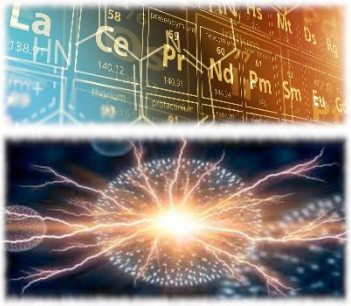
Republic of Türkiye's 100th Anniversary. We are stronger together, our beloved Turkish Nation.



BOOK OF ABSTRACTS

16th International Conference on Nuclear Structure Properties

NSP 2023

May 8 – 10, 2023

Karabük University

Science Faculty, Physics Department

Karabük, Türkiye

16th International Conference on Nuclear Structure Properties

PREFACE

The NSP conference series is a technical event which focuses on advances in nuclear structure, astrophysics, nuclear reactions, nuclear energy, high energy & physics, and other related topics.

The purpose of this conference series is to provide a platform for researchers, academicians, and practitioners to make them familiar with recent advances in nuclear sciences. The organization committee accepts a wide range of papers to encourage young and experienced researchers to present their work and the possibility of initiating mutual collaboration with internationally renowned researchers and experts of the relevant industries. The conference format comprises of multiple sessions and the selected works in these sessions are based on substantial and novel research.

The series of events was initiated in 2004 at Anadolu University, Eskişehir / Türkiye. The following is a list of subsequent meetings in the series:

I. Workshop on Nuclear Structure Properties (NSP2004),
Anadolu University, Eskişehir, Türkiye

II. Workshop on Nuclear Structure Properties (NSP2005),
Anadolu University, Eskişehir, Türkiye

III. Workshop on Nuclear Structure Properties (NSP2006),
Dumlupınar University, Kütahya, Türkiye

IV. Workshop on Nuclear Structure Properties (NSP2007),
Gazi University, Ankara, Türkiye

V. Workshop on Nuclear Structure Properties (NSP2011),
Muş Alparslan University, Muş, Türkiye

VI. International Workshop on Nuclear Structure Properties (NSP2013),
Karabük University, Karabük, Türkiye

VII. International Workshop on Nuclear Structure Properties (NSP2014),
Sinop University, Sinop, Türkiye

VIII. International Workshop on Nuclear Structure Properties (NSP2015),
Sakarya University, Sakarya, Türkiye

IX. International Conference on Nuclear Structure Properties (NSP2016),
Sivas Cumhuriyet University, Sivas, Türkiye

X. International Conference on Nuclear Structure Properties (NSP2017),
Karabük University University, Karabük, Türkiye

XI. International Conference on Nuclear Structure Properties (NSP2018),
Karadeniz Technical University, Trabzon, Türkiye

XII. International Conference on Nuclear Structure Properties (NSP2019),
Bitlis Eren University, Bitlis, Türkiye

XIII. International Conference on Nuclear Structure Properties (NSP2020)
It has been attributed to Covid-19.

XIV. International Conference on Nuclear Structure Properties (NSP2021)
as an online event due to Covid-19 – Selçuk University, Konya, Türkiye

XV. International Conference on Nuclear Structure Properties (NSP2022),
Kırıkkale University, Kırıkkale, Türkiye

We were wishing that 16th NSP conference would be a face-to-face event in which we could enjoy international collaborations between young and renowned researchers in a direct and more accessible way. However, on **February 6 - 2023**, Türkiye hit and affected by a massive earthquake. As shattered by the devastating images of the quake and trying to manage the aftermath, it was now impossible to organize this event in a way that we can manage accommodations, travel problems, and other issues related to having some or all participants required to be in the same physical location. Therefore, we decided to conduct 16th of the series as **an online event** starting on May 8, 2023 and ending on May 10, 2023. **Collected fees were directed to AFAD as aid for the survivals of the earthquake.**

Hosted and organized by the Physics Department of University of Karabük, the conference was comprised of a series of online presentations contributed by researchers from different countries. **11** renowned researchers across different countries were invited to give talks on various subjects that can give directions to future scientific studies. **40** speakers from **18** different countries presented their works (**48 speeches in total**). The countries represented by their respective fellow researchers were *Türkiye, USA, United Kingdom, France, Japan, Italy, Greece, Russia, Croatia, Romania, Malaysia, Pakistan, Iraq, Iran, Azerbaijan, Uzbekistan,*

Algeria, Nigeria. There were also non-speaker participants from these countries along with other non-speaker participants from *Germany, Australia, China, Brazil, Czech Republic, Slovakia, Bulgaria, Kazakhstan*. These participants had a chance of watching and listening presentations, asking some important questions on the possible future directions of presented works and igniting useful discussions. In total, number of participants were **99** attending from across **26** different countries.

The event was conducted with the aim of honouring **100th anniversary of foundation of Turkish Republic**, and we believe, we achieved that. The topics of the meeting were more diverse compared to the previously held ones, but we managed to keep the integrity of the series intact. The quality of works presented was evident. Respected researchers around the world appreciated our sincere efforts and praised useful discussions among peers that made the event even more delightful. Our hope is that this meeting made a positive impact on future collaborations among participants and guide our young Turkish researchers to the right path on their respective scientific studies.

Thanks to **Mustafa Kemal ATATÜRK** and his reforms, we achieved significant advances in science in the first century of our republic's history. We wish a brighter future for our beloved country and its young researchers.

Prof. Dr. Necla ÇAKMAK
Chief of NSP 2023 Conference

ACKNOWLEDGEMENTS

First of all, we would like to thank all participants for their important contributions. Sounded and well researched works presented in these meetings will encourage future participants to have even more quality in their respective works. The organizers of this conference make every effort to keep conference fees as low as possible to facilitate attendance of young researchers. These efforts were relatively successful, and a lot of new young faces could be seen at the conference.

We also thank the chairs of each session who successfully managed to let each presentation start and finish in time. Thanks to their patience and persistence on keeping the track of time we could have enough time for question-answer sessions that was necessary to ignite useful discussions along the lines of relevant topics. They also helped young presenters when they needed some encouragements during their presentations, and they kindly handled some difficulties that are inherit in any online meeting. The organizing committee also wishes to acknowledge the assistance and encouragement that we have received from our organizations and the many other individuals, who helped prepare this event. In some stages of preparations, there were only a handful of people who could sacrifice their time and they did it without asking favours. We are also very grateful to the reviewers, whose very consistent reviewing of abstracts was of great help in improving the quality of many papers.

Finally, we would like to note that this year is the 100th anniversary of foundation of Turkish Republic. 100 years ago, Mustafa Kemal ATATÜRK and his fellow fighters fought for independence of this country with great resolve. Therefore, we like to see this event as a commemoration of their efforts on saving our beloved nation and leading us to create a modern Turkish state. The following quotation united us in the past and will always guide us to the future:

“My moral heritage is science and reason. Anyone willing to appropriate my ideas for themselves after me will be my moral inheritors, provided they would approve the guidance of science and reason on this axis”.

