

**ISINN-30**

**XXX International Seminar  
on Interaction of Neutrons with Nuclei**



**Fundamental Interactions &  
Neutrons,  
Nuclear Structure,  
Ultracold Neutrons,  
Related Topics**

**Dubna, 2024**

**Abstracts**

Joint Institute for Nuclear Research

**FUNDAMENTAL  
INTERACTIONS & NEUTRONS,  
NUCLEAR STRUCTURE,  
ULTRACOLD NEUTRONS,  
RELATED TOPICS**

*XXX International Seminar  
on Interaction of Neutrons with Nuclei*

**Organized by**  
Frank Laboratory of Neutron Physics, JINR, Dubna  
Egyptian Academy of Scientific Research and Technology  
(ASRT)  
Egyptian Atomic Energy Authority (EAEA)  
Xi'an Jiaotong University (XJTU)

Sharm ash Shaykh, Egypt, April 14–18, 2024

*Abstracts*

Dubna 2024

УДК 539.125.5(042)  
ББК 22.383.2я431+22.383.5я431+22.383.25я431  
F97

### ***Organizing Committee***

#### **Conference Chairs**

Dr. Valery Shvetsov (JINR)  
Prof. Gina El Feky (ASRT)  
Prof. Amr Elhag Ali (EAEA)  
Prof. Sheng Wang (XJTU)

#### **Scientific Secretary**

Alexander Nezvanov (JINR)

#### **Committee Members**

Egor Lychagin (JINR)	Diana Al-Maaitah (JINR)
Walter Furman (JINR)	Mona El Naa (ASRT)
Marina Frontasyeva (JINR)	Rana H. Refaey (ASRT)
Yuri Kopatch (JINR)	Menna-t-allah M. El-Kotamy (ASRT)
Ludmila Mitsyna (JINR)	Medhat Naguib Eliwa (EAEA)
Pavel Sedyshev (JINR)	Mona Mohamed Tohamy (EAEA)
Inga Zinicovscaia (JINR)	Reham Sabry (ASRT)
Tatiana Pikelner (JINR)	Zhifeng Li (XJTU)
Wael Badawy (EAEA, JINR)	

The contributions are reproduced directly from the originals presented by the Organizing Committee.

**Fundamental** Interactions & Neutrons, Nuclear Structure, Ultracold Neutrons, F79 Related Topics: Abstracts of the XXX International Seminar on Interaction of Neutrons with Nuclei (Sharm ash Shaykh, Egypt, April 14–18, 2024). — Dubna: JINR, 2024. — 137 p.

ISBN 978-5-9530-0613-2

**Фундаментальные** взаимодействия и нейтроны, структура ядра, ультрахолодные нейтроны, связанные темы: Тезисы докладов XXX Международного семинара по взаимодействию нейтронов с ядрами (Шарм-эш-Шейх, Египет, 14–18 апреля 2024 г.). — Дубна: ОИЯИ, 2024. — 137 с.

ISBN 978-5-9530-0613-2

## CONTENTS

### **Levels of Heavy Metals in Pregnant Women with Fetal Central Nervous System Anomalies Using ICP-OES**

*Abdo S.Y., Zinicovscaia I. and Seleem M. ....15*

### **Neutronic Behavior of SMART-ATFs Nuclear Fuel**

*AbouAlo R.F.M. ....16*

### **Use of Neutrons for Plants Breeding**

*Aleksiyayenak Yu.V., Kruglyak A.I., Doroshkevich A.S. ....17*

### **Elemental Composition Analysers Based on the Tagged Neutron Method**

*Alexakhin V.Yu., Komarov I.K., Lichkunova A.I., Razinkov E.A., Rogov Yu.N., Sapozhnikov M.G., Chirikov-Zorin I.E. ....18*

### **Geochemical Characterization of Egyptian Red Sea Mangrove Sediments: Composition, Pollution Sources, and Environmental Implications**

*Badawy W.M., Dmitriev A.Yu., El Samman H., El-Taher A., Blokhin M.G. ....19*

### **GEM-Based Detectors for Thermal Neutrons with a VMM3 ASIC Readout**

*Bautin V., Bodnarchuk V., Enik T., Kambar Y., Kolesnikov A., Mukhamedzhanova A., Ramachov S., Rogachev A., Salamatin K., Zruev V., Sosnov D., Kuznezova E. ....20*

