FIRST INTERNATIONAL BILATERAL WORKSHOP ON SCIENCE BETWEEN DOKUZ EYLÜL UNIVERSITY AND AZERBAIJAN NATIONAL ACADEMY OF SCIENCES

19 NOVEMBER 2021

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The organization will be held via Zoom video conferencing. To attend, please fill out the following form before 17.11.2021 midnight.
https://forms.gle/iCQ69WrHMWyECCAr5

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FIRST INTERNATIONAL BILATERAL WORKSHOP ON SCIENCE (IBWOS-1)

BETWEEN DOKUZ EYLÜL UNIVERSITY AND AZERBAIJAN NATIONAL ACADEMY OF SCIENCES

IBWOS-1 PROGRAM, 19 NOVEMBER 2021 09:45 – 18:30 (GMT+3)

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09:45-10:00	Aylin ALIN Dean, Faculty of Science, Dokuz Eylül University	Opening Speaches
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Biology Session

Antibacterial properties of AZ-130 strain isolated from oil contaminated soil sample in Azerbaijan

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Abstract

Soil is a source of great microbial diversity, and the specific location of sampling determines the range of organisms available for culturing. Unusual and previously unanalyzed soil sources are of considerable interest to isolate new, previously unknown bacterial species producing novel biomolecules with the potential for valuable pharmaceutical and industrial applications. The goal of this study is to isolate bacteria strains from oil-contaminated soil of Azerbaijan, their screening for antibacterial activity, and further evaluation of a selected compound. Here, by plating an oil-polluted soil sample, collected in the Lokbatansettlement, onto TSA plates 44 bacterial species were isolated. All 44 strains were analyzed for antibacterial activity against two gram-positive (*Staphylococcus aureus* and *Enterococcus faecalis*) and two gram-negative (reference and permeable outer membrane mutant strains of *Escherichia coli*) opportunistic pathogenic strains using the growth inhibition assay. 3 isolates showed antimicrobial activity against at least one indicator organism and were identified as "isolates of interest". To determine if bacteria secretes compounds into the supernatant the "active" in culture isolates were screened for an inhibitory activity in cell-free supernatant. After supernatant screening strain AZ-130 showed strong anti-gram-positive activity. The identity of AZ-130 strain has been categorized by 16S rRNA gene sequencing. It was found out that the strain shares 99% similarity with the *Bacillus vallismortis* strain. A search in APD3 showed that currently there are no known antibiotics produced by *B. vallismortis*.To determine the optimal media, incubation temperature and time point at which the production of the antimicrobial compound by AZ-130 strain is highest growth conditions were optimized. Collected from 16 different conditions (4 different media types at 4 different temperatures) supernatants were analyzed by spot-testing and 96-well plate microdilution assay. AZ-130 produces the most antimicrobial compound in a TB + 2% glucose medium for 2 days at a temperature of 32°C.

Keywords: antibiotics, biologically active molecules, secondary metabolite, natural products, media optimization, pathogenic bacteria

References:

1. Hockett, K. L., & Baltrus, D. A. (2017). Use of the soft-agar overlay technique to screen for bacterially produced inhibitory compounds. Journal of visualized experiments: JoVE, (119).https://doi.org/10.3791/55064
2. Ali, S. M., Siddiqui, R., & Khan, N. A. (2018). Antimicrobial discovery from natural and unusual sources. Journal of Pharmacy and Pharmacology, 70(10), 1287-1300.https://doi.org/10.1111/jphp.12976
3. Singh, V., Haque, S., Niwas, R., Srivastava, A., Pasupuleti, M., & Tripathi, C. (2017). Strategies for fermentation medium optimization: an in-depth review. Frontiers in microbiology, 7, 2087.https://doi.org/10.3389/fmicb.2016.02087

Legled and legless lizards and their osteological differences

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Abstract

There are 7059 defined lizard species in the world, including the order of Squamata. In spite of a large number of species (lizards, snakes and amphisbaenians) that distribute in variety of habitats, detailed descriptions of their osteological development are rare.The ordo in question creates significant differences in terms of body shape and size, as it includes both legged and legless lizard species. Morphologically, there is a remarkable evolutionary process between legged and legless forms, and the modifications in this process are hidden in the skeletons of forms with snake-like body structures. Morphological changes occur in the pelvic and pectoral arches, legs (such as reduction or complete disappearance of the legs) and body shape (such as the lengthening of the body structure with the increase in the number of vertebrae) of the lizard forms, which have a snake-like body structure. For this reason, these species are defined as having the most striking anatomical features for anatomists.