Mustafa Kemal ATATÜRK

Prof. Dr. Necla ÇAKMAK
Chief of NSP 2023 Conference

COMMITTEES

Honorary Committee

- ✓ Prof. Dr. Refik Polat *(Rector, Karabük University, Karabük, Türkiye)*
- ✓ Prof. Dr. Ayşe Nallı *(Dean, Science Faculty, Karabük University, Karabük, Türkiye)*

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- ✓ Hasan Gümüş *(Independent Researcher – retired from Ondokuz Mayıs University, Samsun, Türkiye)*
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- ✓ Khusniddin K. Olimov *(Physical-Technical Institute of Uzbekistan Academy of Sciences, Tashkent, Uzbekistan)*
- ✓ Mannap Yusupovich Tashmetov *(Institute of Nuclear Physics, Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan)*
- ✓ Manuela Cavallaro *(Laboratori Nazionali del Sud - INFN, Catania, Italy)*

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- ✓ Tahmasib Aliyev *(Middle East Technical University, Ankara, Türkiye)*
- ✓ Takehiko R. Saito *(High Energy Nuclear Physics Laboratory, RIKEN, Saitama, Japan)*
- ✓ Valentin Olegovich Nesterenko *(Joint Institute for Nuclear Research, Dubna, Moskow Region, Russia)*

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- ✓ Aybaba Hançerlioğulları *(Kastamonu University, Kastamonu, Türkiye)*
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- ✓ Nihal Büyükçizmeci *(Selçuk University, Konya, Türkiye)*
- ✓ Serkan Akkoyun *(Sivas Cumhuriyet University, Sivas, Türkiye)*
- ✓ Tuncay Bayram *(Karadeniz Technical University, Trabzon, Türkiye)*

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- ✓ Ahmet Mustafa Erer
- ✓ Hüseyin Yıldırım
- ✓ Khalid Hadi Mahdi Aal-Shabeeb
- ✓ Necla Çakmak ***(Chief)***
- ✓ Savaş Ağduk
- ✓ Ulvi Kanbur
- ✓ Taufiq Abdullah

INVITED SPEAKERS

Esra YÜKSEL

(Surrey University, Guilford, United Kingdom)

Constraining the nuclear symmetry energy using parity-violating electron scattering experiments

Fabrice PÉLESTOR

(Toulon, France)

Anti-Missile Reactive Net

İlkay TÜRK ÇAKIR

(Institute of Technology Accelerator, Ankara University, Ankara, Türkiye)

Future Circular Collider (FCC) Project

Izyan Hazwani HASHIM

(Universiti Teknologi Malaysia, Jahor, Malaysia)

Ordinary Muon Capture Delayed Gamma Ray Analysis for double beta decays (DBDs) and anti-neutrino nuclear responses

Jameel-Un NABI

(University of Wah, Vice Chancellor, Wah, Pakistan)

Half-life of heavy and exotic nuclei to investigate the r-process

Khusniddin K. OLIMOV

(Physical-Technical Institute of Uzbekistan Academy of Sciences, Tashkent, Uzbekistan)

Correlations between parameters of the Tsallis distribution and Hagedorn function with transverse flow in proton-protons collisions at the LHC

Mannap Yusupovich TASHMETOV

(Institute of Nuclear Physics, Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan)

The development and implementation of perspective technologies

TOPICS

- ✓ Nuclear Structure
- ✓ Nuclear Reactions
- ✓ Nuclear Astrophysics
- ✓ Nuclear Models
- ✓ Nuclear Scattering
- ✓ Nuclear Energy
- ✓ Nuclear Reactors
- ✓ Nuclear Analytical Methods
- ✓ Accelerator Physics
- ✓ Medical and Health Physics
- ✓ High Energy and Particle Physics
- ✓ Nuclear Application in Life Science
- ✓ Radiation Measurements and Dosimeters
- ✓ Nuclear Engineering
- ✓ Other Related Topics

CONTACT

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Website: https://nsp2023.karabuk.edu.tr/en

SCIENTIFIC PROGRAMME

May 8, 2023 Monday

Morning Session 09.15 – 10.50 **Time Zone Istanbul (GMT+3)**
Chair: Necla Çakmak (Karabük Un., Karabük, Türkiye)

09.15 – 09.30 Opening Remarks
09.30 – 09.55 **Takehiko R. Saito** (RIKEN, Japan)
Experimental studies of light hypernuclei

09.55 – 10.20 **Serkan Akkoyun** (Sivas Cumhuriyet Un., Sivas, Türkiye)
Creating an Online Calculation Tool for Fission Barrier Energy based on Machine Learning Methods

10.20 – 10.35 **Mouna Bouhelal** (Echahid Cheikh Larbi Tebessi Un., Algeria)
Theoretical investigation of the T=1/2, A=27 Mirror Nuclei

10.35 – 10.50 **Mouna Bouhelal** (Echahid Cheikh Larbi Tebessi Un., Algeria)
Study of the Energy Spectrum of ^{26}Mg

10.50 – 11.20 COFFEE BREAK
Morning Session 11.20 – 12.30 **Time Zone Istanbul (GMT+3)**
Chair: Serkan Akkoyun (Sivas Cumhuriyet Un., Sivas, Türkiye)

11.20 – 11.35 **Abir Selim** (Echahid Cheikh Larbi Tebessi Un., Tebessa, Algeria)
Shell-Model Study of the Nuclear Structure of ^{25}Al Nucleus

11.35 – 11.50 **Abir Selim** (Echahid Cheikh Larbi Tebessi Un., Tebessa, Algeria)
Investigation of The Energy Spectrum of ^{24}Al Using the PSDPF Interaction

11.50 – 12.05 **Ayşe Çömü** (Selçuk University, Konya, Türkiye)
Analysis of Irradiation Effects on Laroxyl Drug Using EPR Spectroscopy

12.05 – 12.20 **Gamze Ekici** (KTO Karatay University, Konya, Türkiye)
ESR Dating of Old Beyşehir Lake Basin Using Fossil Mollusc Shells

12.30 – 13.30 LUNCH BREAK
Afternoon Session 13.30 – 15.00 **Time Zone Istanbul (GMT+3)**
Chair: Nihal Büyükçizmeci (Selçuk Un., Konya, Türkiye)

13.30 – 13.55 **Fabrice Pelestor** (France)
Anti-Missile Reactive Net

13.55 – 14.20 **Khusniddin K. Olimov** (Uzbekistan Academy of Sciences, Tashkent Uzbekistan)
Correlations between parameters of the Tsallis distribution and Hagedorn function with transverse flow in proton-protons collisions at the LHC

