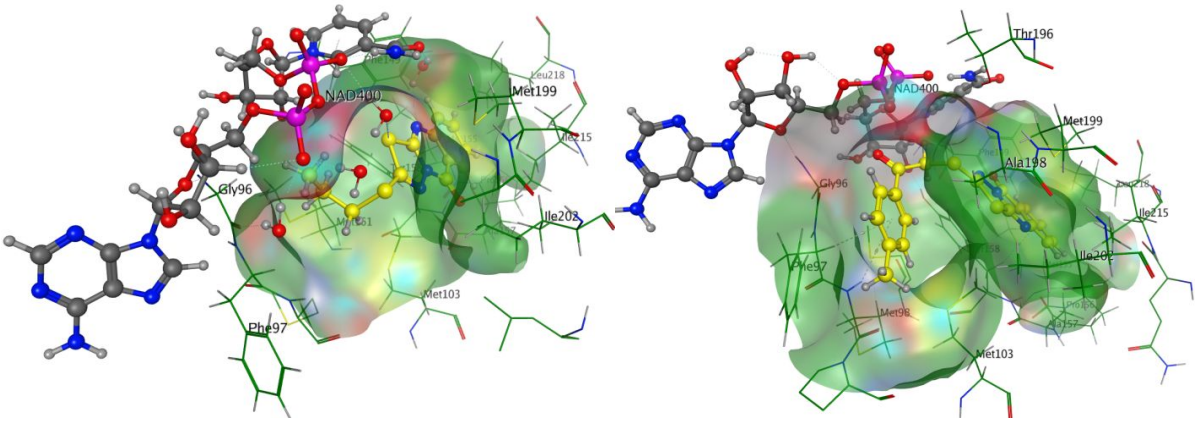


Figure 1. 3D representations for the docking poses of compounds **1** (left) and **2** (right) in the active site of **InhA** (PDB code: 4U0J).

By taking as an example, one active **1** and one inactive **2** inhibitors, let us consider their interaction with the active site if the receptor **InhA**. In contrast to the previously described mechanism of interaction (Fe-porphirine ring containing dioxygenase-**2D0T**), ligand binds with **InhA** through the amino acid residues. By this, water molecules, which are in the active site of the receptor, play a definite role in the interactions. With the help of the *ab initio* molecular dynamics, the role of the water molecules and NAD cofactor in the active site of InhA had been considered in details earlier. The most energetically profitable disposition of atoms belonging to compounds **1** and **2** in the active site of enzyme **InhA** is presented in Fig.1.

As seen from the Fig.1, the presence of the water molecules in the active site causes the hydrogen bonds formation between the ligand (atom N in quinoline hetero ring) and NAD. Besides, weak interaction between Tyr158 and phenyl ring of quinoline (Aromatic-Aromatic ring type of bonding, 3.41Å) is observed for the active molecule **1**.

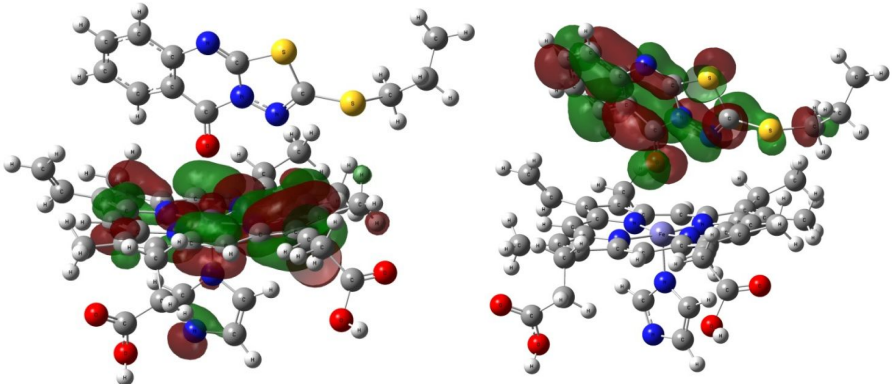


Figure 2. A three-dimensional view of HOMO/LUMO orbitals for compound **1**.

Week hydrophobic interaction with Met199 (3.39Å), Gly96 (3.58Å) and Ile215 (3.59Å) happens in the case of compound **1**. Inactive molecule **2** binds with receptor for the account of aromatic--aromatic moiety (Gly96-3.34Å) and H--Aromatic interaction with Phe97 (3.71Å), Met98 (3.33 Å) and Tyr158 (3.56Å).

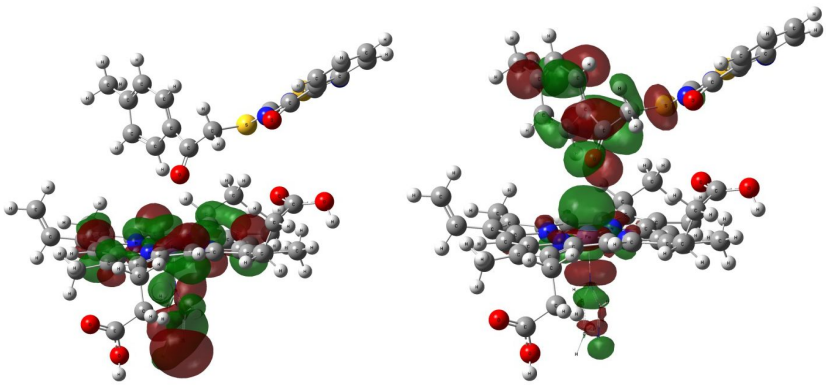


Figure 3. A three-dimensional view of HOMO/LUMO orbitals for compound **2**.

The discussion of the electron density distribution in the active centre of **InhA** (as in the case of **IDO-1**) is important for the understanding of the mechanism of inhibition related to the synthesized molecules. A special interest for the ligand-receptor interaction presents analysis of the border orbitals (HOMO-LUMO). Electron density distribution on these orbitals for the molecules **1** and **2** is given in Fig.2 as well as in Fig.3.

As seen from Fig.2, electron density for the compound **1** is distributed both on ligand and amino acid residues that causes more effective donor-acceptor interaction. For the compound **2** (Fig.3), electron density is concentrated on residues and absent on the ligand's atoms. The *E(2)* value for the compound **1** is 5.7 kcal mol^{-1}, while for the compound **2** it equals to 2.1 kcal mol^{-1}.

It should be noted that opposite to the mechanism of IDO-1 inhibition, there is no good correlation dependency between anti-tuberculosis activity and such parameters as binding affinity and stabilization energy *E(2)* for the second mechanism of the **InhA** inhibition.

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^{31}P NMR investigation of new *P**-chiral phosphates

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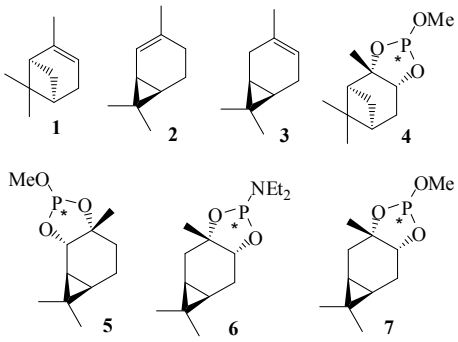
Chiral phosphites represent an important type of chirality transfer agents for asymmetric catalysis. The most important advantages of phosphite-type ligands include their pronounced π-acidity, oxidation stability, as well as their synthetic availability and low cost.

Correspondingly, the idea of designing *P*-monodentate phosphites that possess a *P**-stereocenter is rather attractive, since ligands with asymmetric donor centers are particularly efficient stereoinductors. Nevertheless, there are rather sufficiently limited number of very promising *P**-chiral monodentate phosphite-type ligands.

Herein we report the ^{31}P NMR investigation of new synthesized [1] *P**-chiral phosphites based on terpene - α-pinene **1**, 2-carene **2** and 3-carene **3** as one of cheapest natural optically active auxiliaries. The ^{31}P NMR spectroscopic data for **4-7** are summarized in Table 1. Compound **6** with NEt_2 exocyclic fragment is formed as single stereoisomer, while **4**, **5** and **7** each contain from 3 to 34% of the second epimer by *P** - stereocentre. To estimate steric demands of ligands **4-7**, we calculated their Tolman's angles [2] by the reported method using of semiempirical quantum mechanical AM1 techniques with full optimization of geometrical parameters [3]. The obtained results (Table 1) show that the steric demands of **4-7** vary over a rather wide range between 90° and 122°.



1 2 3 4 5 6 7

Table 1. ^{31}P NMR chemical shifts ($CDCl_3$) and cone angles θ (deg) of phosphites **1-4**.

Ligand	δ_P	θ
4	141.5 (95%), 151.2 (5%) [a]	97.9
5	138.7 (66%), 143.9 (34%)	121.5
6	152.5	122.3
7	141.0 (97%), 147.1 (3%)	90.4

[a] Percentage of *P**-epimers

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Diagnosis of the functional state of autonomic nervous system in patients with burns

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Burn injury is one of the most stressful factors. In response to any stress the body changes defensive adaptation and adaptive reactions for the regulation of which, on a subconscious level, autonomic nervous system (ANS) is responsible, by antagonistic interaction of its sympathetic and parasympathetic divisions. The same principles are peculiar to eastern-philosophical concept of Yin and Yang, philosophical law of unity and struggle of opposites etc. Understanding the special features of ANS activity in patients with burns of various severity allows to evaluate adequately their general condition and increase the efficiency of treatment and rehabilitation measures.

That is why the purpose of our research was to study the functional state of autonomic nervous system of patients with burns of various severity.