### **Source of Radiation Emission with a Plasma-Physical Accelerator of a Linear Configuration**

*Bedenko S.V., Demin A.S., Polozkov S.D. ....21*

### **Study of Quaternary Spontaneous Fission of $^{252}\text{Cf}$**

*Berikov D., Ahmadov G., Holik M., Kopatch Yu., Ahmadov F., Nuruyev S., Sadigov A., Madadzada A. ....22*

### **Measurement of Cross-Section of the $p + ^7\text{Li}$ , $d + \text{Li}$ , $p + ^{11}\text{B}$ , and $d + \text{B}$ Reactions at Ion Energies up to 2.2 MeV**

*Bessmeltsev V., Bikchurina M., Bykov T., Kasatov D., Kolesnikov Ia., Koshkarev A., Krasilnikov A., Meshaninov S., Nemtsov G., Nikolaev A., Oks E., Ostreinov G., Savinov S., Shuklina A., Sokolova E., Yushkov G., Taskaev S. ....23*

### **Possible Experiments to Search for Singlet Deuteron and the Problem of the Existence of Neutral Nuclei**

*Borzakov S.B. ....24*

<b>Distribution of Radionuclide Impurities in Irradiated Topaz</b> <i>Bulavin M., Enik T., Grozdov D., Kuznezova E., Tutunnikov S., Vergel K., Yoldoshev B., Zinicovscaia I., Ulanova I. ....</i>	25
<b>Enhancement of the Fundamental Symmetry Breaking Effects in Neutron Resonances: Kinematic or Resonance?</b> <i>Bunakov V.E. ....</i>	26
<b>Analyzing the Accumulation of Trace Elements in Moss Samples from Agricultural and Mountainous Environments</b> <i>Chaligava O., Zinicovscaia I., Peshkova A., Yushin N., Frontasyeva M.V., Vergel K., Grozdov D., Cepoi L. ....</i>	27
<b>Measurement of the <math>^{235,238}\text{U}(n, f)</math> Cross-Section Relative to n-p Scattering from 10 to 70 MeV at CSNS Back-n</b> <i>Chen Y. ....</i>	28
<b>Neutron Spectrum Unfolding Method Based on Shifted Legendre Polynomials, Its Application to the IREN Facility</b> <i>Chizhov K.A., Chizhov A.V. ....</i>	29
<b>Measurements of the <math>^6\text{Li}(n, \alpha)^3\text{H}</math> Reaction in the Neutron Energy Range <math>E_n=3.3\text{--}5.3</math> MeV</b> <i>Chuprakov L., Gledenov Yu.M., Sansarbayar E., Krupa L., Khuukhenkhuu G., Zhang Guohui, Liu Jie, Xia Cong, Bai Haofan, Wu Zepeng, Ren Wenkai. ....</i>	30
<b>The Influence of Organic and Inorganic Chemical Compounds on Elemental Content, Bioactive Compounds and Morphological Parameters of Some Field-Grown Winter Wheat Genotypes</b> <i>Culicov O.-A., Soran M.-L., Lung I., Racz I., Kadar R., Stegarescu A., Opriş O., and Nekhoroshkov P. ....</i>	31
<b>Determining the Relative Efficiency of HPGe and LaBr<sub>3</sub> Gamma-Ray Detectors Using <math>^{60}\text{Co}</math>, <math>^{152}\text{Eu}</math>, <math>^{228}\text{Th}</math> and <math>^{35}\text{Cl}(n, \gamma)^{36}\text{Cl}</math></b> <i>Das Pr.K., Grozdanov D.N., Fedorov N.A., Kopatch Yu.N., Ruskov I.N., Mishra U. ....</i>	32
<b>The Problem of Verification and Attestation of Computer Programs Used for Research Reactor Calculations</b> <i>Dikova T.S., Bulavin M.V. ....</i>	33
<b>Experimental Measurement of TOF Histogram in High Energy Part of the Neutron Spectrum</b> <i>Djilkibaev R.M., Khliustin D.V. ....</i>	34

**Instrumental Neutron Activation Analysis of River Sediments of Danube (Romania), Nile (Egypt) and Zarafshon (Tajikistan): A Comparative Investigation**

*Duliu O.G., Dinescu L., Badawy W., Abdusamadzoda D., Culicov O., Frontasyeva M., Zinicovscaia I., Trtić-Petrović T. ....35*