Keywords: Lizard, body shape, skeletal bones, osteology.

References:

1. M Woltering, J. (2012). From lizard to snake; behind the evolution of an extreme body plan. Current genomics, 13(4), 289-299.https://doi.org/10.2174/138920212800793302
2. Čerňanský, A. (2016). From lizard body form to serpentiform morphology: the atlas–axis complex in African Cordyliformes and their relatives. Journal of Morphology, 277:512–53.https://doi.org/10.1002/jmor.20516
3. Klembara, J., Dobiasova, K., Hain, M., &Yaryhin, O. (2017). Skull anatomy and antogeny of Legless Lizard Pseudopusapodus (Pallas, 1775): Heterochronic influences on form. The Anatomical Record, 300: 460-502.https://doi.org/10.1002/ar.23532

Population-level biomedical researches in Azerbaijan: polymorphisms of ACE and TCF7L2 genes in predisposition to T2D

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Abstract

Around 100 genes and single nucleotide polymorphisms are associated with T2D progression. One of these genes are Angiotensin-converting enzyme (ACE) and Transcription factor 7-like 2 (TCF7L2) gene. The main polymorphism of the ACE gene that is associated with the several diseases including T2D is Insertion/Deletion (I/D) polymorphism while for TCF7L2 gene is rs7903146 (C/T SNP mutation). These two polymorphism showed to be as risk genes for T2D among Caucasians, East and West Asians as well as Africans populations. However, there is no information about the association of these two polymorphisms with T2D in Azerbaijan population. To determine the possible role of these indel and SNP mutations on T2D development,the sequence specific pairs of primers (Hace3s and Hace3as (I), ACE-F and ACE-R (II)) for ACE gene and two forward and one common reverse primer for TCF7L2 gene was used. DNA samples isolated from 100 patients with T2D and a group of conditionally healthy people of different ages (72 control).

For I/D polymorphism of ACE gene the allele frequency in patient group; for I allele 30% for D allele 70% while the genotype frequency was II 10%, ID 44% and DD 46%. For control group the allele frequency; D allele 70% and I allele 30% while the genotype frequency was II 10%, ID 40% and DD 50%. The DD genotype vs II genotype in patients group correlate with high risk for T2D (OR=7.2; 95%CI=0.8 to 63.1; P=0.05). Meanwhile for rs7903146 of TCF7L2 gene the allele frequency in patient group: for C allele 48% and for T allele 52%, while the genotype frequency CC 23%, CT 50% and TT 27%. For control, group the allele frequency: for C allele 67% and for T allele 32% while the genotype frequency was for CC 46%, for CT 44% and for TT 10%. The TT genotype vs CC genotype in patients group correlate with high risk for T2D (OR=31.2; 95%CI=3.8 to 250.6; P=0.0012). In addition, the T allele is also showed strong association with T2D development compare to wild C allele (OR=2.23; 95%CI=1.4 to 3.4; P=0.0004).

In conclusion, the DD genotype and the D allele of ACE gene as well as TT genotype and T allele of TCF7L2 gene are associated with T2D.

Keywords: *Type 2 diabetes, Single Nucleotide Polymorphism, gene*

The virus concept

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Abstract

Originally, viruses were defined as diminutive infectious agents that can pass through filters that hold any kind of unicellular organisms. Subsequently, viruses were regarded as strict intracellular parasites, the reproduction of which relies on the molecular building blocks and metabolism of their cellular hosts. However, these properties attributed to viruses are inadequate to make a clear and unambiguous definition of viruses as they are more comprehensively understood today. Here in this presentation, discovery and attempts on making definitions of viruses will be briefly reviewed with a historical perspective. The key attributes of viruses and their inadequacy in defining viruses will be discussed. Finally, the official, operational virus definition of the International Committee On Taxonomy of Viruses (ICTV) and possible approaches to better define viruses and the boundaries of the virosphere will be outlined.