The research involved diagnostics of the functional state of autonomic nervous system in 90 patients with burns of various severity according to the methods of V.G. Makats using the device VITA-01-M. Depending on the severity index, injuries were divided into 3 groups, 30 victims in each group. The first group consisted of burnt patients with the severity index (SI) 60-90 units, second - 91-120 units, third - above 120 units. All patients took infusion-transfusion therapy, early surgical necrectomy on 2-3 day, xenoplastic transplantation. Wounds were treated in a humified box. The research was conducted from 10 to 12 hour on 1, 3, 7, 14, 21 and 50 day. After computer processing of obtained results and analysis of the dynamics of functional energy information systems activity, we determined the index of vegetative homeostasis (IVH).

Obtained results allowed finding out that the state vegetative equilibration was restored only in patients with SI of 60-90 units on 50 day of observation. Patients with SI of 91-120 units were in a state of parasympathetic activity compensation. Patients with SI of more than 120 units remained in a state of evident parasympathetic activity.

It was established that recovery of vegetative equilibration in the body of burnt was achieved by a pathological way due to a sharp depression of some biologically active zones and activation of others. Significant disturbance of energy circulation through functional energy channels requires its correction, which is treated as an urgent tendency of psychosomatic rehabilitation of patients with burns.

Novel derivatives of pyrimidine nucleosides with both antibacterial and antiviral activity

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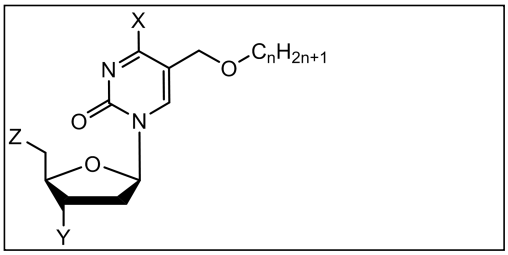
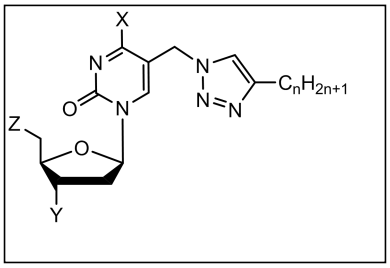
Nucleoside analogues play an important role in medicine as antiviral agents. Many 5-substituted derivatives of 2'-deoxyuridine inhibit the replication of herpes viruses (e.g., HSV and VZV) [1]. Only at the beginning of the XXI century several groups reported a few sets of modified nucleosides that displayed *in vitro* antimycobacterial activity [2]. Recently we synthesized 2'-deoxypyrimidine nucleoside derivatives bearing extended alkyloxymethyl or alkyl(1,2,3-triazol-1-yl)methyl substituents at C-5 position and demonstrated their effective bacteriostatic activity against *Mycobacterium tuberculosis* strains [3]. However, the nucleosides with large hydrophobic fragments are insoluble in water thus limiting the biological investigations. The goal of this work was to synthesize and to study antibacterial activity as well as anti-HSV-1 activity and stability of 5'- derivatives of C-5 modified nucleosides in human blood serum.



X = OH, NH_2, Y = OH, N_3, NH_2, Z = OH, I, N_3, NH_2, $OP(O)(OH)_2$, $HO(C_2H_4O)_3C(O)O$, n = 10-14



X = OH, NH_2, Y = OH, Z = OH, I, N_3, $OP(O)(OH)_2$, $HO(C_2H_4O)_3C(O)O$, n = 8, 10, 12, 12

All compounds were not cytotoxic at concentrations up to 200 μM for *Vero* cells and up to 100 μM for *A549* and *Jurkat* cell lines. 5'-Monophosphates and 5'-triethylene glycol derivatives of C-5 modified nucleosides were stable in human blood serum over a period of 2 –24 hours, that allowing their application as potential prodrugs. According to preliminary data, synthesized 5'-monophosphates and 5'-triethylene glycol derivatives demonstrated moderate activity *in vitro* against two laboratory strains of human herpes simplex virus type 1 (*HSV-1*): acyclovir-sensitive (*HSV-1/L₂*) and acyclovir-resistant (*HSV-1/L₂/*RACV) in the *Vero* cell culture. 5'-Triethileneglycol derivatives effectively inhibited the *in vitro* growth of *Mycobacterium smegmatis, Staphylococcus aureus* and *Mycrococcus luteus*.

Acknowledgment. This study was supported by the Russian Foundation for Basic Research (grants № 14-04-00755 and № 15-04-05116).

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Thermoelectric properties semimetal and semiconductor $Bi_{1-x}Sb_x$ foils

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We have studied thermoelectric magneto- thermoelectric properties of $Bi_{1-x}Sb_x$ foils in semimetal and semiconductor states. The $Bi_{1-x}Sb_x$ foils were prepared by crystallization a thin layer of the melt on the inside polished of surface of a rapidly rotating copper cylinder. The cooling rate of the liquid phase was ~$5*10^5$ K/s [1]. The rapidly solidified foils have a microcrystalline structure and texture (1012) with thickness 15-40 μm.

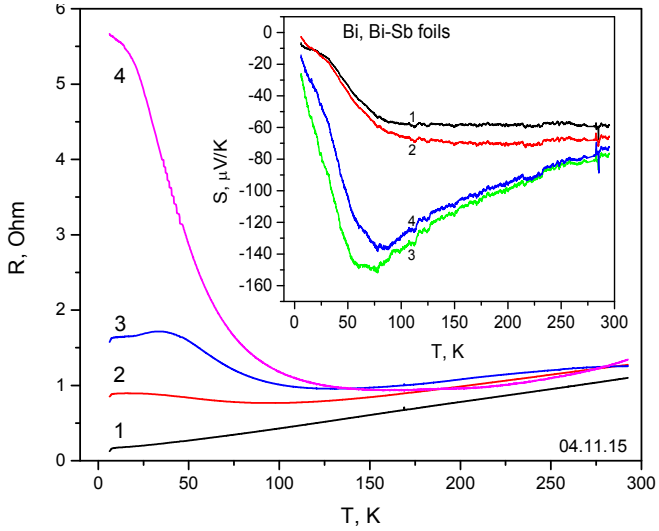

Fig.1. Resistance and thermopower (inset) as a function of temperature for the Bi and $Bi_{1-x}Sb_x$ foils. 1- Bi, 2- Bi-3at%Sb, 3- Bi-9at%Sb, 4- Bi-15at%Sb.

The thermoelectric figure of merit depending on the foils structure, magnetic field and entire temperature has been calculated.

It is discussed the question the enhancement of the thermoelectric figure of merit in semiconductor $Bi_{1-x}Sb_x$ foils at high temperatures, using the reduction phonon-thermal conductivity, due to phonon – grain boundary scattering.

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Nonlinear dynamics of quantum dots lasers under the influence of double cavity external feedback

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This paper reports results on investigations of the dynamical behavior of a semiconductor laser with quantum dots active medium under the influence of a feedback from double external cavity. This configuration is treated in the framework of Lang-Kobayashi equations. The locus of external cavity modes is found to be elliptic, as in case of conventional optical feedback, but also represents different shapes, even with possible satellite bubbles. The nature of bifurcations and the stability of steady state solutions are analyzed in dependence on different parameters. A bifurcation analysis is carried out revealing the points of saddle-node and Hopf bifurcations. The effect of the different parameters on the stabilization and destabilization of laser emission is investigated. Finally,

the possibility of application of quantum dots lasers under the influence of feedback from double cavity as a key element in chaos based communications system is discussed.

During recent years, the phenomena of control and stabilization, as well as the destabilization and chaos of laser emission by external cavities have received considerable attention due to its fundamental and applied interests. The main aim of technological progress is the production of structures with stable properties and the possibility of their application in different areas.

Stabilization of laser emission by external cavities has a long history [1] and is still of continuous interest. Another well-known method of control is due to Pyragas [2] applied successfully to different systems. These control techniques found certain applications in information transmission systems.

On the other hand, different dynamical behaviors have been obtained for lasers under the influence of feedback from external cavities, including periodic and quasi-periodic pulsations, low frequency fluctuations, coherent collapse, optical turbulence, chaos (for more details, see [3]). The chaotic waveform is suitable for chaos-based communications. Recently, chaotic communications have become an option to improve privacy and security in date transmission, especially after the recent field demonstration of the metropolitan fiber networks of Athens [4]. In optical chaos-based communications, the chaotic waveform is generated by using semiconductor lasers with either all-optical or electro-optical feedback loops. In particular, synchronized chaotic waveforms have found applications in chaos based communication systems.

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Ecological effects of the use of silver iodide for weather modification in Moldova

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Active influences on atmospheric processes are a reality: it has been practiced for over 50 years and is currently applied in over 40 countries. Effectiveness has been demonstrated in several scientific experiments. The most common seeding material is the silver iodide. Silver iodide is the primary and widely used component for ice-nucleating complexes utilized for cloud seeding in order to prevent hail or induce artificial rainfall. Therefore, it is only logical to study the environmental effects of cloud seeding with silver iodide [1,2].

The results of studies of the silver content in water bodies and air and the ice nuclei concentrations in the regions subjected to hail protection in the Republic of Moldova in 1977 1991 are summarized. The problems of environmental pollution in the regions involved in the activities are discussed.

It is demonstrated that (1) long-term observations of the use of AgI-based ice-forming compositions have not revealed either a tendency of silver aerosol accumulation in the ground air or its correlation with the amount of the consumed reagent; (2) a study of the accumulation of silver ions in water, air and soil as a result of works on active influences on atmospheric processes in Moldova has clearly shown that no environmentally harmful effects arising from cloud seeding with silver iodide aerosols have been observed.