**4D Neutron Imaging for Textured Samples**

*Elewa N.N. ....36*

**Design and Implementation of Protective Layer for Protecting Cultural Heritage Wooden Artifacts**

*Elhaes H., Ibrahim M. ....37*

**Proposed New Different Coincidence Neutron Detection Systems Using Monte Carlo Simulation**

*El-Tayebany R.A., Shalaf M.E. ....38*

**Operation and Experimental Introduction of the CSNS Back-n White Neutron Facility**

*Fan R. on behalf of Back-n collaboration.....39*

**Angular Correlation ( $n', \gamma$ ) in the Reaction of Inelastic Neutron Scattering on  $^{12}\text{C}$**

*Filonchik P.G., Barabanov A.L. and TANGRA collaboration.....40*

**Simulation of the Experiments with Ultracold Neutrons at the PIK Reactor**

*Fomin A.K., Serebrov A.P. ....41*

**Direct Measurement of the Neutron Velocity in a Refractive Medium and Test of the Dispersion Law for UCN**

*Frank A.I., Kulin G.V., Zakharov M.A. ....42*

**To the UCN Source at Periodic Pulsed Reactor**

*Frank A.I., Kulin G.V., Kurylev V.A., Popov A.A., Zakharov M.A. ....43*

**Atmospheric Deposition of Cosmic Dust Studied by the Moss and Trepel Analysis**

*Frontasyeva M.V., Tselmovich V.A. and Hoover R.B. ....44*

**Review of FLNP JINR Cooperation on Environmental Research in Egypt**

*Frontasyeva M., El Samman H., Badawy W. ....45*

**Measurement of Fission Cross Section and Angular Distribution of Fission Fragments from Neutron-Induced Fission of  $^{242}\text{Pu}$  in the Energy Range 1–500 MeV**

*Gagarski A.M., Vorobyev A.S., Shcherbakov O.A., Vaishnene L.A., Tiagelskaia A.M., Olkhovich N.M., Barabanov A.L., Kuz'mina T.E. ....46*

**Unlocking the Interfacial Synergy of 2D/2D CuO/Reduced Graphene Oxide (rGO) Nanocomposite for Reduction of Cr(VI)**

*Gomaa I., Helal A., Ibrahim M.A. and Hosny N. ....47*

**On Estimating the Loss Rate of Ultracold Neutrons in Material Traps**

*Grigoriev P.D., Kochev V.D. ....48*

**Measuring the Angular Distributions of 14.1-MeV Neutrons' Scattering on Carbon Nuclei**

*Grozdanov D.N. for TANGRA collaboration .....49*

**Estimation of the Magnitude and Sign of the ROT Effect for  $^{239,241}\text{Pu}$ ,  $^{241}\text{Am}$  and  $^{245}\text{Cm}$  Nuclei at Low Neutron Energy Inducing Their Fission**

*Guseva I.S., Gusev Yu.I. ....50*

**Efficiencies and Characterization of Hexagonal Scintillator Detector**

*Hamzawy A., Badawi M.S., Ruskov I.N., Grozdanov D.N., Badawi M.I., Thabet A.A., Kopatch Yu.N., Fedorov N.A., Salem B.A., and TANGRA Collaboration.....51*

**Optimization of the Main Parts of the New Pulsed Nuclear Reactor NEPTUNE**

*Hassan A.A., Rzyanin M.V. and Bulavin M.V. ....52*

**Development of Novel Scintillation Detectors**

*Hassan A.M.A. ....53*

**Heat Producing Elements and Microfossils in the Polonnaruwa Meteorite: “Wet Panspermia” and the Cosmic Distribution of Biospheres**

*Hoover R.B., Rozanov A.Yu., Frontasyeva M.V., Wallis D., Klyce B. and Wickramasinghe N.C. ....54*

**Determination of Parameters of Multisectional Liquid Scintillation Spectrometer and of Prototype of “Gamma” Installation at the IREN Facility**

*Hramko C., Borzakov S.B., Yergashov A., Kopatch Yu.N., Kuznetsov V.L., Mazhen S., Mitsyna L.V., Rebrova N.V., Simbirtseva N.V., Sedyshev P.V. ....55*