14.20 – 14.35 **Khusniddin K. Olimov** (Uzbekistan Academy of Sciences, Tashkent Uzbekistan)
Dependencies of the average transverse momenta of charged particles on particle species, centrality and collision energy in Au+Au collisions from the BES program at the RHIC

14.35 – 14.50 **Fatima Benrachi** (Frères Mentouri Constantine-1 Un., Algeria)
Nuclear Properties of Even-Even Nuclei in Calcium-40 Region

14.50 – 15.05 **Nadjet Laouet** (Frères Mentouri Constantine-1 Un., Algeria)
Proton Rich A=95 Systems Nuclear Structure: Nushellx@MSU Application

15.10 – 15.30 COFFEE BREAK

Afternoon Session 15.30 – 17.00 Time Zone Istanbul (GMT+3)
Chair: Savaş Ağduk (Karabük Un., Karabük, Türkiye)

15.30 – 15.45 **Robert Poenaru** (Horia Hulubei National Institute of Nuclear Physics and Engineering, Romania)
Parity Partner Bands and the Wobbling Motion in 163-Lu

15.45 – 16.00 **Christopher Oluwatobi Adeogun** (Miva University, Nigeria)
Investigation of the Air-Gap Signal in Kalman Filter Under Relative Acceleration

16.00 – 16.15 **Gamze Hoşgör** (Sakarya University, Sakarya, Türkiye)
Polarization Effects on g_R-factors in Odd-Mass Deformed Nuclei

16.15 – 16.30 **Gamze Hoşgör** (Sakarya University, Sakarya, Türkiye)
Understanding the Low-Energy Electromagnetic Dipole Response in ^{155}Sm Nucleus: A Theoretical Perspective

16.30 – 16.45 **Esra Evcin Baydilli** (Hakkari University, Hakkari, Türkiye)
The Detection of the Gamma-Irradiation Effects on Electrical Characteristics of Au/3% Gr-doped PVA/p-Si Type Schottky Structure

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May 9, 2023 Tuesday

Morning Session 09.30 – 10.50 Time Zone Istanbul (GMT+3)
Chair: Mahmut Böyükata (Kırıkkale Un., Kırıkkale, Türkiye)

09.30 – 09.55 **Jameel-Un Nabi** (University of Wah, Wah Cantt, Pakistan)
Half-life of heavy and exotic nuclei to investigate the r-process

09.55 – 10.20 **Manuela Cavallaro** (Laboratori Nazionali del Sud – INFN, Catania, Italy)
Double charge-exchange reactions for the nuclear matrix elements of neutrinoless double beta decay

10.20 – 10.35 **Francesco Cappuzzello** (Catania University, Catania, Italy)
Heavy-ion induced direct reactions with the MAGNEX spectrometer at INFN-LNS: A multi-channel approach

10.35 – 10.50 **Frederic Lasiaille** (FL Researcher, France)
Relativity in motion

10.50 – 11.20 COFFEE BREAK

Morning Session 11.20 – 12.30 Time Zone Istanbul (GMT+3)
Chair: Tuncay Bayram (Karadeniz Technical Un., Trabzon, Türkiye)

11.20 – 11.35 **Dennis Bonatsos** (Inst. of Nuclear and Particle Phy., NCSR, Greece)
Shape coexistence and shape/phase transitions in even-even nuclei

11.35 – 11.50 **Ergash M. Tursunov** (INP-Academy of Sciences, Uzbekistan)
Detailed Study of the Astrophysical Capture Reaction $\alpha(d, \gamma)^{6}Li$ in a Three-Body Model

11.50 – 12.05 **Majid Gojayev** (Baku State University, Baku, Azerbaijan)
Production of the vector boson and two Higgs bosons in the electron-positron collisions

12.05 – 12.20 **Elif Kemah** (Sakarya Un., Sakarya, Türkiye)
Investigation of the Ground-State M1 moments in ^{229,231}Th Isotopes

12.30 – 13.30 LUNCH BREAK

Afternoon Session 13.30 – 15.00 Time Zone Istanbul (GMT+3)
Chair: Nihal Büyükçizmeci (Selçuk Un., Konya, Türkiye)

13.30 – 13.55 **Mannap Yu.Tashmetov** (INP-Academy of Sciences of the Republic of Uzbekistan)
The development and implementation of perspective technologies

13.55 – 14.20 **Esra Yüksel** (University of Surrey, Surrey, United Kingdom)
Constraining the nuclear symmetry energy using parity-violating electron scattering experiments

14.20 – 14.35 **Sema Küçüksucu** (University of Zagreb, Zagreb, Croatia)
Isotopic dependence of (n, α) reaction cross sections for Fe and Sn nuclei

14.35 – 14.50 **Büruce Öztürk** (Sakarya Un., Sakarya, Türkiye)
Magnetic Moment Inference and Modeling of $^{53-81}$Cu Nuclei with Anfis

14.50 – 15.05 **Nihal Büyükçizmeci** (Selçuk Un., Konya, Türkiye)
Rapidity distributions of nuclei and hypernuclei

15.10 – 15.30 COFFEE BREAK

Afternoon Session 15.30 – 17.00 Time Zone Istanbul (GMT+3)
Chair: Aybaba Hançerlioğulları (Kastamonu Un., Kastamonu, Türkiye)

15.30 – 15.45 **Mohammad Reza Hadizadeh** (Central State University, Ohio, USA)
Investigating Few-Body Systems in 2D Materials: Adapting Faddeev Method from Nuclear Physics

15.45 – 16.00 **Aybaba Hançerlioğulları** (Kastamonu Un., Kastamonu, Türkiye)
Utilization Of Some Boron Containing Minerals as Fast Neutron Shielding in Nuclear Power Plants

16.00 – 16.15 **Rezvan Rezaeizadeh** (University of Guilan, Rasht, İran)
Solutions of Klein-Gordon equation with Woods-Saxon potential through PQR method

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May 10, 2023 Wednesday

Morning Session 09.30 – 10.50 Time Zone Istanbul (GMT+3)
Chair: Nihal Büyükçizmeci (Selçuk Un., Konya, Türkiye)

09.30 – 09.55 **Valentine O. Nesterenko** (JINR, Dubna, Russia)
Anomalous behavior of nuclear moment of inertia

09.55 – 10.20 **Izyan Hashim** (Universiti Teknologi Malaysia, Malaysia)
Ordinary Muon Capture Delayed Gamma Ray Analysis for double beta decays (DBDs) and anti-neutrino nuclear responses

10.20 – 10.35 **Mehmet Dağ** (Karabük Un., Karabük, Türkiye)
Gamow-Teller Transition Logft Value for Pd-114 Isotope