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Infrared System for Detection of Explosives and CBRN Agents

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It is proposed a simultaneous method for treatment and control of potentially dangerous objects like viruses or explosives, immersed in a post-office deliverables. Those methods are based on the irradiation and post-irradiation IR-control.

To resolve the problem of mail items safety the methods of indirect temperature-contrasting imagining [1,2] can be successfully used. For preventive bactericidal treatment of mail items it is proposed to use the method of radiative sterilization, which is widely spread all over the world for processing of medical materials. The value of the absorbed dose 15-25 kGr can kill the vital pathogenic microorganisms. Estimated cost of such treatment can be received proceeding from the calculation that for processing of 15 kg of envelopes it is necessary to apply electric power equal to 1 KWatt·hour.

Besides the preventive treatment there is also a problem of revealing of envelopes with suspicious immersions. It is known, that at radiation passing through the substance, the part of the absorbed energy is spent for increasing temperature of irradiated object. Thus the object absorbtion ability depends on its density and geometrical sizes, in particular on thickness of an immersing layer. If in a post envelope there is an unauthorized immersion (for example the plastic explosives), the radiation field will be immersed more intensively and the temperature on an irradiation zone output will differ from a background temperature.

One more indication of the unauthorized immersion presence can be the change of a radiation field after passing through the irradiated object. For control of the radiation field it is offered to use the screen made from a thin metallic foil. The change of a radiation flow also will cause a change of the screen surface temperature.The measurement of a screen temperature and irradiated objects is offered to be made with an Far-Infrared radiometer [3] (with the sensitivity being in the range of the waves from 15 micrometers to 1 mm, corresponding to a range of about 20 THz to 300 GHz).

Acknowledgments

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Biosilver nanoparticles as a new antimicrobial agent

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Nowadays, there is an increasing concern about the emergence and re-emergence of drug resistance to many pathogens such as bacterial and fungal strains [1]. Therefore, the development of novel antimicrobial compounds to combat resistant pathogens is a research of high priority. In relation to its broad spectrum of efficient activity and lower costs, nanosilver particles based on antimicrobial agents are excellent candidates for therapeutic purpose. However, it is well known that size of NPs influence the physicochemical properties and mechanisms of toxic action and in consequence the bioavailability [2]. A range of analytical techniques are available for providing information on particle size distributions, including microscopy approaches [3], chromatography [4], centrifugation [5], laser scattering [6], filtration [7], spectroscopic [8] and flow field flow fractionation [9]. The present work has been focused on the antimicrobial activity of silver nanoparticles synthetized from acidophilic actinobacteria strain CGG11n and their physicochemical characteristics using different techniques. Moreover, the interaction of these nanoparticles with antibiotics in different combination on bacterial strains was evaluated.

Key words: actinobacteria, antibacterial activity, separation techniques, silver nanoparticles.

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Application of magnetite nanoparticles for pesticide decontamination in soil and water

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The recent rapid development of the nanotechnology has produced a considerable number of studies dedicated the usage of iron-based nanoparticles as soil and groundwater remediation materials. Magnetite nanoparticles (Fe_3O_4) have a strong reductive degradation ability, and the Fe^{2+} might play an important role as an electron donor to remain available for reaction with the chlorinated organic compounds [1].

Magnetite nanoparticles were prepared according to the method of chemical co-precipitation in the presence of poly-N-vinylpyrrolidone (PVP). Fe_3O_4/PVP nanoparticles aqueous colloidal solution at a concentration of 50 mg/kg of dry soil was used for treatment of long-term pesticides contaminated soil for 4 days. The major component of the pollution was trifluralin, the synthetic fluorinated dinitroaniline herbicide, it residue amounts 30 mg/kg dry soil. The biotest based on determination of the degree of wheat seeds growth demonstrated a stimulation effect, expressed in an increase in the length of the roots (by 178.5%) relative to the control without treatment. In aqueous system, trifluralin dissolved in acetone was mixed with Fe_3O_4/PVP nanoparticles powder (NP1) and Fe_3O_4/PVP nanoparticles aqueous colloidal solution (NP2), in concentration of 200 mg/l. After 14 days of treatment trifluralin remains 1.52% and 3.51% from the initial concentration of 0.15 mM, when used NP1 and NP2 correspondingly.

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Eficiența tratamentului stomatologic în asociere cu metodele *biofeedback* la pacienții cu bruxism nocturn

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Bruxismul nocturn este o patologie polisistemică, care se manifestă nu numai prin semne tipice bruxismului la nivelul sistemului stomatognat (scrăşnit din dinți, dureri în mușchii masticatori etc.), dar şi prin dereglări în alte sisteme ale organismului (dereglări psihoemoționale şi vegetative, dereglări respiratorii etc.). Reieşind din aceasta, se studiază posibilitățile terapeutice ale bruxismului nocturn prin în asocierea tratamentului stomatologic cu aplicarea diferitor metode de tip *biofeedback*, capabile să influențeze dereglările din diferite sisteme ale organismului.

Scopul studiului: aprecierea efecienței tratamentului stomatologic a bruxismului nocturn prin aplicarea gutierelor cu sau fără asocierea metodelor de corecție *biofeedback*. Au fost studiați 100 pacienți cu bruxism nocturn primar. Un grup de pacienți (n = 50) a primit tratament stomatologic cu aplicarea în continuare a gutierelor; al doilea grup de pacienți (n = 50), pe lângă acest tratament, a urmat proceduri prin intermediul *biofeedback*, cu aplicarea dispozitivului portabil *SleepGuard SG5* (SUA). În timpul primelor zile, *SleepGuard*-ul era aplicat cu scop de *training*: tensionare musculară-sunet de avertizare-relaxare conştientă. În timpul activității cotidiene (lucrul la calculator etc.), o încordare a mușchilor masticatori conduce la apariția sunetului de avertizare, la care pacientul trebuie să întrerupă activitatea şi să se relaxeze. În felul acesta, se creează o programare subconştientă a reacției musculare la sunet. În timpul somnului, în timpul angrenării maxilarelor, apare un ton de intensitate slabă, care durează 2s, timpul necesar pentru relaxarea mușchilor. Dacă relaxarea nu a avut loc (apreciată de *SleepGuard*), peste 2s apare un sunet mai puternic, care semnalează că mușchii în continuare sunt tensionați şi este un semn pentru a reacționa prin relaxare. Când tonul devine mai puternic, se începe înregistrarea timpului ca peste 5s, tonul continuu să se transforme în semnal de alarmă, care durează până la întreruperea încleştării/angrenării sau automat se opreşte peste 25s. Frecvența sunetului pentru biofeedback, aplicată în *SleepGuard* este de 2 kHz. La pacienții fără aplicarea metodei *biofeedback*, eficacitatea tratamentului era mai mică: în perioada pre-tratament, numărul total de episoade nocturne ale bruxismului era în mediu de 48,6 ± 5,85, durata totală a episoadelor constituia 83,8s; la a 6-a lună de tratament, numărul de episoade ale bruxismului era de 37,7±5,43, iar durata totală a episoadelor 66,7s. Eficacitatea tratamentului în grupul cu aplicarea *SleepGuard SG5* este mai mare: numărul de episoade în perioada pre-tratament constituia în mediu 52,3, iar durata totală a episoadelor bruxismului constituia 89,3s; peste 6 luni de tratament s-au obținut următoarele rezultate: numărul de episoade – 31,1±6,01, iar durata totală a episoadelor constituia 48,5s. Aceste rezultate se deosebesc statistic semnificativ ($p < 0,01$) de indicii obținuți sub influența tratamentului fără aplicarea metodelor de corecție de tip *biofeedback*.

În concluzie, se poate constata că metodele de corecție de tip *biofeedback* sporesc semnificativ eficiența tratamentului stomatologic complex şi pot fi recomandate pentru aplicarea mai largă în practica stomatologică.

Noi posibilităţi de individualizare a tratamentului bruxismului nocturn prin aprecierea reflexului ocluzal (*masseter inhibitory reflex*)

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În ultimii ani, se studiază posibilităţile reflexului ocluzal (*masseter inhibitory reflex* - MIR) în diagnosticul dereglărilor ocluzale la pacienţii cu diferite patologii stomatologice. Un nou aspect al acestei probleme este individualizarea tratamentului bruxismului nocturn, prin aplicarea terapeutică a gutierelor în baza indicilor MIR.