<b>The Measurement of PFNS in CIAE</b> <i>Huang H., Ruan X., Kang M., Zhu Y., Wu H., Sun Q., Ren J.</i> .....	56
<b>Exploring Materials at Molecular Modeling and Spectroscopy Laboratory, National Research Centre, NRC, Egypt</b> <i>Ibrahim M.A. and Elhaes H.</i> .....	57
<b>Estimate of Radiation Damage Using the Stopping and Range of Ions in Matter</b> <i>Ibrahim M.A., Laptev R.</i> .....	58
<b>The SFiNx Detector System</b> <i>Isaev A.V., Mukhin R.S., Yeremin A.V., Kuznetsova A.A., Malyshev O.N., Popeko A.G., Popov Yu.A., Sailaubekov B., Svirikhin A.I. and Sokol E.A.</i> .....	59
<b>Trace Analysis of Uranium by Laser Spectroscopy and ICP-MS</b> <i>Izosimov I.N., Saidullaev B.D., Strashnov I., Vasidov A.</i> .....	60
<b>Cross-Section Measurement of <math>^{14}\text{N}(n, p)^{14}\text{C}</math> Reaction</b> <i>Jiang W.</i> .....	61
<b>Investigation of Spectroscopic Properties of <math>^{108}\text{Ag}</math> via the <math>^{107}\text{Ag}(n, 2\gamma)</math> Reaction</b> <i>Jovančević N., Milanović T., Maletić D.</i> .....	62
<b>Artificial Neural Networks for Unfolding Procedures in Neutron and Photon Activation Measurements</b> <i>Jovancevic N., Ilic S.</i> .....	63
<b>Fundamental Differences in Theoretical Approaches to Describing of the Observed Characteristics of Spontaneous and Induced Binary and Ternary (with the Emission of Nucleons and Light Nuclei as Third Particles) Nuclear Fission</b> <i>Kadmensky S.G., Lyubashevsky D.E., Titova L.V.</i> .....	64
<b>Observation of Fission Isomers among Fragments of Spontaneous and Induced Fission of Heavy Nuclei</b> <i>Kamanin D.V., Pyatkov Yu.V., Solodov A.N., Zhuchko V.E., Goryainova Z.I., Strekalovsky O.V., Kuznetsova E.A., Zhukova A.O.</i> .....	65
<b>Manifestation of the Fission Dynamics in Muon-Induced Prompt Fission</b> <i>Karpeshin F.F.</i> .....	66



**Digital System for Signal Processing from a Position-Sensitive Detector Based on a Digitizer with Open FPGA**

*Kazliakouskaya A.A., Bogdzal A.A., Churakov A.V., Lapkin A.V., Litvinenko E.I., Milkov V.M. ....67*

**Characteristic Features of Double and Triple Coincidence Spectra Coupling in Radiative Neutron Decay**

*Khafizov R.U., Kolesnikov I.A., Nikolenko M.V., Tarnovitsky S.A., Tolokonnikov S.V., Torokhov V.D., Trifonov G.M., Solovei V.A., Kolkhidashvili M.R., Konorov I.V. ....68*

**Retention of Liquid Helium Films by an Electric Field in Ultracold Neutron Traps**

*Kochev V.D., Molilyuk T.I., Kostenko S.S., Grigoriev P.D. ....69*

**Applications of the Tagged Neutron Method for Fundamental and Applied Research**

*Kopatch Yu.N. and TANGRA collaboration ....70*

**Moderated and Fast Neutrons Dosimetry Using Radiometric Gafchromic™ EBT3 Film**

*Kotb O.M., Elmaghraby E.K., El Ghazaly M., Mohamed A. ....71*

**Phytoremediation of Contaminated Urban Soils Using Two Ornamental Plants**

*Kravtsova A.V., Zinicovscaia I.I., Vergel K.N., Tran T.A., Ho M.D. ....72*

**Mechanical and Temperature Calculations of the Reactivity Modulator Construction of the Research Pulsed Reactor NEPTUN**

*Kushnir I.V. ....73*

**Monte-Carlo Evaluations of Low-Energy Neutron Radiative Capture in <sup>93</sup>Nb Nucleus and  $\gamma$ -Quanta Forward-Backward Asymmetry Caused by Geometry and Kinematics**