Keywords: Mobile genetic element, virosphere, virus, virus definition, virus classification

References:

1. Aherfi, S., Belhaouari, D. B., Pinault, L., Baudoin, J. P., Decloquement, P., Abrahao, J& La Scola, B. (2021). Incomplete tricarboxylic acid cycle and proton gradient in Pandoravirusmassiliensis: is it still a virus?. The ISME Journal, 1-10.https://doi.org/10.1038/s41396-021-01117-3
2. Koonin, E. V., Dolja, V. V., Krupovic, M., & Kuhn, J. H. (2021). Viruses Defined by the Position of the Virosphere within the Replicator Space. Microbiology and Molecular Biology Reviews, 85(4), e00193-20.https://doi.org/10.1128/MMBR.00193-20
3. Lwoff, A. (1957). The concept of virus. Microbiology, 17(2), 239-253.

Chemistry Session

New trends in oxidative conversion of methane. Hydroformylation to propylene

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Abstract

An approach based on a combination of oxidative conversion of methane (OCM) to mixtures of ethylene + carbon monoxide / oxides with required CO / C_2H_4 ratio and the reaction of hydroformylation of this mixture to propylene, as well as structural and catalytic features of the well-known MnNaW and LaCe oxide systems based on SiO_2 synthesized by various methods as catalysts for this OCM reaction are discussed. Data on elemental and phase composition, distribution of active elements in catalysts, textural parameters (specific surface area, pore volume and pore size), magnetic properties of the synthesized samples obtained using X-ray diffractometry (XRD), scanning electron microscopy with energy dispersive elemental analysis (SEM/EDX), N_2 adsorption-desorption, infrared (FT-IR), electron magnetic resonance (EMR) spectroscopy are presented and the peculiarities of high-temperature reactions catalyzed by multicomponent systems with different aggregationstates of the components under the reaction conditions are discussed. It is shown that the MnNaW / SiO_2 catalysts under the reaction conditions are in melted state with Na_2WO_4 covering the surface of crystalline SiO_2 (with cristobalite and / or tridomite structure) in the form of a film containing nanosizedMnOx particles.An effect of the temperature and duration of calcination of the samples on the distribution of catalytically active components in the catalyst structure is analyzed.Based on the data of EPR in combination with mass spectroscopy of gas-phase products of the OCM reaction the stages of recombination of methyl radicals on the surface and in the gas phase are studied which allow to control of the OCM process. The composition of catalysts that allow the OCM reaction to be carried out at temperatures below the ignition of ethane and ethylene (~ 600 ^oC) is discussed.

Acknowledgements. This work is funded by the European Union's Horizon 2020 research and innovation program under grant agreement No.814557.

Keywords: oxidative conversion of methane, hydroformylation, ethylene, propylene

Biofouling: is it a nightmare or a basis of new innovations in Turkey?

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Abstract

Biofouling is defined as the colonisation of fouling organisms on artificial surfaces within aquatic ecosystems. Ships' hulls and fish nets which are used in fish farms are very ideal platforms for fouling organisms. Although fouling activities are considered natural events in aquatic ecosystems, coverage of surfaces by fouling organisms creates critical problems. When ships' hulls are covered by fouling organisms, fuel consumption and CO_2 emissions increases significantly (1). If fouling organisms colonise on the fish nets, O_2 saturation decreases and mortality of fishes is observed (2). In order to prevent the surfaces from fouling organisms, the special coatings are used and these coatings are defined as antifouling paints. Banning of the most successful tributyltin based antifouling paints due to their eco-toxicities on non-target marine organisms opened a new gate in antifouling technology. There is a great need for the production of eco-friendly alternatives. Turkey is surrounded by the marine ecosystems with different physicochemical water qualities. Among these marine ecosystems, the Mediterranean marine macrophytes are of great importance to discover new eco-friendly antifouling agents since they have native antifouling agents (3). This presentation emphasizes the importance of marine organisms with natural antifouling capacities from the Turkish coastlines as a basis of new innovations related to antifouling paint technology.

Keywords: biofouling, antifouling, biocides, antifoulants, coatings.