Scopul studiului: aprecierea eficienţei tratamentului bruxismului nocturn prin aplicarea gutierelor în baza indicilor MIR. Au fost studiaţi 100 pacienţi cu bruxism nocturn, investigaţi stomatologic şi neurofiziologic – am determinat *masseter inhibitory reflex*, aplicând complexul *Neuro-MVP micro* (Neurosoft). Toţi pacienţii au fost investigaţi prin aplicarea dispozitivului portabil *SleepGuard SG5* (SUA), cu scop de apreciere cantitativă (numărul de episoade a bruxismului nocturn, durata totală a episoadelor, numărul de episoade per oră) a manifestărilor bruxismului nocturn. În grupul pacienţilor cu inhibiţie MIR normală, sub influenţa tratamentului stomatologic în asociere cu aplicarea gutierei, în timpul somnului, peste 6 luni s-a observat o ameliorare a indicilor bruxismului (numărul de episoade, durata totală a episoadelor, numărul de episoade per oră) aproximativ cu 15-20%, în comparaţie cu perioada pre-tratament. Indicii reglării vegetative în sistemul stomatognat, au rămas la nivelul pre-tratament sau cu mici tendinţe spre agravarea dereglărilor (statistic nesemnificative). Posibil, ca prezenţa gutierei creează o aferentaţie neobişnuită din structurile sistemului stomatognat, care conduce la tensionări adaptive în sistemul vegetativ. La pacienţii cu bruxism nocturn şi prezenţa fenomenului de inhibiţie a MIR (n = 73), sub influenţa tratamentului stomatologic şi aplicării gutierei, s-a constatat o ameliorare a indicilor bruxismului nocturn aproximativ cu 20-25%, comparativ cu perioada pre-tratament. În linii generale, rezultatele obţinute erau identice cu grupul de pacienţi, care aveau indicii MIR normali. Un alt tablou se observă la pacienţii cu bruxism nocturn, care în afara tratamentului stomatologic şi aplicarea gutierei, au utilizat complexul de autoajutorare elaborat de noi (respiraţie dirijată diafragmatică, metoda reflexo-bruxism reglatoare, regimul de locomoţie optimal, înlăturarea/limitarea acţiunii cofactorilor cotidieni ai bruxismului – alcool, nicotină, cafeină, etc.). La pacienţii din grupul cu inhibiţia MIR normală (n = 27), efectul terapeutic se manifesta prin ameliorarea indicilor bruxismului aproximativ cu 30-35% în comparaţie cu perioada pre-tratament, iar în grupul pacienţilor cu diferit grad de inhibiţie a MIR, efectul terapeutic se manifesta mult mai pronunţat – ameliorare aproximativ cu 40-50% în comparaţie cu perioada pre-tratament. În concluzie se poate constata, că pacienţii cu dereglarea MIR necesită tratamentul stomatologic în asociere cu aplicarea gutierelor, chiar dacă nu sunt prezente semne de uzură dentară, deoarece gutierele contribuie la ameliorarea reacţiilor reflectorii în sistemul stomatognat şi diminuează procesele patologice asociate cu bruxismul nocturn.

Triplet transport in S_1FIS_2 heterostructures based on ferromagnetic Co_2CrAl Heusler-alloy films

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Current-voltage characteristics of MoRe/Co_2CrAl-I-Pb heterostruictures have been studied for different ways of the current flow. It has been found that their form depends on the current paths as well as on the thickness of ferromagnetic Co_2CrAl alloy films. Based on the experimental data, we conclude that the observed effect may be associated with a triplet transport in the Co_2CrAl layer.

Триплетный транспорт в S_1FIS_2 гетероструктурах на основе ферромагнитных плёнок сплава Гейслера Co_2CrAl

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Изучены вольтамперные характеристики гетероструктур MoRe/Co_2CrAl-I-Pb при разных путях протекания тока. Обнаружено, что вид вольтамперных гетероструктур зависит как от путей протекания тока, так и от толщины ферромагнитных плёнок сплава Гейслера Co_2CrAl. На основании полученных экспериментальных данных сделан вывод о том, что наблюдаемый эффект может быть связан с триплетным транспортом в слое Co_2CrAl.

Cianobacterium *Spirulina platensis* – biological matrix for silver nanoparticles synthesis

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The biological synthesis of nanoparticles is an ecological alternative to the physical and chemical method. The biological method is considered to be safe, cost effective, sustainable and not requiring any special preparation techniques. In chemical nanosynthesis for medical practice, biological coatings should be attached to the nanoparticles, in order to cut their toxicity. This phase can be skipped using the methods of biosynthesis of nanoparticles through the cyanobacterium *Spirulina platensis*, which make the nanoparticles more biocompatible.

The study of biosynthesis of silver nanoparticles trough spirulina biomass showed the accumulation of silver nanoparticles over 24 hours of contact of the biomass with silver nitrate solution (Fig 1, a). Biochemical changes in *Spirulina platensis* biomass during the nanosynthesis have manifested themselves by a decrease of protein content by 22.7% in the first 24 hours of the reaction. Therefore biomass degradation is minimal.

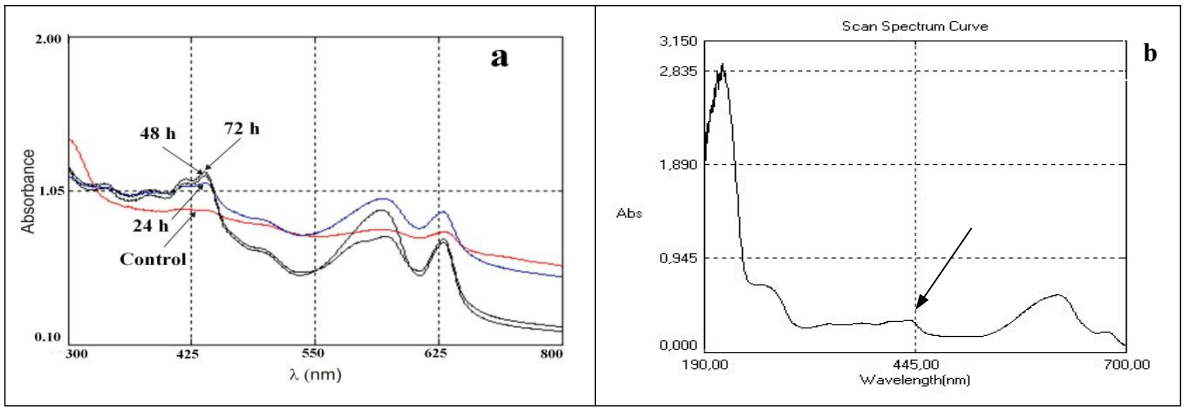

Figure 1. UV-VIS spectrum of: a) the culture of *Spirulina platensis* during different interaction duration with the source of silver nanoparticles; b) the phycobilin fraction with silver nanoparticles

Thus, biologically structured nanoparticles can be obtained. The phycobilins were extracted from the spirulina biomass by a process of repeated freezing. The phycobilin extract was standardized at the concentration of 10 mg/ml.

The absorption spectrum of phycobilin fraction with silver nanoparticles from spirulina biomass confirmed the presence of silver nanoparticles (Figure 1 b). The biochemical composition of the biomass of spirulina attested minimum structural degradation.

Characterization of GaN thin films and Eu-doped GaN nanowires and nanoparticles produced on the basis of Ga_2O_3 nanomaterial

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Due to advantageous properties such as wide bandgap, pronounced chemical and thermal stability, gallium nitride is currently considered as one of the most important semiconductor materials for practical applications [1]. We present results of preparation of Eu doped GaN nanoparticles and nanowires by using Ga_2O_3 as source nanomaterial. Monoclinic Ga_2O_3 nanoparticles and nanowires have been prepared by hydrothermal growth with high purity $Ga(NO_3)_3$ $9H_2O$ and 1M precursors [2]. The geometrical parameters of the nanomaterial were found to be determined by the duration of the hydrothermal process, Ga_2O_3 nanoparticles or nanowires being produced. The hydrothermal process lasts for 5 to 24 hours at the temperature of 220°C. The Ga_2O_3 nanomaterial is transformed unto GaN nanoparticles and nanowires by nitridation in a flow of NH_3 and H_2. The photoluminescence properties of Eu doped Ga_2O_3 and GaN nanomaterial were investigated under laser excitation. The photoluminescence proprieties of GaN films obtained by magnetron sputtering were compared with those of GaN nanowires and nanoparticles. The produced material was also investigated by means of XRD analysis, Raman scattering and Fourier transform infrared (FTIR) spectroscopy.

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Interface tailoring effect on the magnetic properties of LSMO films

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The fundamental and technological interest for thin $La_{0.67}Sr_{0.33}MnO_3$ (LSMO) films is basically determined by the attractive possibility to stabilize bulk-like properties (magnetism and metallicity) at interfaces making thus accessible the advantages of half-metallic manganites for tunneling magnetoresistance (TMR). A new approach that we used for engineering of interfaces of LSMO ultrathin films is an insertion of additional SrO monolayers, which form the so-called Ruddlesden-Popper (RP) structures at interfaces [1]. For this study we applied both SQUID magnetomety (the measurement covers a temperature range 2-400K) and magneto-optical Kerr effect (MOKE), which are two complementary techniques for defining magnetic properties of thin ferromagnetic films, as MOKE allowing to investigate angle-resolved hysteresis loops and understanding magnetic domain structure.

In this study LSMO films were prepared and interface engineered by metalorganic aerosol deposition technique on $SrTiO_3$(100) substrates (STO). SQUID revealed retention of a high Curie temperature 337K for the thinnest 5 nm LSMO interfaced film. The saturation magnetization, normalized on the number of Mn ions, consists of 3.6 μ_B/Mn and exceeds significantly the corresponding values obtained for the optimally doped manganite films with the same thicknesses. All films independently of thickness and interface modification present uniaxial magnetic anisotropy. The directions of the easy axes for unmodified films was [100] with respect to the crystallographic directions of the cubic STO with an orthogonal arrangement of the hard axis. The creation of RP interface between substrate and LSMO layer rotates the uniaxial system in-plane to [110] direction. The Stoner-Wohlfarth model was used to validate results obtained for hysteresis shapes, coercivity, and saturation fields. Unusual uniaxial anisotropy of thin LSMO films on a nominally flat STO(001) substrate [2] is under discussion. These results are promising for the future realization of room-temperature TMR devices making use of the RP-like engineering of interfaces.