10.35 – 10.50 **Huseynqulu Quliyev** (National Aviation Academy of Azerbaijan, Azerbaijan)
Distribution of dipole excitation up to 10 MeV: The case of ^{124}Xe nucleus

10.50 – 11.20 COFFEE BREAK

Morning Session 11.20 – 12.30 Time Zone Istanbul (GMT+3)
Chair: Savaş Ağduk (Karabük Un., Karabük, Türkiye)

11.20 – 11.45 **İlkay Türk Çakır** (Institute of Technology Accelerator, Ankara Un., Türkiye)
Future Circular Collider (FCC) Project

11.45 – 12.00 **Sultan Şahin Bal** (Bitlis Eren Un., Bitlis, Türkiye)
The Determination of ^{238}U, ^{232}Th and ^{40}K Radioactivity Concentrations of Some Healing and Spa Water in Bitlis

12.00 – 12.15 **Sultan Şahin Bal** (Bitlis Eren Un., Bitlis, Türkiye)
The Determination of ^{222}Rn Gas Radioactivity Concentrations of Some Healing and Spa Water in Bitlis

12.15 – 12.30 **Khalid H. Mahdi Aal-Shabeeb** (Karabük Un., Karabük, Türkiye)
Comparing the concentration of radon in the old and new residential houses in Karabük city/Türkiye using the passive method

12.30 – 13.30 LUNCH BREAK

Afternoon Session 13.00 – 14.15 Time Zone Istanbul (GMT+3)

Chair: Mahmut Böyükata (Kırıkkale Un., Kırıkkale, Türkiye)

13.30 – 13.45 **Abdurahman Büber** (Kırıkkale Un., Kırıkkale, Türkiye)
Nuclear Structure of even-even $^{100-128}Cd$ isotopes under the framework of IBM-1

13.45 – 14.00 **Najm Abdullah Saleh Saleh** (University of Duhok, Duhok, Iraq)
U1F Transition Logft Value for As-74 Isotope by pn-QRPA

14.00 – 14.15 **Esranur Yalçınkaya** (Sakarya Un., Sakarya, Türkiye)
Investigation of $I^{\pi}=1^{-}$ excited states properties in neutron-deficient ^{162}Yb nucleus

14.30 – 15.00 Closing Remarks

16th International Conference on Nuclear Structure Properties
NSP 2023
8 – 10 May, 2023, Karabük University, Karabük, Türkiye

TIME ZONE ISTANBUL (GMT+3)

8 May 2023 Monday		9 May 2023 Tuesday		10 May 2023 Wednesday	
Chair: Necla Çakmak		**Chair: Mahmut Böyükata**		**Chair: Nihal Büyükçizmeci**	
09.15 - 09.30	Opening Remarks				
09.30 - 09.55	Take R. Saito	09.30 – 09.55	Jameel-Un Nabi	09.30 – 09.55	Valentine O. Nesterenko
09.55 - 10.20	Serkan Akkoyun	09.55 – 10.20	Manuela Cavallaro	09.55 – 10.20	Izyan Hashim
10.20 – 10.35	Mouna Bouhelal	10.20 – 10.35	Francesco Cappuzzello	10.20 – 10.35	Mehmet Dağ
10.35 – 10.50	Mouna Bouhelal	10.35 – 10.50	Frederic Lasiaille	10.35 – 10.50	Huseynqulu Quliyev
10.50 – 11.20 COFFEE BREAK					
Chair: Serkan Akkoyun		**Chair: Tuncay Bayram**		**Chair: Aysuhan Ozansoy**	
11.20 – 11.35	Abir Selim	11.20 – 11.35	Dennis Bonatsos	11.20 – 11.45	İlkay Türk Çakır
11.35 – 11.50	Abir Selim	11.35 – 11.50	Ergash M. Tursunov	11.45 – 12.00	Sultan Şahin Bal
11.50 – 12.05	Ayşe Çömü	11.50 – 12.05	Emilya Omarova	12.00 – 12.15	Sultan Şahin Bal
12.05 – 12.20	Gamze Ekici	12.05 – 12.20	Elif Kemah	12.15 – 12.30	Khalid H. Mahdi Aal-Shabeeb
12.30 – 13.30 LUNCH BREAK					
Chair: Nihal Büyükçizmeci		**Chair: Nihal Büyükçizmeci**		**Chair: Mahmut Böyükata**	
13.30 – 13.55	Fabrice Pelestor	13.30 – 13.55	Mannap Yu.Tashmetov	13.30 – 13.45	Abdurahman Büber
13.55 – 14.20	Khusniddin K. Olimov	13.55 – 14.20	Esra Yüksel	13.45 – 14.00	Najm Abdullah Saleh Saleh
14.20 – 14.35	Khusniddin K. Olimov	14.20 – 14.35	Sema Küçüksucu	14.00 – 14.15	Esranur Yalçınkaya
14.35 – 14.50	Fatima Benrachi	14.35 – 14.50	Büruce Öztürk	14.15 – 14.30	Closing Remarks
14.50 – 15.05	Nadjet Laouet	14.50 – 15.05	Nihal Büyükçizmeci		
15.10 – 15.30 COFFEE BREAK					
Chair: Savaş Ağduk		**Chair: Aybaba Hançerlioğulları**			
15.30 – 15.45	Robert Poenaru	15.30 – 15.45	Mohammad Reza Hadizadeh		
15.45 – 16.00	Christopher Oluwatobi	15.45 – 16.00	Aybaba Hançerlioğulları		
16.00 – 16.15	Gamze Hoşgör	16.00 – 16.15	Rezvan Rezaeizadeh		
16.15 – 16.30	Gamze Hoşgör				
16.30 – 16.45	Esra Evcin Baydilli				

ABSTRACTS

16th International Conference on Nuclear Structure Properties (NSP2023),
May 8 – 10, 2023, Karabük University, Karabük, Türkiye