References:

1. Cavas, L., Yildiz, P.G., Mimigianni, P. et al. (2018). Reinforcement effects of multiwall carbon nanotubes and graphene oxide on PDMS marine coatings. J Coat Technol Res 15, 105–120.https://doi.org/10.1007/s11998-017-9956-z
2. Sen, K., Erdogan, U. H., &Cavas, L. (2020). Prevention of biofouling on aquaculture nets with eco-friendly antifouling paint formulation. ColorTechnol, 136(2), 120-129.https://doi.org/10.1111/cote.12454
3. Kurth, C., Cavas, L., &Pohnert, G. (2015). Sulfation mediates activity of zosteric acid against biofilm formation. Biofouling, 31(3), 253–263. https://doi.org/10.1080/08927014.2015.1034697

New approaches to the synthesis and study of some physiologically active substances

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Abstract

In this study, we have synthesized primarily functional heteroatomic compounds based on amino alcohols – active, new organic compounds consisting heterocyclic urea, thiourea derivatives based on one-stage three-component condensation.

At the same time, the synthesis and biological properties of urea and thiourea derivatives of a new class of amino alcohols with different substituents and ring sizes examined. On the basis of amino alcohols, the activation of urea or thiourea to triazine(on)thion derivatives with related aromatic aldehyde and ammonia or amino compounds investigated in a sour medium, and to tetrahydropyrimidinecarboxylate derivatives by condensation of various aldehydes, methylene active compounds and urea(thiourea) in a sour environment. Density Functional Theoretical (DFT) calculations and theoretical predictions for these reactions tested experimentally, and extensive theoretical studies carried out in terms of mechanical examination of heterocycles. In the synthesis stage, heterocyclic thiourea derivatives will be synthesized on the basis of aminoalcohol. For this purpose, thioures reacted with aromatic aldehydes with different substituents by leaving β-keto ether in a reaction flask based on one-stage three-component condensation in isopropyl alcohol with the catalytic effect of trifluoric acid at room temperature for a total of 10-15 hours. It was synthesized thiourea derivatives with heterocycles. The mixture in the balloon were been taken to the separating funnel and extracted with solvents such as acetone ($(CH_3)_2CO$) or ethanol. The product drawn into the organic phase will be dried and the solvent will be removed from the evaporator. The crude product obtained will be purified by crystallization method.

DFT studies were been carried out for optimizing the reaction condition via changing parameters (e.g., temperature, solvent, gas phase, substrate, catalyst design). The best parameters was been applied experimentally, which considerably prevents time consumption and utilization of toxic solvents.

By determining the biological properties of the newly synthesized compounds, the ring size, substituent effect and heteroatom effect on the inhibitory activity of antioxidant and enzyme-isoenzymes were been determined.

Keywords: additive, antimicrobial; antioxidant; imidazole; pyrimidine, tion, ionic – liquid catalysist; optimization.

References:

1. Farzaliyev, V., Shuriberko, A., Sujayev, A., Osmanova, S., Gojayeva, S., & Gahramanova, K. (2020). Synthesis, computational and biological activity of heteroatomic compounds based on phenylthiourea and acetophenone. Journal of Molecular Structure, 1221, 128844.https://doi.org/10.1016/j.molstruc.2020.128844
2. Abdullayev, Y., Sudjaev, A., & Autschbach, J. (2019). Computational investigation of catalytic effects of CX 3 COOH (X= F, Cl, H) on the three-component

cyclocondensation reaction. Journal of molecular modeling, 25(6),1-7.https://doi.org/10.1007/s00894-019-4059-7

Note: *This work was carried out with the financial support of the Science Development Fund under the President of the Republic of Azerbaijan - Grant NoEIF-ETL-2020-2(36)-16/11/4-m-11.*

Polymeric systems

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Abstract

Molecular Imprinting Technology (MIT) is a technique to design artificial receptors with a predetermined selectivity and specificity for a given analyte, which can be used as ideal materials in various application fields. Molecularly Imprinted Polymers (MIPs), the polymeric matrices obtained using the imprinting technology, are robust molecular recognition elements able to mimic natural recognition entities, such as antibodies and biological receptors, useful to separate and analyze complicated samples such as biological fluids and environmental samples. After an overview of MIPs, the preparation of the MIP and its applications in various fields will be discussed.

This presentation aims to outline the molecularly imprinted process and present a summary of principal application fields of molecularly imprinted polymers, focusing on chemical sensing, separation science, drug delivery and catalysis. Some significant aspects about preparation and application of the molecular imprinting polymers with examples taken from the recent literature will be discussed.