*Kuznetsov V.L., Mitsyna L.V., Rebrova N.V., Sedyshev P.V. ....74*

**Angular Correlation Analysis in the Neutrons Capture Process by <sup>109</sup>Ag Nucleus**

*Kuznetsov V.L., Mitsyna L.V., Oprea A.I., Oprea C., Rebrova N.V., Sedyshev P.V. ....75*

**Pressure-Induced Phase Transitions in VdW Magnets**

*Lis O.N., Kozlenko D.P., Kichanov S.E., Lukin E.V., Zel I.Yu. ....76*

<b>Classification of Mortars from the St. George Cathedral of the Yuryev Monastery (Veliky Novgorod, Russia) Based on Neutron Activation Analysis Data at the IREN Facility (JINR, Russia) and the WWR-K Reactor (INP, Kazakhstan)</b> <i>Lobachev V.V., Dmitriev A.Yu., Philippova O.S., Lennik S.G. ....</i>	77
<b>Ultracold Neutron Source for Research in Fundamental Physics at the PIK Reactor</b> <i>Lyamkin V.A., Serebrov A.P., Fomin A.K., Koptuykhov A.O., Ivanov S.N., Kolomenskiy E.A., Hazov P.A. ....</i>	78
<b>Relation of Transuranium Isotopes Yields as Indicator of the Achieved Neutron Fluences at the Pulse Nucleosynthesis</b> <i>Lyashuk V.I. ....</i>	79
<b>Research with Neutrons at FLNP JINR</b> <i>Lychagin E. ....</i>	80
<b>Methodology for Simulating the Properties of Nanostructured Reflectors for Very Cold Neutrons</b> <i>Lychagin E., Muzychka A., Nesvizhevsky N., <u>Nezvanov A.</u> ....</i>	81
<b>Spin Distributions of Fragments in Binary Asymmetric Nuclear Fission</b> <i>Lyubashevsky D.E., Pisklyukov A.A., Stepanov D.A., Kostryukov P.V., Kadmensky S.G. ....</i>	82
<b>Orbital Momenta of Fragments in Binary Asymmetric Fission of Actinide Nuclei</b> <i>Lyubashevsky D.E., Pisklyukov A.A., <u>Titova L.V.</u>, Kadmensky S.G. ....</i>	83
<b>Determination of the Electrical Parameters of the GaS Thin Film</b> <i>Madatov R.S., Tagiev T.B., Mamishova R.M., Khaligzadeh A.Sh. ....</i>	84
<b>Soft Rotator Multiband Optical Model Parameters for Fissile Actinides</b> <i>Martyanov D., Capote R., Quesada J.M., Chiba S. ....</i>	85
<b>Prompt Fission Neutron Spectra of <math>^{233}\text{U}(n,F)</math></b> <i>Maslov V.M. ....</i>	86
<b>Prompt Fission Neutron Spectra of <math>^{240}\text{Pu}(n,F)</math></b> <i>Maslov V.M. ....</i>	87

<b><math>^{242m}\text{Am}</math> Isomer Yield in <math>^{243}\text{Am}(n,2n)</math> Reaction</b> <i>Maslov V.M.</i> .....	88
<b>The Elemental Content of Seawater and Algae Collected from the Red Sea, the Arabian Gulf, and the Gulf of Oman: Preliminary Study</b> <i>Nassar N., Sherif M.M., Yushin N., Zinicovskaia I.</i> .....	89
<b>The Accumulation Features of Plants and Bivalves near the Natural Sources of Strontium (Tula Region, Russia)</b> <i>Nekhoroshkov P.S., Pakhnevich A.V., Zinicovskaia I.I., Yushin N.S., Peshkova A.A.</i> .....	90
<b>Testing the Effect of Nanodiamond Fluorination on the Efficiency of Reflection of Very Cold Neutrons</b> <i>Nezvanov A.Yu., Teymurov E.</i> .....	91
<b>Neutron Flux Density Spectral Parameters of the Pulse Neutron Source IREN</b> <i>Nhat L.T.M., Khiem L.H., Son N.A., Borzakov S.B., Dmitriev A.Yu., Toan T.N., Phi T.H.B., Cong V.D.</i> .....	92
<b>Mosses as Bioindicators of Air Pollution with Potentially Toxic Elements in Karaganda Region, Kazakhstan</b> <i>Nurkassimova M., Omarova N., Aidargalieva N., Zinicovskaia I., Chaligava O., Yushin N.</i> .....	93
<b>SiPM-Based Gamma Spectrometer for Nuclear Spectroscopy</b> <i>Nuruvev S., Ahmadov G., Akbarov R., Ahmadov F., Sadigov A., Berikov D.</i> .....	94
<b>The Dynamics of Oscillation Instability of the IBR-2M Reactor. The Noise Analysis</b> <i>Pepelyshev Yu.N., Tsogtsaikhan Ts.</i> .....	95
<b>Optimization of Automatic Power Control System of the IBR-2M Pulsed Reactor</b> <i>Pepelyshev Yu.N., Sumkhuu D.</i> .....	96
<b>Verification of an Available Cross-Section Library for Neutron Interaction with Solid Deuterium Using Monte Carlo Simulation</b> <i>Pham K.T., Nezvanov A.Yu.</i> .....	97