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Superconductor/Ferromagnet nanostructures: non-uniform superconductivity and spintronics application

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Last decade rose intensive study of layered superconductor-ferromagnet (S/F) nanostructures, motivated by rapid increasing implementation of S/F hybrids in superconducting spintronics. Theory of S/F hybrid heterostructures with two and more ferromagnetic layers predicts generation of a non-uniform superconductivity, a long-range odd-in-frequency triplet pairing at non-collinear alignment (NCA) of the F-layers magnetizations [1]. Using the ideas of the superconducting triplet spin-valve [2-4] we have fabricated $Co/CoO_x/Cu_{41}Ni_{59}/Nb/Cu_{41}Ni_{59}$ multilayred hybrids (Fig.1) and detected triplet pairing: switching of the proximity-effect coupled heterostructures from normal to superconducting state. The resistance of the samples as a function of an external magnetic field shows that the system is superconducting at the collinear alignment of the $Cu_{41}Ni_{59}$ and Co layers magnetic moments, but switches to the normal conducting state at the NCA configuration. The existence of the T_c minimum at the NCA regime is consistent with the theoretical prediction of the long-range triplet pairing. The $Co/CoO_x/Cu_{41}Ni_{59}/Nb/Cu_{41}Ni_{59}$ layered heterostructures were prepared by magnetron sputtering on silicon substrate covered by a silicon buffer layer prior the heterostructures deposition [5]. The Co/CoO_x composite layer provided strong exchange biasing (~ 1800 Oe) of the adjacent hard ferromagnetic $Cu_{41}Ni_{59}$ alloy layer, while the outer soft $Cu_{41}Ni_{59}$ alloy layer could be remagnetized by a weak external magnetic field creating controllable alignments with respect to the hard interior $Cu_{41}Ni_{59}$ layer and the metallic Co layer as well. Upon cycling the in-plane magnetic field in the range ± 6 kOe and keeping temperature close to the superconducting transition, a memory effect has been detected. If the magnetic field was dropped to zero from the initial field-cooling direction at 10 kOe, the heterostructures resistance dropped down to the almost superconducting low-resistive state. Changing polarity of the field, raising its magnitude to -6 kOe and driving the field to zero again brought the system to the resistance at the normal conducting state. That bistability was repeatedly reproduced upon further cycling along the full magnetic hysteresis loop of the heterostructures. Both, low- and high-resistive states at zero magnetic field were determined solely by pre-history of the field cycling and did not need biasing field to keep them steady.

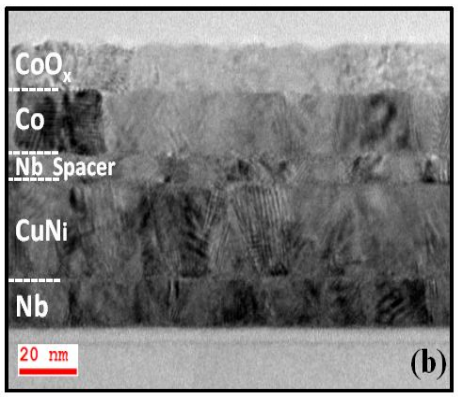

Figure 1: TEM image of the hybrid nanostructure $Co/CoO_x/Cu_{41}Ni_{59}/Nb/Cu_{41}Ni_{59}$

The detected triplet spin-valve effect and the memory effect, caused by generation of the triplet pairing at non-collinear magnetic configurations, opens possibilities for design of a new generation of superconducting spintronic devices: high frequency operating superconducting spin-valves and memory elements.

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Exchange Biasing of $Cu_{41}Ni_{59}$ Alloy Films in Superconducting Spin-Valves

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Exchange biasing of diluted ferromagnetic alloys (low-T_C weak ferromagnets) is a serious problem since basic condition $T_C>T_N$ (T_C and T_N are Curie and Neel temperatures of a ferromagnet and antiferromagnet, respectively), fulfilled in conventional room-temperature spin-valves, is violated. The ability to exchange bias diluted ferromagnetic alloys is a keypoint for every kind of cryogenic spin-valve, Josephson or proximity, if low-TC alloy is utilized as a functional material in a superconductor-ferromagnet heterostructure. We present our recent finding of strong exchange biasing of $Cu_{41}Ni_{59}$ weak ferromagnet by $CoO_x/Cu_{41}Ni_{59}$ interface with the aid of very thin cobalt sublayer adjacent to the CoO_x antiferromagnet from the opposite side to the alloy layer. The magnetic properties of Si(substr.)/Si(buffer)/Co/CoO_x/$Cu_{41}Ni_{59}$/Nb/$Cu_{41}Ni_{59}$/Si(cap) superconducting spin-valve system are investigated by SQUID magnetometry, and two strongly exchange biased signals are observed. The obtained results are compared with predictions of the domain state and spin-glass models of exchange bias.

Keywords: exchange bias, diluted ferromagnetic alloys, spintronics, SQUID magnetometry, training effect

Recognition of Contexts of Neurodynamic Networks via Complex Analysis of the Central Regulatory Component of Heart Rhythm

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Key words: Neurodynamic circuits in central nervous system, central component of heart rhythm regulation, complex analysis of heart rhythm variability, induced psychoemotional states.

Analysing heart rate variability (HRV) is nowadays one of the methods, allowing relevant ppredictios for the health state, first of all the prediction of different cardiovascular risks. But it also alows a deep psychophysiological interpretation which can open the door for identification of conscious and unconscious processes of human. So is imortant in social inphysiolog. Based on different physiological mechanisms of regulating the heart rate, including the influence of segmentar and suprasegmentar levels of vegetative nervous system (VNS) controlling the HRV. It's one of the most objective and non-invasive methods to look inside of working processes of the VNS. Due to the alalysis of complexity we obtain information of influence of the central nervous system on the regulatory systems of the heart rate. This is an important information helping to reveal if a person has neurological network circulating in the central nervous system, being harmful for one's health and/or occasionally for the society.

Time domain statistical analysis, which we can represent in form of rhytmogram gives us the possibility to identify whether the investigated person has a dominant (neurological network circulating in the central nervous system) in his brain. Furthermore we can find out if the dominant is circulating in our conscious or in our unconscious. During our investigation we found some criteria for differentiation of conscious vs unconscious dominants: conscious dominants can be detected at a rhytmogram by appearance of spontaneous single waves in direction to tachycardia area; such tachycardia - tendency monowaves appeared at the end of very low frequency (VLF) wave after appearance of low frequency (LF) waves. Their appearance in the end of VLF waves indicates that their origin comes from the central regulatory structures. This means that it's our cognition. The fact that such waves occur with a certain periodicity we can say that these are impulses from a circulating neurological "network" in our brain, which represents a dominant from physiologic point of view. Such a network can be a statement or an idea etc. which doesn't leave the person in peace, e.x. "I have to come in time!" (action during a certain period of time in the presence and the action depends mainly on the person himself). So a conscious dominant is a transitory stress reaction, which is emotionally and cognitively percepted by the person. That it's a stress reaction indicates the close dependence with LF waves. LF waves indicate the activity of sympathetic nervous system, which highly increases in acute stress reactions.

In case of a dominant circulating in our unconscious the rhytmogram has other properties : At first: appearance of solitar tachycardia oriented in condition of high frequency (HF) waves, which are responsible for parasympathetic nervous system, assuring our calm and all adaptive reactions. Secondly: No strict VLF- dependence. Third: the appearance is observed when the person feels subjective relaxed, so in calm state. Finally, disappearance in orthostatic probe. A situation which is circulating in the unconscious is not a situation from

the presence, it is from the past or from the future, and normally, does not depend directly on the person.

A second group of criteria we find by analyzing spectral analysis of HRV in conditions of modeled psychoemotional states. We show some pictures to the context of which we expect from the person to have an emotional reaction. It means that normally we percept emotions by emotional component of perception (we feel emotions) and by the cognitive one (we understand the meaning of emotions). Of course a normal perception of emotions happens predominantly due to the emotional component. To find out the conscious vs unconscious by observing emotional reactions we showed some pictures the context of which is closed connected to main life principles of a human being. The person is expected to have an emotional reaction which we inregistrate as an increase of segmentar (HF and LF) level of vegetative regulation of the HRV, reading from the spectral analysis of HRV. This is a normal psychophysiologic reaction. That means such a person feels these emotions because consciously he understands its meaning, the reason is his consciousness is ruled by normal live - saving principles from the unconsciousness.

An other situation is when under the same conditions a person percepts the emotional ruled situation by the cognitive component (increased VLF spectrum of HRV in the spectral analysis in comparison with the segmentar components - HF and LF). That means in his unconscious is a neurological network which is orientated against human life. It blocks the speed of normally occurring emotional reaction by impulses which come from such a harmful network, circulating the unconscious of such person.

In conclusion, we found some metods and criteria to identify persisting impulsatory networks in the central nervous system of human, by deep analysis of heart rate variability with linear and non linear methods. We found criteria to destinguish whether the circulating network comes from a person's conscious or unconscious. Creating conditions of modelled psychoemotional states during HRV measurement, we perform the analysis in order to understand whether the circulating neurological network is dangerous for his own health or if the context of his neurologic network is conected to social harmful threats.

Qualitätsmanagement – ein unentbehrliches Verfahren mit Werkzeugen für die Qualitätsicherung in der Medizin: Das Deutsche Model als Beispiel für Entwickelnde Länder. Am Bespiel der Qualitätsicherung durch die Ärztekammer Berlin.

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Key words: Qualitätsmanagement (QM), Qualitätsicherung (QS), Ärztekammer Berlin (ÄKB), Critical Incident Reporting System CIRS, Schlaganfallregister, Patientensichereicht, Gesundheitswesen.