Computer Sciences Session

Development of technologies, algorithms and software complex for online evaluation of projects submitted to competitions

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Abstract

In current development level of society, almost all organizations, irrespective of their fields of activity, have to make different decisions both in the establishment of strategic and tactical plans, and for solving daily issues. Collective and individual entrepreneurs, even each person should use modern decision-making techniques in order to be able to build successful business. It is impossible to imagine the work of technical systems without making diagnostic and forecast decisions.

It is known that, decision-making theory methods, management theory, probability theory, information science theory method and algorithms are used in modern decision-making systems. It is assumed that the object is defined with accurate parameters and characteristics. In most cases, it becomes impossible to make adequate decisions with the application of aforementioned techniques.

Bellman-Zadeh approach is broadly applied in recent decision-making systems, and in systems created for choosing the option among others, that is more relevant for objectives put forward. In this case, it is certainly recognized that parameters characterizing object, process or system form vague, fuzzy compositions. Therefore, decision-making techniques and algorithms under uncertainty may be applied. So, undoubtedly, Fuzzy logic, Fuzzy logic rules, and methods being developed for implementation of this logic in different practical systems may be useful.

In addition to the above, it is intended to approach the evaluation process as a stochastic process, and build algorithms using probability theory methods. In this regard, probability distributions of assessed objects will be determined, and decision will be made on this basis.

Thus, submitted projects will be evaluated on the basis of modified versions of different methods. Hybrid decision-making algorithms will be created for making final decision.

Software package to be created will include sample of modern Base Management System via internet, Decision-making technologies and Internet programming.

Keywords:
Project evaluation, Base management systems, probability theory, Fuzzy logic, Hybrid decision-making techniques.

References:

1. Stewart, J. (2012). Calculus: Early Transcendentals. Ed. Stewart, J., Clegg, D. and Watson, D.Seventh Editing.Brooks/Cole.Boston. 1356 p.
2. Zadeh, L. A. (1973). Outline of a new approach to the analysis of complex systems and decision processes. *IEEE Transactions on systems, Man, and Cybernetics*, (1), 28-44.

Artificial intelligence: a big brain revolution

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Abstract

Throughout history, people would always use the technology and bring it to the next level to make their lives easier. This is how the concept of the industrial revolution began. Right now, we are going through the fourth industrial revolution, so-called Industry 4.0. Until Industry 4.0, machines were only physical aids to humans. But the ability to think and plan was a uniquely human trait. The revolutions so far have been revolutions for human physical aids. But Artificial Intelligence (AI) is a big revolution for human mental aids (Tempest, 2019). Thanks to AI, human mental activities can be also transferred to machines!

The overall goals of AI such as Problem-solving, Knowledge representation, Planning and Learning are analyzed in the article. It is noted that, an intelligent system is a system that can make decisions in a situation of uncertainty, and it should able to perceive also with the senses, not only with measurements, able to perform conceptual calculations instead of numerical calculations only.

Two major modeling approaches of AI such as i) Logic (hard algorithmic) or Rule based approach; ii) Machine Learning (ML) approach, are handled in the paper.

Rules-Based approach is that the construction of the model is done on the basis of prior knowledge, without using the data-based training process (Nasiboğlu, 2020). But, the ML algorithms build a model use sample data to make predictions or decisions without being explicitly programmed to do so. The ML model can improve automatically through experience and by the use of data (Russell & Norvig, 2021).

Artificial intelligence has paved its way into several industries and areas today. From gaming to healthcare, the application of AI has increased immensely. But it is clear that we are still at the beginning of the AI adventure.

Keywords:
Industry 4.0, Artificial Intelligence, Fuzzy Inference System, Neural Network, Machine Learning, Deep Learning.

References:

1. Nasiboğlu E.(2020). Yapay Zekanın Mantığı: Bulanık Mantık, Online seminer, İzmir. https://youtu.be/SVlKDhuYWVE
2. Tempest, M.(2019). Big Brain Revolution: Artificial Intelligence Spy or Saviour?. Austin Macauley Publishers Ltd.
3. Russell, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach, Global Edition 4th. Foundations, 19, 23.E-ISBN: 978-1-292-40117-1.