**Existing Developments and Directions for Further Development of Thermal-Neutron Detectors at the IBR-2 Department of Spectrometers Complex**

*Podlesnyy M.M., Milkov V.M., Bogdzel A.A., Bodnarchuk V.I., Churakov A.V., Daulbayev O., Drozdov V.A., Kazliakouskaya A.A., Kurilkin A.K., Litvinenko E.I., Petrova M.O., Prikhodko V.I., Shvetsov V.V., Zhuravlev V.V. ....*98

**Dynamics Model for the "Neptune" Reactor**

*Podlesnyy M.M., Verkhoglyadov A.E., Shabalin E.P., Rzyanin M.V. ....*99

**Stationary Magnet of Neutron Flipper-Decelerator for the UCN Source at a Periodic Pulsed Reactor**

*Popov A.A., Frank A.I., Kulin G.V., Kurylev V.A., Osipenko K.S. ....*100

**The Measurement of the  ${}^6\text{Li}(n, t){}^4\text{He}$  Reaction Cross-Section in the Energy Range of 4.25–7.50 MeV**

*Prusachenko P.S., Bobrovskiy T.L. ....*101

**Progress in Neutron Resonance Imaging Experiments Using MCP at CSNS Back-n**

*Qiu Y. ....*102

**Interaction of 14-MeV Neutrons with  ${}^{75}\text{As}$**

*Ruskov I.N. for TANGRA collaboration ....*103

**Interaction of 14-MeV Neutrons with  ${}^9\text{Be}$**

*Ruskov I.N. for TANGRA collaboration ....*104

**Interactions of 14-MeV Neutrons with  ${}^{40}\text{Ca}$**

*Ruskov I.N. for TANGRA collaboration ....*105

**Preliminary Conceptual Design of the High-Intensity Ultracold Neutrons Source at the WWR-K Reactor**

*Sakhiyev S., Nesvizhevsky V., Korobkina E., Lychagin E., Muzychka A., Nezvanov A., Strelkov A., Frank A., Sairanbayev D., Shaimerdenov A., Turlybekuly K., Muhametuly B. ....*106

**Exploring the Role of Nuclear Structure Effects in Photofission Mechanism of  ${}^{237}\text{Np}$**

*Seipiani M., Nasri Nasrabadi M. ....*107

<b>Development of a Project for a Universal Trap for Storing Ultracold Neutrons</b> <i>Serebrov A.P., Fomin A.K., Klyushnikov G.N., Koptyukhov A.O., Murashkin A.N.</i> .....	108
<b>Neutron Slowing Down as a Random Walk Problem</b> <i>Sharapov E.I.</i> .....	109
<b>The Ecological-Geochemical Assessment in Recreational Zones of Moscow Based on the Study of Three Environmental Components (Soil, Vegetation, Atmospheric Air)</b> <i>Shvetsova M.S., Kamanina I.Z., Zinicovscaia I.</i> .....	110
<b>Computer Simulation Process of Neutron Transport in Liquid Scintillator Filled Multi-Module Neutron Detector</b> <i>Sidorova O.V. and Zeynalov Sh.S.</i> .....	111
<b>Non-Destructive Investigation of Fragment of Leggings (4th Century BCE) Using Neutron Resonance Capture Analysis</b> <i>Simbirtseva N., Mazhen S., Yergashov A., Sedyshev P.V., Saprykina I.A., Savchenko E.I.</i> .....	112
<b>Structural Studies of Greek Alabaster Vases: Data from X-Ray Tomography and Diffraction, Raman Spectroscopy</b> <i>Smirnova V.S., Kichanov S.E., Bakirov B.A., Saprykina I.A., Egorova T.V.</i> .....	113
<b>Innovative Neutron Activation Approach for Analysis of Liquid Samples Based on Short-Lived Radionuclides</b> <i>Soliman M.</i> .....	114
<b>Neutron Activation Analysis Lab at ETRR-2: Achievements and Future Work</b> <i>Soliman M.</i> .....	115
<b>Fundamental Information from Combined Analysis of Nuclear Data and Particle Masses</b> <i>Sukhoruchkin S.I., Soroko Z.N.</i> .....	116
<b>Fine and Superfine Structures in Neutron Resonance Positions</b> <i>Sukhoruchkin S.I., Soroko Z.N.</i> .....	117