Experimental studies of light hypernuclei

Takehiko R. Saito

High Energy Nuclear Physics Laboratory – RIKEN, Saitama, Japan

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Abstract

Studies of hypernuclei, subatomic bound systems with at least one hyperon, have been contributing for understanding the fundamental baryonic interactions as well as the nature of dense nuclear matters. Hypernuclei can also reveal nature of ordinary sub-atomic nuclei by using a hyperon as a prove or/and an impurity in nuclei. Hypernuclei have already been studied for almost seven decades in reactions involving cosmic rays and with meson- and electron-beams. In recent years, hypernuclear studies can also be performed by using energetic heavy ion beams, and some of these experiments have revealed unexpected results on three-body hypernuclear states, i.e., shorter lifetime [1-7] and larger binding energy [8] of the lightest hypernucleus, the hypertriton, than what was formerly determined and the unprecedented bound state with a Lambda hyperon with two neutrons [9]. These results have initiated several ongoing experimental programs all over the world to study these three-body hypernuclear states precisely. We are studying those light hypernuclear states by employing different approaches from the other experiments. We employ heavy ion beams on fixed nuclear targets with the WASA detector and the Fragment separator FRS at GSI (the WASA-FRS project) in Germany for measuring their lifetime precisely [10]. The experiment was already performed in the first quarter of 2022, and the data analyses are in progress. We also analyze the entire volume of the nuclear emulsion irradiated by kaon beams in the J-PARC E07 experiment [11, 12, 13] in order to measure their binding energies at the world best precision [10]. We have already uniquely identified events associated with the production and decays of the hypertriton, and the binding energy of the hypertriton is to be determined. We also search events of other single-strangeness hypernuclei and double-strangeness hypernuclei in the E07 emulsion to understand the nature of Lambda-nucleon, Lambda-Lambda and Xi-nucleon interactions. We are using Machine Learning techniques for all our projects with heavy ion beams and nuclear emulsions [10]. These projects will be extended at FAIR in Germany, HIAF in China and J-PARC in Japan.

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Creating an online calculation tool for fission barrier energy based on machine learning methods

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Abstract

Fission barrier height is an important component for many reasons, including stellar nucleosynthesis [5], estimating the survival probabilities of the produced stable super-heavy nuclei [6], and calculating the competition between the fission process and neutron evaporation [7]. It is not possible to observe directly [8], although little experimental information is available [9]. However, Fission barrier height is estimated theoretically with various models. With the fission barrier height information, the survival probabilities of superheavy nuclei can also be reached. It is therefore important to have accurate knowledge of fission barriers, such as the discovery of superheavy nuclei in the stability island in the region of superheavy nuclei. In this study, an online computation module has been developed that includes the results of fission barrier height estimation using different machine learning approaches. The results obtained in the calculations with different machine learning approaches were published as a calculation module on an open access website. By entering basically proton, neutron, and mass numbers of the nuclei, it can be obtained fission barrier height information with the statistical error indicators of the machine learning methods.

Keywords — *Fission barrier height, nuclear structure, machine learning*

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Theoretical investigation of the T=1/2, A=27 mirror nuclei

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Abstract

Theoretical study of the mirror states in the T=1/2 pair ^{27}Al and ^{27}Si, reduce uncertainties in the astrophysical ^{26}Al(p,γ)^{27}Si reaction rate. We performed a shell model calculation using the Coulomb free PSDPF interaction to study the complete spectra of the ^{27}Al and ^{27}Si mirror system. The excitation energies of the negative-parity states were calculated for the first time in these nuclei. The good agreement between the calculated spectrum and the experimental spectra of the two mirrors permitted us to confirm the uncertain J^{π} and to assign states with unknown J^{π}. We were able to restrict the assignments of proton-unbound states in ^{27}Si, which are important to evaluate the ^{26}Al(p,γ)^{27}Si reaction rate. We calculated the half-lives as well in the T=1/2 pair ^{27}Al and ^{27}Si and compared them to experiment. There is a quite good agreement experiment versus theory. The detailed discussion of our study will be presented in our contribution.

Keywords — *Mirror nuclei, astrophysical ^{26}Al(p,γ)^{27}Si reaction rate, spin/parity assignments, PDFPF interaction.*

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Study of the energy spectrum of ^{26}Mg

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Abstract

Proton-rich nuclei are of great relevance in astrophysics, especially the rapid proton capture rp-process. Advances in spectroscopic studies of these nuclei have aroused renewed interest. One of the most important rp-process is the ^{25}Al(p,γ)^{26}Si reaction. The determination of the correct levels of ^{26}Si, based on their analogues in the mirror nucleus ^{26}Mg, is crucial to calculate the reaction rate.

A complete study of the energy spectrum, up to about 10 MeV, of the ^{26}Mg nucleus has been performed in a shell model context, using our effective (0+1)$\hbar\omega$ PSDPF interaction. All the excitation energies are quantitatively well reproduced by PSDPF. The comparison of the obtained results with available experimental data led to the confirmation of the ambiguous states and to the prediction of the spin/parity assignments of the unknown states. Important predictions have been proposed in ^{26}Mg that pushed us to extend the study to the ^{26}Si mirror nucleus and the determination of the T=1 states in ^{26}Al. In our study, all the spin/parity assignments of states above the proton threshold in ^{26}Si have been proposed. Detailed discussion of this study will be presented in our contribution.

Keywords — *rp-process, astrophysical ^{25}Al(p,γ)^{26}Si reaction, spin/parity assignments, PDFPF interaction.*

Half-life of heavy and exotic nuclei to investigate the r-process

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Abstract

β-decay is amongst the key properties of nuclei required for the modeling of r-process nucleosynthesis. It governs the flow of abundances among neighboring isotopic chains of high-mass elements. Several theoretical models are being used for the evaluation of different parameters of nuclear β-decay. In the present work, microscopic proton-neutron quasi particle random phase approximation (pn-QRPA) model has been used for the calculations of β-decay half-lives of Rb, Sr and Zr neutron rich isotopes. For $^{(97-103)}$Rb, $^{(98-107)}$Sr and $^{(104-112)}$Zr, where the experimental data are available, the half-life values are reproduced. In addition, predictions of half-lives for some experimentally unmeasured, very neutron-rich nuclei $^{(104-112)}$Rb, $^{(108-113)}$Sr and $^{(113-115)}$Zr are also made by using the best fit parameterization values of Gamow-Teller force constants. Our results exhibit good agreement with the recent available experimental data having ratios of calculated to experimental half-lives within 0.25 to 2.0. Our predicted half-life values are also comparable to the predictions from other models.

Double charge-exchange reactions for the nuclear matrix elements of neutrinoless double beta decay

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Abstract

The presentation aims at describing an overview of the activities related with the NUMEN project at INFN – LNS. NUMEN is an international collaboration which proposes an innovative technique to give information on the nuclear matrix elements entering the expression of the decay rate of double beta decay by cross section measurements of heavy-ion induced Double Charge Exchange (HI-DCE) reactions. The exploration of HI-DCE reactions is of interest not only for double beta-decay investigations, but also for studies of nuclear reaction and nuclear structure. From the experimental side, the characteristically tiny cross sections for HI-DCE processes and the high background generated by other more probable competing reactions is the main challenge, which has hindered HI-DCE spectroscopy until recent years. From the theory side, the description of the measured HI-DCE cross sections poses manifold challenges. Dealing with processes involving composite nuclei, HI-DCE reactions can, in principle, proceed through several alternative paths. These, in turn, correspond to different reaction mechanisms probing competing aspects of nuclear structure, from mean field to various classes of nucleon-nucleon interactions and correlations. A powerful way to scrutinize the nuclear response to HI-DCE is to consistently link it to the information extracted from the competing quasi-elastic reactions. Indeed, these complementary studies are mandatory to minimize the systematic errors in the data analyses and build a many-facets and parameter-free representation of the systems under study.