Damit alle Prozesse im medizinischen Bereich effektiv und qualitativ ablaufen können, fordert es gute Struktur und Organisation des gesamten Systems im Gesundheitswesen global und local in den medizinischen Einrichtungen.

Um qualitative Vorgänge zu pflegen sind spezielle Werkzeuge für Organisatoren, Ärzte und Pflegepersonal zu handhaben.

Ein wichtiges Werkzeug der Qualitätssicherung (QS) ist das Critical Incident Reporting System CIRS – ein internes Fehlermeldesystem für die Krankenhäuser Berlins, der

schon über 10 Jahren geführt wird. Die Einführung eines anonymisierten Fehlermeldesystems, geschaffen um voneinander zu lernen welche Prozesse im beruflichen Alltag zu verbessern sind, wäre auch für Entwickelnde Länder sehr wichtig. Das Netzwerk wird betreut von der Ärztekammer Berlin (ÄKB) und vom Zentrum für Qualität in der Medizin.

Damit die Stroke-Units allen Qualitätsicherungensvorgaben entsprechen und die Leading-Experten Up-to-Date sind, findet monatlich eine Schlaganfallregistersitzung in der ÄKB statt. Repräsentiert von Schlaganfallexperten aller 17 Berliner Stroke-Units. Ein Register, der die wichtigsten Daten aller Schlaganfallpatienten beinhaltet, ist eine vielversprechende Basis für die Qualitätskontrolle der Stroke-Care in Berlin und ein bedeutender Anfangspunkt wissenschaftlicher Recherchen. Die statistische Auswertung erfolgt auf Vertragsbasis durch die Universität Würzburg.

In der ÄKB ist ein permanenter Ansprechpartner in Fragen bezüglich des Schlaganfallregisters und des übergreifenden CIRS-Berlin Networks immer offen für ein Dialog unter Experten um Verbesserungsvorschläge aufzunehmen. Die Planung eines möglichen Registers in Moldova und eines ausgewählten Ansprechpartners würde der Verbesserung der qualitätssichernden Maßnahmen fördern.

Zu anderen Qualitätssicherung- und Qualitätmanagement-Projekten der ÄKB gehört das Berliner Herzinfarktregister, Peer-Review in der Intensivmedizin und der Transfusionsmedizin und andere. Bei einem kollegialen Peer-Review werden Kollegen aus anderen Klinken eingeladen, um über die Schulter für einen Tag zu schauen und schließlich eine Analyse der ablaufenden Prozesse mit Verbesserungsvorschlägen aus eigener Sicht bereitzustellen. Dies wird in unserem klinischen Alltag noch nicht praktiziert. Wäre aber möglich durchzuführen. Von diesem Werkzeug der QS würden die Ärzte und Leiter auch interdisziplinär profitieren.

Um die Kenntnisse auf dem Gebiet der QS zu profundieren, werden von der ÄKB 3-Wöchentliche Kurse für Ärztliches Qualitätsmanagement für Spezialisten angeboten, die von ihrem Krankenhaus für QS beauftragt sind. Im Rahmen dieses Kurses werden Grundkenntnisse und wichtige Informationen über die Qualitätssicherung, Organisation, Projektplanung und Projektführung beigebracht und ein neuer Einblick in die Betriebskommunikation offenlegt. Zum Abschluss des Kurses sind alle Teilnehmer beauftragt einen Abschlussbericht zusammenstellen, der dazu beitragen soll die gesammelten Kenntnisse zu strukturieren, und nochmals darauf eingehen wie ein Projekt von Anfang und bis zum Erfolg zu führen ist. Die Prüfung am Ende dieses Kurses ermöglicht Ärzten unter den Teilnehmern den Anspruch auf die Zusatzbezeichnung Ärztliches Qualitätsmanagement. Der Kurs ist sehr gut gestaltet mit übergreifenden und aufeinander abgestimmten, komplementären Vorträgen, vorgestellt von sehr kompetenten Lektoren aus verschiedenen Ausschüssen, Verbänden und Organisationen, die eine wichtige Rolle in der Gestaltung der Gesundheitsszene spielen (BÄK, G-BA, KÄV, AQUA, etc – Kompetenzorgane im Deutschen Gesundheitswesen). Die Teilnahme am Kurs von Kollegen aus Drittstaaten würde ihnen ermöglichen im eigenen Land zur QS mit erworbenen Kompetenzen dem Gesundheitswesen beizutragen.

Die Fragen der Qualität ärztlicher Dienstleistungen und der Patientensichereicht sind von großer Bedeutung im deutschen Gesundheitswesen und bekommen seit 2001, als dies in die Rechtsgrundlage – den §137 des Sozialgesetzbuches V eingetragen wurde, immer mehr Aufmerksamkeit und dementsprechend zur Verfügung stehender Ressourcen und ist auch für die Öffentlichkeit ein aktuell erhaltenes Thema. Das Qualitätsbüro Berlin, in dessen Lenkungsausschuss auch die ÄKB eintritt, ist auf Landesebene zuständig für organisatorische Tätigkeiten um die Qualitätssicherung in den Krankenhäusern. In unserem Land übernimmt die Rolle des Qualitätsbüros die Statistische Abteilung des Gesundheitsministeriums, das mit

Daten operiert, die von den Krankenhäusern übermittelt wurden. Ein eigenständiges Organ für landesweite QS fehlt in Moldova.

Das deutsche QM und QS System im Gesundheitswesen bietet viele anspruchsvolle und effektive Werkzeuge, deren Umsetzung in unser System nach der Anpassung an landesspezifische Besonderheiten und der aktiven Involvierung des Ministeriums für Gesundheit zu positiven Veränderungen für die autochthone QS führen könnte.

Action of nanoparticles of Fe_3O_4 on micromycetes

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Nanoparticles now have found wide use in all sectors of the economy. Successful use in pharmacology are (obtaining various drugs), medicine (treating different diseases), biology (immune research in the study of intracellular processes, etc.), technologies (electronics, information technology etc.) in production, processing and preserving food. In food production, nanoparticles allow the administration of vitamins and minerals with food, intensifying flavors and removal of pathogens in food. Agriculture uses more efficient spreading of pesticides and fertilizers and water decontamination [1-4].

Based on the above mentioned, the research aim was to study the action of Fe_3O_4 nanoparticles on growth of micromycetes.

As a subject of researchserved 8 strains of micromycetes from NCNM and 9 strains isolates from infected soil with persistent organic pollutants. As pollutant was studied trifluralin. Were used Fe_3O_4 nanoparticles with size 17-20 nm.

It was studied the growth of fungal strains in liquid and agarized medium Czapek supplemented with different doses of nanoparticles in the presence of trifluralin.

To find the action of nanoparticles on micromycetes capable to growing in the presence of trifluralin, the isolates were grown on agar Czapek medium without glucose + 500mg/l trifluralin supplemented with different doses of nanoparticles of iron: 1.0; 10.0; 25.0; 50.0, and 100.0 mg/l.

The results showed that, of the 8 strains grown on Czapek medium without glucose 500 ml trifluralin in the presence of various concentrations of nanoparticles of Fe, 2 did not growth, at 3 strains increase was the same as on the medium with trifluralin and 3 strains has been a stimulus to growth. These are strains *Sp*.11; *Sp*.5; and *Sp*.15. *Sp*.11 strain does not grow on Czapek medium without glucose, but growth on the medium Czapek + 500 mg/l trifluralin. Supplemented of Czapek medium + 500 mg/l trifluralin with nanoparticle concentration of 1 - 10 mg/l, stimulates the growth of this strain, but increase their dose up to 50-100 mg/l lead to stopping the increase. *Sp*.5 and *Sp*.15 strains growth well both on Czapek medium without glucose and supplemented medium with trifluralin. In this case the action of trifluralin was neutral and in the presence of nanoparticles in a concentration of 10-25 mg/l and *Sp*.15 *Sp*.5 strains showed growth stimulation.

The results obtained from submerged cultivation of strains *Sp*.5; *Sp*.15 and *Sp*.11 not confirm exactly the same data obtained on agar medium. Thus, on the liquid medium only strain *Sp*.5 demonstrates stimulating accumulation of biomass from 33.3 to 66.6%, compared to control by usingconcentration of nanoparticle 1 - 25 mg/l. 166.6% maximum biomass accumulation was obtained after using the minimum concentrations of the nanoparticles of 1 mg/l. *Sp*.15 strain and *Sp*.11 in the case shown the same results as on agarized medium. Strain

Sp. 15, the biomass accumulated to the use of nanoparticles in a concentration of 1 mg/l, is only 25 % at a concentration of 10 - 25 mg/l - 100%, and increasing the concentration up to 50-100 mg/l biomass accumulation up to 50 % diminish control variant.

In case of strain *Sp.* 11 at all concentrations of nanoparticles tested have registered a significant decrease in biomass accumulation. In embodiments the nanoparticle concentration 1mg/l; 50 mg/l and 100 mg/l, accumulated biomass was 37.5% and the variations of concentrations of 25 mg/l and 50 mg/l - 50% compared to the control.

The obtained results demonstrate that the action of nanoparticles on micromycetes is different depending on their concentration and cultivation methods. Thus in the case of immobilization of the nanoparticles on the surface of the submerged cultivation micromycetes, and their entry into cells it is more accessible, more intense, and in some cases the cell wall destruction takes place causing their death.