<b>Progress in the Simulation of the Energy Resolution Function for CSNS Back-n Facility</b> <i>Tang Sh., Chen Y.</i> .....	118
<b>Using Carbon Stable Isotope to Evaluate Water Efficiency Following Seasonal Variation in Coffee Leaf</b> <i>Tham V.T.M., Thien T.Q., Thang L.X., Dao N.M., Anh T.T., Trung P.Q., Lan N.T.H., Nghia N.H., Hai P.S., Huong T.T.T.</i> .....	119
<b>Nuclear Structure Investigations in Light Nuclei</b> <i>Tonev D.</i> .....	120
<b>Assessment of Environmental Gamma Dose Rate in Ho Chi Minh City, Vietnam</b> <i>Tran D.K.</i> .....	121
<b>Spatial and Temporal Variations in the Distribution of Multiple Elements in Sediments within the Iron Gate I Reservoir along the Danube River</b> <i>Trtić-Petrović T., Culicov O., Šaraba V., Lazarević D., Jovanović J.</i> .....	122
<b>Study of the Native Oxide Layer on the Surface of Semiconductor Material GaAs before and after Hot-Implanted Al Ion by RBS/NR Method</b> <i>Tuan P.L., Kulik M., Turek M., Phuc T.V., Anh N.N., Cong V.D., Bao My N.T., Doroshkevich A.S., Duc P.M.</i> .....	123
<b>Cement-Polymer Composites Containing PANI/B<sub>4</sub>C: Neutron Shielding Performance by Monte Carlo Simulation</b> <i>Tunckilic S., Kahraman D.A., Esen A.N.</i> .....	124
<b>Assessment of Air Pollution in the Vicinity of Industrial Enterprises Using Moss Bags Technique</b> <i>Vergel K., Zinicovskaia I., Yushin N., Chaligava O., Cepoi L.</i> .....	125
<b>Tritium Activity Concentration Study in Seawater Samples in the Gulf of Tonkin, Vietnam</b> <i>Vuong T.T.H., Nguyen T.N., Le N.S., Nguyen V.P., Nguyen D.T., Tran D.K., Le T.M.T., Nguyen T.T.H.</i> .....	126
<b>Radiation Effects on CCDs Induced by Neutron Beams at Atmosphere Neutron Irradiation Spectrometer of CSNS</b> <i>Wang Z.J., Tang N., Mo L.H., Hu Z.L., Yan S.X.</i> .....	127