On a Semi-Markovian process with negative drift, positive jumps

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Abstract

It is interesting problems to study probabilistic characteristic systems which describe random walk process in the probability theory. The study of these classes of random processes is not only of theoretical, but also of significant practical interest due to the fact that they are a mathematical model of many real-life phenomena in technology, economics, medicine and other fields of science. Random walk process with one or two barriers are being used to solve a number of very interesting problems in the fields of inventory, queues and reliability theories, mathematical biology etc. semi-Markovian random walk process practical and theoretical importance. Many researchers have been investigated different types of semi-Markovian processes, i.e. the Laplace transform of distribution of the first crossing time of the zero level of semi-Markovian process. In this talk, our purpose is to find the Laplace transform of conditional distribution of the first moment reaching of the zero level of semi-Markovian random walk process with negative drift, positive jumps.

Keywords: random variable, semi-Markov random walk process.

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Plynomial multiplication in post-quantum cryptography

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Abstract

In this work, we will summarize new directions on implementations of polynomialmultiplication in lattice-based cryptography, one of the promising family of cryptographicprimitives for assuring security after big enough quantum computers are builded. Although themost efficient way to implement polynomial multiplication is Number Theoretic Transform(NTT), which is a version of the FFT that defined in finite fields (Chu & George, 1999), someschemes are avoiding polynomial rings that naturally support NTT based multiplication becauseof their security considerations (Bernstein, Chuengsatiansup, Lange, & van Vredendaal, 2019).Recently, Alkim et al. proposed several methods to implement polynomial multiplicationefficiently on the lattice-based cryptographic primitives that are not support NTT basedmultiplication by their parameter sets (Alkim, et al., 2020). The idea was to perform polynomialmultiplication in a ring that allows efficient, NTT based, multiplication while being sure thatthis polynomial ring is big enough to represent any result without any reduction to disturb theactual result in the target ring. We will investigate this idea further and compare our results withother polynomial multiplication algorithms in terms of number of multiplications and additions.

Keywords: DFT, NTT, Lattice-based Cryptography

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Mathematics-Statistics Session

Linear superpositions of functions and their application to neural networks

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Abstract

The idea of approximation and representation of complicated multivariate functions by linear superpositions of simpler functionscomes from the need of practical applications. A linear superposition is a function of the form $\sum g_i(h_i(x_1,\ldots,x_n))$, where g_i are univariate functions and h_i are fixed n-variable functions. It follows from the famous result of A.N. Kolmogorov that every continuous function, defined on the n-dimensional unit cube, can be represented as a linear superposition of continuous functionsconsisting of 2n+1 summands. Kolmogorov's result solved Hilbert's 13-th problem and served as a ground for the further study of linear superpositions.

In this talk, we show that Kolmogorov's superposition theoremis valid not only for continuous functions but also for all discontinuous multivariate functions.

Our talk will also focus on possible applications of linear superpositions in the approximation theory of neural networks. We show that there exist two hidden layer feedforward neural networks with n inputs, n neurons in the first hidden layer and 2n+2 neurons in the second hidden layer, which can approximate any continuous n-variable function with arbitrary precision (see [1,2]).

Keywords: linear superposition, Kolmogorov's superposition theorem, feedforward neural network.

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Generalized real Bott manifolds

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Abstract

A generalized real Bott tower of height k is a sequence of real projective bundles

$$B_k \to B_{k-1} \to \cdots \to B_1 \to \{pt\}$$

where B_i is the projectivization of the Whitney sum of $n_i + 1$ real line bundles overB_{i-1}. This notion is introduced by Choi, Masuda and Suh [2]. The manifold $B_k$is called a real Bott manifold if$n_i = 1$ for each i, and a generalized real Bott manifold, otherwise.Real Bott manifolds are interesting objects of toric topology since they are cohomologically rigid [3].Generalized real Bott manifolds does not satisfy this property. In [1], the classification of real Bott manifolds up to affine diffeomorphisms in terms of graph operations on acyclic digraphs is given.In this talk, we give classifications of generalized Bott towers in terms of ω-weighted acyclic digraphs. We also discuss some topological properties of these manifolds.

Keywords: Real Bott Manifolds, Digraphs, Cohomological Rigidity

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A new technique of hydrocarbons displacement from a porous medium by gas-liquid systems

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Abstract

Carbon dioxide injection is one of the most relevant and promising technology for enhanced oil recovery in order to extract hard-to-recover and residual hydrocarbon reserves. Despite the significant potential of CO_2 technologies for improving oil recovery, its large-scale application is mainly hindered by the limited reserves of carbon dioxide, economic limitations, technological constraints, weak financial and economic bonuses that stimulate the solution of environmental problems[1].