Of soil polluted with trifluralin were isolated and selected nine strains. Selected strains were inoculated on Czapek non-glucose solid medium supplemented with trifluralin at a concentration of 300 and 500 mg/l in the presence of nanoparticles (1; 10; 25; 50; 100 mg/l).

The results showed that the only one of nine strains did not grow on mentioned media.

On medium Czapek without glucose 4 strains grow well, and 4 weaker. Growing submerged in nutrient medium with trifluralin showed diminishing growth to 2 strains (*Sp*.3 and *Sp*.5) and increasing strain *Sp*.2 greatly on trifluralin with concentration of 500 mg/l. The presence of Fe nanoparticles in media supplemented with trifluralin showed an increase in growth to 3 strains, *Sp*.3; *Sp*.5 and *Sp*.9. Thus *Sp*.3 and *Sp*. 5 strain grows well on Czapek medium without glucose and nutrient supplementation of medium with trifluralin concentration of 300 or 500 is increased diminish, but in the presence of nanoparticles growth increases again.

This increase in growth was manifest at strain *Sp*.3 with use of nanoparticle in concentration 10; 25 and 50 mg/l. The same was registered on strain *Sp*.5, regularity and increasing growth under the influence of nanoparticles of Fe in medium Czapek + 300 mg/l trifluralin concentration of 1-25 mg/l and the medium Czapek + 500 mg/l trifluralin concentration of 10 and 25 mg/l. A considerable increase in the presence of nanoparticle growth was registered strain *Sp*.9. This strain grows poorly on Czapek medium without glucose and supplemented medium with trifluralin, but the enhances growth on Czapk + 300 mg/l in the presence of nanoparticles in concentration of 1-25 mg/l and the medium Czapek + 500 mg/l concentration of 10-25 mg/l. The results showed that the nanoparticles can annihilate action of trifluralin on micromycetes, as well as stimulate growth. Thus, among the selected strains of soil polluted with trifluralin only *Sp*.9 strain exhibited growth stimulation in the presence of nanoparticles.

According to the results we conclude that the action of Fe_3O_4 nanoparticles on micromycetes depends on the method of cultivation and their concentration. They can stimulate growth of micromycetes in the presence of trifluralin.

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Nanoscience and Nanotechnology in Moldova – state of the art and perspectives

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In this report, an overview of the research realized in the Republic of Moldova in the fields of nanoscience and nanotechnology is presented. Although theoretical investigations have been undertaken in 90-ties of the last century, real technological developments started in 2001-2002 when relevant technological equipment along with modern scanning electron and atomic force microscopes have been acquired under the support of various funding institutions such as US Civilian Research and Development Foundation, Alexander von Humboldt Foundation, INTAS, Moldovan Research and Development Association, Science and Technology Center of Ukraine, DAAD etc. In January 2012 the Republic of Moldova became an associated country to the 7th European Framework Programme, and in 2014 – to the Horizon-2020 Programme, which gave a strong impetus to the participation of our researchers in the realization of important regional and European projects and, in consequence of this, to the integration of the Moldovan scientific community into the European Research Area.

An important role in the development of science in the Republic of Moldova, and of nanoscience and nanotechnology in particular, has been played by the Alexander von Humboldt Foundation. One can mention, in this regard, extended stays in Germany of tens of Moldovan researchers, some of them returning home with valuable experience gained, international visibility, new ideas for further scientific developments, and also with important pieces of modern equipment. It is the Alexander von Humboldt Foundation that assisted in building the most sustainable international scientific bridges for Moldova which allowed us to create capacities and prepare the prerequisites for our successful implication in European and international scientific activities.

Achievements and perspectives in nanoscience and nanotechnology of research groups from various institutes of the Academy of Sciences of Moldova and universities will be highlighted, along with stories of success in international scientific collaboration.

Impact of Financial Globalization over offshore centers

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With the expansion of today's financial system the interconnectedness of the global financial markets gave rise to Financial Globalization, which in itself represents a process of unification of financial services, liberalization of customs, banking operations and unification of the coordination payment systems.

Development of Financial Globalization could be characterized through the process of financial innovations, meaning the creation of new and complex financial instruments and technologies in order to reduce the currency, credit and stock transaction risks and costs.

While globalization has opened new markets to the rich-world companies, the increase of the world capital flows, characterized by intensity and dynamism, gave way to a number of fast-moving and adaptable multinationals emerging from the developing world. In its turn, in order to reduce cost, attention was shifted to the offshore centers or sometimes referred to as tax havens.

Offshore financial centers, which are low-tax jurisdictions, who's economic activity concentrates on provision of professional corporate and commercial financial services, mutual funds, trust and company administration and specialized services, involving banking, shipping, structured financial transactions, life insurance and pensions. In other words, it is a system that provides a favorable financial and business infrastructure, which is responsive to the requirements of the non-resident investors.

The low/zero-tax structure allows a more integral financial planning and risk management for international finance and trade. The corporate tax-trend of 1 9 8 0 's through 2010 has trended lower with the top OECD countries. Therefore the offshore centers' economic activity permits capital to increase its rate of return, as well as result in an major economic, social and political impact for people in other jurisdictions. Moreover, the confidentiality and low disclosure of private of financial information creates a favorable environment for managing taxes on capital gains, income and inheritance.

The offshore centers are often seen as a threat to the global financial system due to the extent of the balance sheet management provided by the regulatory framework, facilitating incentives for money laundering, abating tax revenues from the developed countries by tax arbitrage allowance, as well as rendering of capital flows into and out of developing countries.

Having financial globalization described as the latest stage of capitalism, and nation-states unleashing capital from territorial boundaries, the innovational processes of financial instruments along with the technological developments create more dynamism and challenges for the roaming capital.

Impact of TiO_2 and Fe_3O_4 nanoparticles on the biosynthesis protein in the yeasts Rhodotorula Gracilis CNMN-Y-30

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Present-day biotechnological processes are based on the use of the microorganisms producing active biological substances but the yeasts have a high production potential. The advantage of the yeasts use is, first of all, their rapid adaptability, since they grow up easily and have high productivity but their culture medium and cultivation conditions may be adjusted for the purpose of biosynthesis optimisation. They are resistant to alien microflora and do not pollute the environment.

We shall mention the chemical substances acting as precursors or synthesis stimulators, within the range of the main factors regulating the biosynthesis capacity of bioactive principles in the yeasts. Special attention worldwide scientific research is directed to the use of metal nanoparticles which are the most promising structure of the 21st century, able to manipulate molecular processes, biochemical and cellular.

This study elucidates the effect of TiO_2 and Fe_3O_4 nanoparticles having the dimensions of 30 nm and the concentrations of 0.5, 1.0, 5.0, 10.0 and 15.0 mg/L of the culture medium, on protein accumulation on the base of the pigmented yeasts *Rhodotorula Gracilis* CNMN-Y-30. The results mark that the response reaction of the yeasts is manifested through favourable changes in the protein contents – by 16 to 30,9 % for TiO_2 nanoparticles and from 14 to 23,8% for Fe_3O_4 (30 nm), if compared to the witness samples.

The TiO_2 nanoparticle concentrations of 0.5, 1.0 and 5.0 mg/L added to the nutritive medium initiate a clear accumulation of the protein contents in the yeast biomass, varying from 16 to 30,9% for TiO_2 nanoparticles and from to 18,8 to 23,8% for Fe_3O_4. The TiO_2 nanoparticle concentrations of 10.0 and 15.0 mg/L produce an increase by 23,8 to 25,9% in the protein contents in the biomass and Fe_3O_4 nanoparticles stimulates the synthesis protein with 14%.

As a consequence, we may affirm that the protein biosynthesis process depends on the nanoparticle concentrations used, the type and chemical composition.

Hence, the realised researches have shown that titan dioxide and iron oxide nanoparticles are the promising sources for stimulation of protein biosynthesis processes, thus representing and important factor for yeast cultivation *Rhodotorula Gracilis* CNMN-Y-30 and implementation of protein sources in various spheres: nutrition, pharmaceutics, cosmetology and medicine.

Bulk Nanostructured Materials with Superior Properties for Innovation Applications

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In recent years the development of bulk nanostructured metallic materials has become one of the most topical directions in modern materials science. Nanostructuring of metals and alloys paves the way to obtaining unusual properties that are very attractive for innovative applications [1, 2]. In this research topic, the use of severe plastic deformation (SPD) techniques attracts special attention since it offers new opportunities for developing new technologies of fabrication of various large semi-products from nanostructured materials in the form of sheets, rods, thin foils, wire, for various specific applications [2, 3]. Recent years also witness the transition of SPD methods such as high pressure torsion (HPT), equal channel angular pressing (ECAP) and others from laboratory scale to commercial techniques based on continuous processes, for example ECAP-Conform. These new trends are considered with details in the present lecture.

Especially significant progress has been made recently in the development of physical principles of enhancement of nanomaterials properties. It is well-known that nanostructured metals and alloys very often demonstrate high strength at the expense of ductility and may even be brittle, which hinders their wide application as structural materials.

We demonstrate in this talk that application of grain boundary (GB) engineering principles, i.e. generation of mostly high-angle grain boundaries with nonequilibrium, strain-distorted structure [4] or formation of GB segregations and precipitations makes it possible to achieve unique combination of multifunctional properties in nanomaterials [5, 6]. As a result we can

produce the materials with high fatigue strength, endurance, increased fracture toughness. The examples of successful realization of these principles applied to enhance the properties in a number of commercial alloys based on Al, Ti and steels are given in the report. Also first pilot articles for innovative applications in medicine and engineering as well as ways of their commercialization are considered and discussed.