Heavy-ion induced direct reactions with the MAGNEX spectrometer at INFN-LNS: A multi-channel approach

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Abstract

In this study presented the main achievements and future perspectives of the MAGNEX magnetic spectrometer at the INFN-LNS laboratory in Catania (Italy). MAGNEX is a large-acceptance magnetic spectrometer for the detection of the ions emitted in nuclear collisions below Fermi energy. The role of MAGNEX in solving old and new puzzles in nuclear structure and direct reaction mechanisms is emphasized. The use of double charge-exchange reactions toward the determination of the nuclear matrix elements entering in the expression of the half-life of neutrinoless double beta decay is reviewed.

Anti-Missile Reactive Net

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Abstract

We study the detonation of a circular yield explosive cord around a missile which is modelised as a cylinder. Missile has 142 mm diameter (R = 71 mm, top at X = 120 mm, bottom at X = 600 mm = boundary of the mesh); Circular yield explosive HMX cord has 302 mm diameter (R = 151 mm); Diameter of yield HMX explosive cord is 30 mm (center coordinates: X = 120 mm, Y = 151 mm). The yield explosive cord burns instantaneously: Physical justification of this axisymmetric modelisation is time elapsed for full burned yield cord and small missile traveling distance during this time. This is because detonation wave has 9110 m/s and missile speed is 200 m/s: The detonation goes in the two opposites sides, at right and left of the detonator. The speed of the detonation wave, the Chapman-Jouguet speed, is for HMX 9110 m/s.

Relativity in motion

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FL research

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Abstract

In General Relativity (GR), the motion of quarks is assumed to be entirely taken into account when converting their energy of motion into their corresponding macroscopic energy at rest. This is correct locally, but this motion generates also microscopic gravitational waves which propagate their space-time deformations everywhere. Therefore, globally this motion yields immediately a retardation of the gravitational force. This is the first effect of this motion. The other consequences of this motion should be calculated in GR, but those calculations are cumbersome. Hopefully, they can be approximated using a new and discrete equation. This equation shows that another effect arises, which is that the gravitational force must be divided by the energy of the surroundings of the location where the force is exerted, after multiplication by an appropriate factor. This effect was studied in a previous work [1] and was called "surrounding". The main result of this study is that the motion of the quarks generates a surrounding effect in gravitation which might give an explanation to the gravitational issues of today.

Keywords — *Relativity, Gravitation, Gravitational Wave*

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Anomalous behavior of nuclear moment of inertia

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Abstract

There are remarkable examples (back bending [1], magnetic rotation [2-4]) where interplay of global rotation and mean-field degrees of freedom affects nuclear moments of inertia *J*. Here we suggest a new interplay effect leading to anomalous dependence of *J* on nuclear deformation. Light nuclei ^{24}Mg and ^{20}Ne provide interesting opportunities to investigate dependence of *J* on pairing and mean-field features at extreme deformations. Using Skyrme forces SVbas, SkM* and SLy6, we explore pairing and mean-field impacts on *J* in the framework of four different microscopic models of a rising complexity: Inglis, Inglis-Belyaev, Thouless-Valatin and adiabatic time-dependent Hartree-Fock. The constrained calculations cover a wide range of the axial quadrupole deformation $0< b < 1.2$. All the models give similar results: at large deformations close to experimental values (b=0.605 in ^{24}Mg and 0.720 in ^{20}Ne), there is a strong *counterintuitive decrease of J with b*. This anomalous behavior of *J* is explained by specific evolution of particular particle-hole (1ph) proton and neutron configurations with b. A similar effect is found in medium deformed nucleus ^{170}Hf. The experimental data for the ground-state bands in ^{20}Ne and ^{170}Hf partly support our predictions. We discuss the conditions for this effect and possible ways of its experimental search.

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Ordinary muon capture delayed gamma ray analysis for double beta decays (DBDs) and anti-neutrino nuclear responses

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Abstract

This is a brief review of ordinary muon capture (OMC) experiments at the Paul Scherrer Institute (PSI) in Zurich, which are relevant for the study of double beta decays (DBDs) and anti-neutrino nuclear responses. OMC involves a charge exchange reaction mediated by the charged weak boson, resulting in reactions with muons (μ) and muon neutrinos (νμ). In OMC on nuclei, the nucleus typically becomes highly excited and unbound, subsequently returning to its ground state by emitting various particles such as neutrons, protons, alphas, deuterons, and others, accompanied by delayed gamma rays. The subjects discussed in this review include:

- ✓ Unique features of OMC for studying DBDs and astrophysical anti-neutrino nuclear responses.
- ✓ The measurement of delayed gamma rays for ^{24}Mg, ^{82}Kr, and ^{130}Xe at PSI for study neutrino nuclear responses for DBDs and anti-neutrinos.
- ✓ The impact of OMC results on neutrino nuclear responses for DBDs and anti-neutrinos. Finally, remarks and perspectives on OMC experiments for studying neutrino nuclear responses are briefly described.

Shell-model study of the nuclear structure of ^{25}Al nucleus

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Abstract

The study of proton-rich nuclei plays an important role in the understanding of a variety of nuclear astrophysical processes [1]. The spectrum of the ^{25}Al nucleus with a short half-life of only 7.2 s [2] is not well known and thus, it has been the subject of extensive experimental investigations. Our work focuses on the study of the complete energy spectrum of the ^{25}Al, in particular, those observed at excitations energies of astrophysical interest in relation with the ^{24}Mg(p,γ)^{25}Al [3] and ^{22}Mg(α,p) ^{25}Al [4] astrophysical reactions. We use the PSDPF interaction [5] to describe both positive and negative parity states in this nucleus, and then compared them to available experimental data. Important predictions of the spin/parity assignments for the ambiguous states in ^{25}Al have been made based on the comparison to the experimental available data [1] and to its counterparts in the mirror ^{25}Mg one. The results of our calculations are in good agreement with the experimental data. A detailed discussion of our work will be presented in this contribution.

Keywords — *PSDPF interaction, Shell model, rp-process, α-process, reaction rate.*

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Investigation of the energy spectrum of ^{24}Al using the PSDPF interaction

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Abstract

Nowadays, in nuclear physics, as in many other scientific fields, experiment and theory are strongly linked. The combination of the two studies has led to significant advances in our understanding of the structure and behavior of atomic nuclei, in particular, the energy spectra and various other spectroscopic properties of nuclei throughout the sd shell region. Level structure of the ^{24}Al spectrum, just above the proton threshold 1864.11 keV [1], is important for the comprehension of the rp processes. ^{24}Al plays a crucial role in the calculation of the ^{23}Mg(p,γ)^{24}Al reaction rate [2] which involves the determination of the spin/parity level assignments, which are only well-known for the first four states. The main aim of our work is the identification of spin/parity assignments of all the states observed in the ^{24}Al spectrum within the framework of the shell-model and using the (0+1) PSDPF interaction [3]. The comparison of the obtained results with the available experimental data [1] and with their counterparts in the ^{24}Na mirror will be discussed in our contribution.