Innovative method for improving oil recovery based on a new mechanism for in-situ carbon dioxide generation is proposed. The generated carbon dioxide uses as the gas phase for the resulting gas-liquid system slug to sweep efficiency improving and increase oil recovery. The process of in-situ carbon dioxide formation as a result of a stoichiometric reaction of chemicals causes a change in the hydro-thermodynamic state of the reservoir system and, as a result, provides improved oil displacement[2].

Results of wide field application of technology of bed stimulation by gas-liquid fringe for the tight oil displacement and increasing of sweep efficiency are presented. A technique of dynamic state control in the local area of the porous medium, accompanied by strong pressure growth and additional desorption of the gas phase in the porous structure have been describes [3]. Results of recent theoretical and laboratory researches and field application of the energy- and resource efficient technology for EOR and IOR adapt for variable geological and physical conditions of oil field development are shown.The implementation of innovative technology to increase oil recovery and improving oil production was carried out in the United States, China, Russia and Azerbaijan oil fields.

Keywords: Carbon dioxide, gas flooding, in situ generation, oil displacement, sweep efficiency.

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Dynamic Treatment Regimes in Presence of Competing Risks

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Abstract

Personalized medicine is one of the most exciting areas of healthcare since the goal is to tailor treatment to individuals to maximize their well-being. Dynamic treatment regimens (DTRs) are rules that yield different treatment routes for subjects depending on their intermediate responses or covariates. DTRs, therefore, are powerful tools for delivering personalized medicine. Clinical trials consisting of several (commonly two) stages of randomization are used for making inference of DTRs. Competing risks occur when subjects in a study are exposed to more than one risk and the event of interest may not be observed when the competing event occurs. Under competing risks, the cumulative incidence function (CIF), which measures the cumulative probability of observing the target event over time, is commonly used. To quantify the effectiveness of dynamic treatment regimens under competing risks, the CIF should be properly estimated. When data from subjects only following a specific regime are used for estimating the CIF, the resulting estimator becomes biased. Instead, alternative inverse probability weighted estimators should be used. Their definitions and inference procedures will be given in this study. Results from numerical studies are provided for showing the practicality and advantaged of the proposed estimators.

Keywords: Competing risks, Inverse-probability weighting, Personalized medicine, Survival outcome

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Physics Session

Possible ways of elimination of matrix effects in the analysis of microelements in geological methods of exploration using mass spectrometry with inductively coupled plasma

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Abstract

Geological studies of the behaviour of trace elements in natural processes are important for solving many fundamental problems and require the accumulation of a large amount of analytical information on the content of trace elements in objects of complex composition during prospecting for oil and gas deposits (fields). The most promising for these purposes is the use of mass spectrometry with inductively coupled plasma, which provides simultaneous determination at the level of fractions ppb, ppt, a unique opportunity to measure isotope ratios [1-3].However, as the development progressed, it became clear that, as in the case of other methods for determining trace element contents, processes occur at various stages of analysis that can lead to interferences and distort the analytical signal [1,4], and hence the results obtained. It is obvious that the analysis of methods of accounting and elimination of interfering influences are of paramount importance for obtaining reliable information.

The purpose of this article is to detail the most important aspects of inductively coupled plasma mass spectrometry for the determination of trace elements in natural materials by critically considering instrumental and non-instrumental methods for suppressing interference of various origins.

The general limitation of the method of mass spectrometry with inductively coupled plasma when analyzing solutions is the content of salts in them, which should not exceed 0.2%. High acidity of the solution is also undesirable. Another fundamental limitation of ICP-MS is interference from isobaric polyatomic ions. They can be formed in plasma when the aerosol of the sample interacts with the components of the plasma-forming gas (containing C, H, N, O, and Ar) acids and solvents.

The speed and convenience of carrying out multielement analysis, the modern analytical level of sensitivity, accuracy and reproducibility have made the ICP-MS method in world practice an irreplaceable technique for determining trace levels of elements in scientific and industrial facilities. In this regard, the problem of spectral interference of polyatomic ions, which manifests itself in the analysis of most samples, is becoming increasingly important, since ignoring spectral overlaps or misinterpreting the analysis results can lead to a large disregarded systematic error in determinations.