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Синтез азаграфена и оксида нитрида углерода как изоструктурных аналогов графена и оксида графена

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После открытия и успешного синтеза углеродных моноатомных молекул, планарных и цилиндрических наноструктур основное внимание исследователей в области нанохимии углерода сосредоточено на разработке эффективных методов получения гетеро-углерода, в графеновом слое которого один или несколько атомов углерода могут быть замещены атомами азота, бора или кремния. Гетерогенность и асимметрия распределения электронной плотности в различных наноформах гетероуглерода (азафуллерене, N-нанотрубках, N-онион, N-графене) дает основание рассматривать их как наиболее перспективные материалы для различных (адсорбционно-каталитических и электро-физических) применений. Графен - один из наиболее перспективных материалов семейства углеродных наноструктур. Из-за огромной важности графена как уникального материала интенсивные попытки предпринимаются улучшить и оптимизировать характеристики графена посредством функционализации его структуры, например, атомами азота для того чтобы получить азотом допированный графен с повышенным содержанием атомов азота. Однако главная цель экспертов по гетероуглероду синтезировать гетероатомный (азот-углеродный) графен (азаграфен [1, 2]). Разработанный маршрут получения графена из

графита (графит - оксид графита (оксид графена) - графен) является чрезвычайно привлекательным и для возможного синтеза из нитрида углерода его оксида, оксида нитрида углерода [1], как изоструктурного аналога оксида графита. Интенсивные попытки были предприняты, для того чтобы получить оксид нитрида углерода. Однако успешный маршрут превращения графита в оксид графита не совсем является подходящим для превращения нитрида углерода C_3N_4 в его оксид, а затем и в азаграфен. В настоящем докладе мы впервые представляем результаты о получении новых веществ в виде оксида нитрида углерода и многослойного азаграфена (или восстановленного нитрида углерода) как изоструктурного аналога многослойного графена (восстановленного из оксида графена). Многослойный азаграфен образуется при восстановлении гидрохиноном водорастворимого оксида нитрида углерода ($(C_3N_4)O$), впервые синтезированного нами при пиролизе либо меламина [1], либо мочевины [2].

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Testing of electrical methods of exposure on warm cloud to induce precipitations

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We implemented optical technique for testing of full-size pyrotechnical rocket generators of aerosols utilized currently both for the protecting of agricultural crops from hail damage as well as in the experimental modification of precipitation [1]. The elaborated method allows tracking the dynamics of the process in climate chamber and fast calculation of cloud parameters and ice/water droplet-forming process. Powerful cumulonimbus cloud is a metastable system, in which to cause precipitation enough only a small external influence. Along with the thermodynamic phase instability in clouds take place the instability of electric origin. The processes of condensation and coagulation evolve on the background electric fields in the atmosphere and the formation of electric charges of the droplets and crystals [2, 3].

We report on experimental study of electrical methods of exposure on warm cloud to induce precipitations. We investigated the direct impact of high electric field in clouds that affect the phase and microstructure transformations of atmospheric moisture, to regulate the development of rainfall process. Corona induces the water drops falling down at temperatures of testing clouds +2ºC. The estimated efficiency of corona impact at field strength 10^4 V/cm was close to expose of hygroscopic reagent on testing cloud. The mean size of registered droplets was slightly bigger than mean size cloud droplets 20-30 μm whereas density of deposited droplets decreased dramatically with decreasing of field strength. The second approach presented in this work is investigation of impact of electrically charged aerosols on testing cloud. We demonstrate high efficiency of the initiation of rainfall induced by sprayed charged particles of Portland cement. The methods of introducing and parameters of charged aerosols are under discussion.

In summary, we have performed studies of efficiency of wide class of commonly used for weather modification reagents as well as the efficiency of experimental impact methods on testing clouds. We demonstrated that counting of particles and determination of its density and size is possible directly in climate chamber as well as dynamics of particles deposition.

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The rhodopsin molecule applications: from optogenetics to optobioelectronic devices.

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The rapid progress in nanotechnology provides new materials with unique photophysical and surface properties. All-optical switching is necessary to achieve ultrafast and ultrahigh bandwidth information processing. The basic challenge is to design an ultrafast energy-efficient all-optical switch that exhibits high contrast, low-power operations, along with photo and thermal stability and flexibility to reconfigure and tune its characteristics. The prospect of using energy-efficient natural photoreceptors optimized over centuries of evolution to meet these requirements is extremely fascinating. Thus the evolution has led the light, as the source of information, to be caused the appearance, development and improvement of different nature visual systems. The majority of them are based on G protein-coupled receptor (GPCR) rhodopsin that absorbs light quantum thus initiating of enzymatic cascade of phototransduction in photoreceptors.

Optogenetics, one of the modern biological techniques, involves the use of light to control cells in living tissue, typically neurons, which have been genetically modified to express light-sensitive ion channels, like channelrhodopsin, halorhodopsin, and archaerhodopsin. Another rhodopsin application in nanobiotechnology involves the unique properties of cephalopoda molecule, that it is bistable and as a result – photoreversible. This means that in the case of invertebrate pigments, both the rhodopsin and its photoproduct metarhodopsin are chemically stable. Thus photochromic retinal protein from rabdomeric cephalopoda membranes has emerged as an outstanding material for biomolecular photonic applications due to its specific properties and advantages. Unlike the vertebrate photoproduct, metarhodopsin II, there is no separation of the all-trans retinal chromophore (toxic product) from the opsin. Octopus rhodopsin molecules (OctR) maintain their functional activity at

room temperature for several weeks. OctR have an ability to form thin films in gel-matrix. The extremely high ordering of octopus visual membranes, as well as its ability to capture single photons and sensitivity to light polarization suggests the possible use of rhodopsins as a prototype for the photonic qubit detectors.

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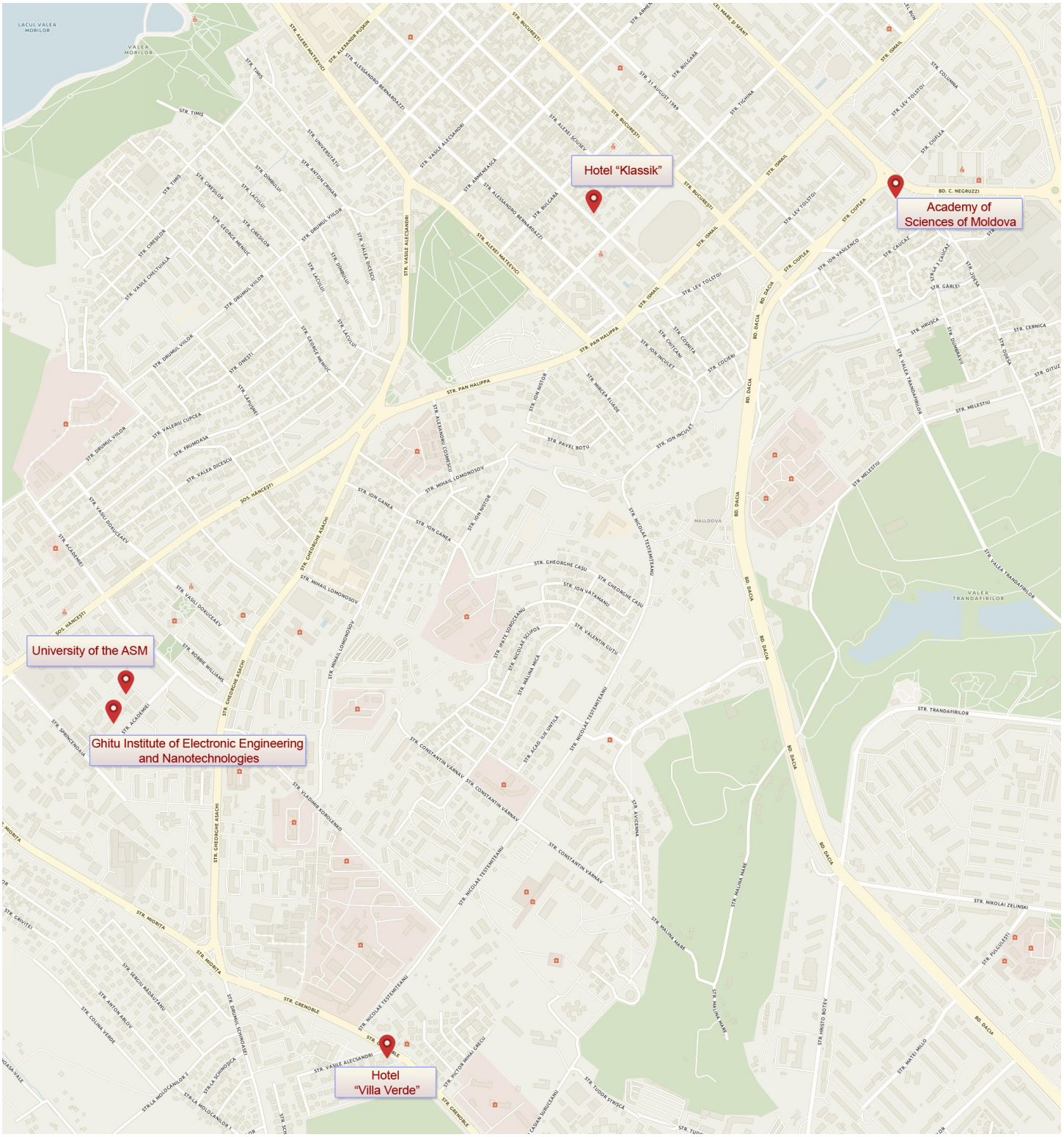

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