Keywords — *PSDPF interaction, Shell model, rp-process, reaction rate.*

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Analysis of irradiation effects on laroxyl drug using EPR spectroscopy

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Abstract

It is known that as a result of exposure to radiation, deterioration in the structure of the drug can occur and radiation can induce radical(s). It is important to determine the effects of radiation in the structure of the drug, as it may adversely affect human health. In this study, the effects of gamma radiation on Laroxyl 25 mg antidepressant drug, which is effective in the treatment of various depressive disorders, were determined using Electron Paramagnetic Resonance (EPR) spectroscopy. Depending on various factors, the incidence of depression has increased in recent years, and therefore the rate of use of antidepressants has reached serious levels. Considering the multitude of uses of radiation in human life, for Laroxyl drug it is meaningful to investigate the radiation effects and to determine whether radiation induced radical(s) formed in its structure. For this purpose, in this study, EPR analysis was performed for the laroxyl drug samples, both unirradiated and irradiated, in the dose range of 10 Gy to 600 Gy. The samples were irradiated by ^{60}Co gamma source located at Turkish Energy, Nuclear and Mineral Research Agency, Nuclear Energy Research Institute and EPR spectra of the samples were recorded using JEOL JesFa-300 X-band EPR spectrometer under various spectrometer conditions. Microwave and temperature dependence of the EPR signals were investigated to obtain the characteristic properties of radiation induced radical(s). In addition, in the studied dose range, radiation dependence of EPR signals and their fading at room temperature were examined to investigate the usability of the drug as an accidental dosimeter.

Keywords — *Electron Paramagnetic Resonance (EPR), irradiation, laroxyl drug, dosimeter*

ESR dating of old beyşehir lake basin using fossil mollusc shells

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Abstract

Electron Spin Resonance (ESR) is a unique spectroscopic technique used in direct detection and characterization of radicals having unpaired electrons. ESR dating, widely used in geology, relies on the time-dependent accumulation of electrons and vacancies in the crystal lattice of minerals due to the radiation exposure emitted by radioactive isotopes in the sample and its surroundings. In this study ESR spectroscopy was used for dating of Old Beyşehir Lake Basin. The study area is in the deposits located between the borders of Konya and Isparta provinces. From the area, mollusc shells were collected for ESR analysis and dating experiments, during systematic sampling in stratigraphic measured sections. Paleontological analysis was performed and the mollusc species of *Valvata pulchella* Studer, typical dominant species of the Old Beyşehir Lake and pointing to a freshwater lake, were selected as dating material for ESR dating of Kömür Construction Site (labelled as L1-1) and Karadiken (labelled as L17-1) locations in the studied area. Powdered fossil mollusc shells (between the sizes of 125-250 µm) were equally massed and irradiated in the dose range of 10-1100 Gy by ^{60}Co gamma source located at Turkish Energy, Nuclear and Mineral Research Agency, Nuclear Energy Research Institute. ESR experiments were carried out by JEOL JesFa-300 X-band ESR spectrometer located in Selçuk University Advanced Technology Research and Application Center (ILTEK). The stable and radiation sensitive orthorhombic CO_2^- radical having g=1.9973 value was used for ESR dating after preheating of samples at 180°C for 16 minutes. Using the Y2Science dating program, the dose-response curves for the fossil shells were fitted to the single exponential function and equivalent dose (D_E) values were calculated by extrapolation. The annual dose rates (D) were found by using the radioactive element concentrations in and around the samples, determined by ICP-MS method, and by considering the cosmic dose rate contributions, moisture effect and powder grain sizes. ESR ages were calculated according to Uranium Uptake model using ROSY program and found 659 ± 257 ka and 479 ± 110 ka for L1-1 and L17-1, respectively which are in the estimated age range by geologists from stratigraphic and paleontological correlations.

Keywords — *Electron Spin Resonance (ESR) Dating, Old Beyşehir Lake Basin, fossil mollusc shells*

Correlations between parameters of the Tsallis distribution and Hagedorn function with transverse flow in proton-protons collisions at the LHC

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Abstract

The correlations among parameters of the thermodynamically consistent Tsallis distribution and Hagedorn function with embedded transverse flow, obtained from combined analysis of the experimental midrapidity transverse momentum spectra of the charged pions and kaons, protons and antiprotons as a function of the average charged-particle multiplicity density, $\langle dN_{ch}/deta \rangle$, measured by ALICE Collaboration at the LHC, have been analyzed in p+p collisions at $(s)^{1/2}$ = 7 and 13 TeV. The strong anticorrelation between non-extensivity parameter q for the charged pions and effective temperature, T, of the Tsallis distribution has been observed in p+p collisions at $(s)^{1/2}$=7 and 13 TeV. The parameter q for the protons and antiprotons has been strongly positively correlated with T in both p+p collisions at $(s)^{1/2}$=7 and 13 TeV. Relatively strong positive correlation between parameter q (n) for the charged pions and q (n) for the charged kaons has been found in both p+p collisions at $(s)^{1/2}$=7 and 13 TeV. This could be due to similarity of mechanisms of production of pions and kaons, having a similar quark structure, in high-energy proton-proton collisions. The strong anticorrelation between parameter q for the charged pions and q for the protons and antiprotons has been obtained in both p+p collisions at $(s)^{1/2}$=7 and 13 TeV. The obtained significant differences in the characters of parameter correlations for protons and antiprotons, on the one hand, and pions and kaons, on the other hand, are probably due to the significant differences in the quark structure and mechanisms of production of baryons and mesons in proton-proton collisions at high energies. The substantially differing behavior of the q (n) versus $\langle dN_{ch}/deta \rangle$ dependencies in regions $\langle dN_{ch}/deta \rangle < 6-7$ and $\langle dN_{ch}/deta \rangle > 6-7$ has been obtained for all studied particle types in both p+p collisions at $(s)^{1/2}$ = 7 and 13 TeV. The totally opposite

correlations between parameter n (q) for pions and kaons and $<dN_{ch}/deta>$ observed in regions $<dN_{ch}/deta> < 6$ ($<dN_{ch}/deta> < 7$) and $<dN_{ch}/deta> > 6$ ($<dN_{ch}/deta> > 7$) support the findings of our recent works [***Universe* 8,** 174 (2022), https://doi.org/10.3390/universe8030174; *Int. J. Mod. Phys. A* 36, 2150149 (2021), https://doi.org/10.1142/S0217751X21501499] about a possible onset of deconfinement phase transition at $<dN_{ch}/deta> \approx 6.1\pm0.3$ ($<dN_{ch}/deta> \approx 7.1\pm0.2$) in proton-proton collisions at $(s)^{1/2}=7$ TeV ($(s)^{1/2}=13$ TeV).