The provided available information on the considered group of spectral interferences can allow analysts not only to successfully correct practical results and choose the optimal conditions for the analysis, but also to predict the manifestation of a particular group of spectral overlays for a particular research object.

Keywords: inductively coupled plasma mass spectrometry, spectral interference, trace elements

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Nonstandard interaction of neutrinos

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Abstract

Neutrino electron scattering is a purely leptonic fundamental interaction and therefore provides an important channel to test Standard Model especially at the low energy-momentum transfer regime. Constraints on neutrino non-standard interactions (NSI) couplings depending on model independent approaches, which are described by a four-Fermi point like interaction, are derived. The upper limits and the allowed regions of vectorial, scalar, pseudo-scalar and tensorial NSI couplings of neutrinos are derived at 90% confidence level in both one-parameter and two-parameter analysis. In addition, constraints on couplings of several Beyond Standard Model (BSM) physics scenarios are placed via neutrino electron scattering channel to test Standard Model at low energy-momentum transfer regime which are mediated by massive intermediate particles which include: (1) Extra Z-prime, (2) New Light Spin-1 Boson, (3) Dark Photon, and (4) Charged Higgs Boson. Bounds to coupling constants of Flavor Conserving and Flavor Violation New Light Spin-1 Boson, Dark Photon, and Charged Higgs Boson with respect to different mass of mediators are placed. The relevant parameter spaces are extended by allowing light mediators. New lower mass limits for extra Z-prime gauge boson models are placed. Data on neutrino and anti-neutrino electron scattering from the TEXONO and LSND experiments, respectively, are used.

Keywords: Beyond Standard Model, Neutrino Electron Elastic Scattering, Non-Standard Interaction of Neutrino (NSI).

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"Aharonov-bohmparamagnetism" in non-interacting diluted magnetic semiconductor quantum ring and Specific heat in diluted magnetic semiconductor quantum ring

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Abstract

In the present work, we consider magnetic properties of the non-interacting diluted magnetic semiconductor (DMS) quantum ring lattices applying the 2D rotator model. The exchange interaction and the Zeeman termeffect on the magnetic moment is taking into account . For this purpose, the exact analytic expression for the single-particle partition function is found and it used to determine the magnetic moment. We show that magnetization in DMS quantum ring sharp changes with a small increase in temperature and after a peak the magnetization starts to decrease and also we have calculated the specific heat and magnetization of a quantum ring of a diluted magnetic semiconductor (DMS) material in the presence of magnetic field. We take into account the effect of Rashba spin-orbital interaction, the exchange interaction and the Zeeman term on the specific heat. We have calculated the energy spectrum of the electrons in diluted magnetic semiconductor quantum ring. Moreover we have calculated the specific heat dependency on the magnetic field and Mn concentration at finite temperature of a diluted magnetic semiconductor quantum ring.

Keywords: Diluted magnetic semiconductor, specific heat, quantum ring, partition function

Possibilities of enhancing magnetocaloric effect in low dimensional systems

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Abstract

You can write your Magnetocaloric effect (MCE) is one of the promising applications of magnetismin cooling technology [1]. It is based on entropy change of the material due to the applied magnetic field. The efficiency of the MCE can be determined by some quantities such as refrigerant capacity(RC) and isothermal magnetic entropy change (IMEC)of the material. A good candidate for a magnetic refrigerant material should have a large magnitude of IMEC spread in a broader temperaturespan. This gives a large RC.

Low dimensional materials could display interesting magnetic properties due to their confinement in one (e.g. thin films) or two dimensions (e.g. nanotubes or nanowires). This interesting changes in the magnetic properties of the material could show themselves in magnetocaloric properties. For instance, recently experimentally it has been shown that, doublepeaks behaviour in IMEC for manganite bilayers occurs [2]. This can be used for enhancing the MCE properties. Thus, it is important to explain these types of behaviours theoretically in low-dimensional magnetic systems.

In this talk, the MCE in low-dimensional systems is reviewed. Theoretical results regarding the multi-peak behaviour of the low-dimensional magnetic systems will be given [3]. Besides, the tuning of the magnetocaloric performance of the materials by changing dimensionality or adjusting the material's parameters of the system will be discussed.

Keywords: Magnetocaloric effect, magnetic materials, effective field theory.

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