<b>Measurements of Spectral and Dose Characteristics of Neutron Fields behind Biological Protection at the IREN Facility at the Electron Energy of 110 MeV</b> <i>Yakubov T.R., Shvetsov V.N., Beskrovnaya L.G. ....</i>	128
<b>Modeling the Impact of High and Thermal Energy Neutron Flux on Semiconductor Film Heterostructures</b> <i>Yamurzin V.R. ....</i>	129
<b>Investigations of Low-Energy P-Resonances in (n,<math>\gamma</math>) Reaction on <math>^{93}\text{Nb}</math> Nucleus</b> <i>Yergashov A., Kopach Yu.N., Kuznetsov V.L., Mitsyna L.V., Oprea A.I., Oprea C., Rebrova N.V., Sedyshev P.V. ....</i>	130
<b>Effect of Neutron Irradiation on the Electronic and Optical Properties of AlGaAs/InGaAs-Based Quantum Well Structures</b> <i><u>Yskakov A.</u>, Klochkov A.N., Bulavin M.V., Galushko A.V., Vasil'evskii I.S. ....</i>	131
<b>Cyanobacteria <i>Arthospira platensis</i> as an Effective Tool for Gadolinium Removal from Wastewater</b> <i>Yushin N., Zinicovscaia I., Cepoi L., Chiriac T., Rudi L., Grozdov D. ....</i>	132
<b>Numerical Study of the Non-Stationary Quantum Phenomena with Ultra-Cold Neutrons in 2D Dimension</b> <i>Zakharov M.A. ....</i>	133
<b>PFN Investigation at IREN Resonance Neutron Energy Range</b> <i>Zeynalov Sh., Sidorova O. ....</i>	134
<b>Research Progress of High Repetition Frequency and Ultrashort Pulse Neutron Source Based on 3 MeV Proton Accelerator</b> <i>Zhang X., Sheng L., Wang Z., Liu X., Weng X., Tan X., Hei D., Qiu M., Tang B., Ma G., Xia J., Shi Q., Yin H. ....</i>	135
<b>Fission Induced by High Energy Particles and Energy Release in Massive Fissionable Targets Applied for ADS</b> <i>Zhivkov P. ....</i>	136
<b>Nuclear and Related Analytical Techniques in Environmental and Nanotechnological Studies</b> <i>Zinicovscaia I. ....</i>	137

## Spatial and Temporal Variations in the Distribution of Multiple Elements in Sediments within the Iron Gate I Reservoir along the Danube River

Trtić-Petrović T.<sup>1</sup>, Culicov O.<sup>2,3</sup>, Šaraba V.<sup>1</sup>, Lazarević D.<sup>1</sup>, Jovanović J.<sup>1</sup>

<sup>1</sup>*Laboratory of Physics, Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia*

<sup>2</sup>*Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, IIO, Dubna*

<sup>3</sup>*National Institute for R&D in Electrical Engineering ICPE-CA, Bucharest, Romania*

Iron Gate I, situated in the Đerdap Gorge and extending over 117 km, stands as the largest hydropower dam and reservoir system along the Danube River. The environmental impact of this dam encompasses alterations to the hydrological regime of both surface and groundwater, as well as changes to sediment patterns. Notably, the sedimentation rate within the Iron Gate I Reservoir is remarkably high, estimated at approximately 23.3 cm per year, suggesting a significant potential for accumulation and, consequently, the preservation of pollutants. Monitoring efforts have been focused on evaluating pollution levels in the River Danube, with particular attention given to emerging contaminants such as metals and metalloids (Hg, As, Ni, Zn, Cu, Cr, Pb, and Cd). This study aims to determine major and trace elements in Danube River sediment using instrumental neutron activation analysis (INAA) and to identify possible contamination.

The concentrations of 40 major and minor elements were measured at 8 locations along the Danube River, spanning from 1141 to 864 km, to monitor the spatial and temporal quality of sediment. Sediments were collected from the surface of the river bottom at the central and the deepest part using an Ekman grab sampler in April and September 2016, April 2017, April and July 2018. All samples are analyzed applying the INAA. The major elements (Al, Ca, Fe, K, Na, Ti, Mg, and Mn), trace elements (Ba, Zn, Cr, Sr, V, Rb, Ni, Cu, Co, As, Sc, Th, Cs, Hf, Sb, U, W, Ta), and lanthanides (La, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Tm, Yb) were quantified. Irradiations of the samples were performed at the pulsed reactor IBR 2 (Frank Laboratory of Neutron Physics - FLNP, Joint Institute of Nuclear research—JINR, Dubna, Russian Federation) using thermal or epithermal neutrons.

The concentrations of the investigated elements varied significantly among the sample locations, with relative standard deviations ranging from 18 to 90%. The contamination factor (CF) was calculated by comparing the concentration of the target element in sediment from the sampled location to values from a reference sample, denoted as background. A sediment sample collected from the depths of the River Danube, specifically at a depth of 7 meters, and displaying the lowest concentrations of nearly all elements, served as the reference sample.

We found a contamination factor (CF) exceeding 6, signaling exceptionally high levels of contamination for Zn, As, and Sb in the sample gathered from location Smederevo. CF values for Zn, As, and Sb varied between 1 and 6, indicating low to moderate contamination levels across all examined samples. The sediment sample from the River Danube in Smederevo serves as a focal point for contamination with Zn, As, and Sb, likely stemming from anthropogenic sources, possibly linked to a nearby steel processing plant in the vicinity of Smederevo.