The work of the coauthors from Kazakhstan, Uzbekistan, and China has been supported by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP14869032), Agency of Innovative Development of the Ministry of Higher Education, Science and Innovation of Uzbekistan (Grant № F3-20200929146), and by the National Natural Science Foundation of China (Grant № 11575103) and the Shanxi Provincial Natural Science Foundation (Grant № 201901D111043), respectively.

Keywords *— proton-proton collisions at the LHC; transverse momentum distributions of hadrons; Tsallis distribution; effective temperature; non-extensivity parameter q; QCD-inspired Hagedorn function; Hagedorn function with embedded transverse flow; transverse flow; kinetic freeze-out temperature; exponent parameter n; onset of deconfinement phase transition; Quark-gluon plasma (QGP)*

Dependencies of the average transverse momenta of charged particles on particle species, centrality and collision energy in Au+Au collisions from the BES program at the RHIC

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Abstract

The experimental spectra of the average transverse momentum, $\langle p_t \rangle$, versus the average number of participant nucleons, $\langle N_{part} \rangle$, dependencies of the identified charged particles at midrapidity in Au+Au collisions from the Beam Energy Scan (BES) program at the RHIC in $(s_{nn})^{1/2}$= 7-39 GeV energy range have been described very well with the proposed simple power model function. The degree of flattening of $\langle p_t \rangle$ of the charged pions and kaons, protons and antiprotons in the analyzed heavy-ion collisions in $(s_{nn})^{1/2}$=7-39 GeV energy range have been investigated analyzing the dependencies of the obtained exponent parameter *alpha* of the simple power function on the particle species and collision energy $(s_{nn})^{1/2}$. On the whole, the exponent parameter *alpha* for the charged kaons, protons and antiprotons decreases noticeably with increasing collision energy of Au+Au collisions from $(s_{nn})^{1/2}$= 7 to 39 GeV. While for the charged pions the power parameter *alpha* decreases weakly in range $(s_{nn})^{1/2}$=7-20 GeV and practically does not change in region $(s_{nn})^{1/2}$=20-39 GeV. The significant gap between parameter *alpha* for the protons and antiprotons has been observed in region $(s_{nn})^{1/2}$=7-20 GeV. The normalization fitting constant *C* and power parameter *alpha* of the simple power function have been strongly anticorrelated for all studied particle species. The differences observed between parameter *alpha* versus collision energy dependencies of the particles and antiparticles have been related to the ratios of antiparticle and particle yields and differences in the mechanisms of production of particles and antiparticles. The observed dependencies of the evolution of the parameter *alpha* with changing Au+Au collision energy for the particles and antiparticles could reflect the interplay between associated particle production, which is

dominant at the low energy range of BES at the RHIC, and pair production mechanism, which becomes dominant at the high energy range of BES. It is deduced that the parameter *alpha* can be sensitive to the particle production mechanism(s) and its significant change could be related to the change in mechanisms of particle production or/and phase transitions in a nuclear/hadronic matter.

The work of the coauthors from Kazakhstan, Uzbekistan, and China has been supported by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP14869032), Agency of Innovative Development of the Ministry of Higher Education, Science and Innovation of Uzbekistan (Grant № F3-20200929146), and by the National Natural Science Foundation of China (Grant № 11575103) and the Shanxi Provincial Natural Science Foundation (Grant № 201901D111043), respectively.

Keywords — *Heavy-ion collisions at the RHIC, average transverse momenta of particles, flattening of the average p_t, mechanisms of particle production; onset of deconfinement phase transition, mixed phase of QGP and hadrons*

Nuclear properties of even-even nuclei in Calcium-40 region

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Abstract

In this work, we have investigated some spectroscopic properties of even-even proton-rich nuclides located above the ^{40}Ca region. The calculations, included isotopes with the same proton and neutron particle (Z=N) numbers, are performed by means of NuShellX@MSU nuclear shell model code. The used fp valence space consists of eight proton and neutron orbitals with single particles energies outside of ^{40}Ca doubly magic core. The fpd6 effective interaction is adopted on pn-formalism. Energies of low-lying states and transition probabilities of these isobars have been determined. The obtained results are then compared with the available experimental Data.

Keywords — *NuShellX@MSU nuclear structure Code; ^{40}Ca core; Z=N proton-rich nuclei*

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Proton rich A=95 systems nuclear structure: Nushellx@MSU application

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Abstract

Proton rich isotopes close to proton-drip line are of intensive interest for nuclear structure studies in such limit conditions. These unstable systems offer the opportunity to develop theoretical models studying nuclear structure. In this context, the work carried out within the framework of this study is based on the nuclear structure properties investigation of A=95 isobars near ^{90}Zr isotope. The calculations are realized in the framework of the nuclear shell model, by means of NushellX@msu nuclear structure code. Using the snet original interaction of the code, we carried out some modifications based on the mass dependent and introduced *gdpn* one. The calculated excited states are, then, compared with the available experimental data for all studied isobars.

Keywords — *A=95 isobars, Proton rich nuclei, Nuclear structure, NuShellX@MSU code*

Parity partner bands and the wobbling motion in 163-Lu

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Abstract

The wobbling spectra for 163-Lu nuclei is studied with a new formalism in which the four known Triaxial Strongly Deformed bands (i.e., TSD1, TSD2, TSD3, and TSD4) are re-structured in terms of phonon excitations. It is shown that TSD1 and TSD2 are signature partner bands (zero-phonon excitations), TSD3 is the one-phonon excitation built on top of TSD2, and TSD2-TSD4 are Parity Partner Bands. This concept of parity partner bands, which assumes both bands are described by the same wave-function that is invariant to space inversion, is used within a Particle-Rotor-Model. The model gives a semi-classical expression for the total energy of an odd-mass nucleus, and it is used to describe the wobbling spectra for 163-Lu. Moreover, from the conservation laws for the total angular momentum and the total energy, one obtains a set of geometrical representations that give an insight into the actual trajectories of the system as it rotates around a fixed position. The rotational properties of wobbling nuclei are becoming a hot topic nowadays, as it is one of the few fingerprints of triaxiality.

Keywords — *Nuclear structure, wobbling motion, parity, phonon excitations*

Investigation of the air-gap signal in Kalman filter under relative acceleration

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Abstract

The basic element of the EMS suspension is the electromagnet system, which suspends the vehicle without contact by attracting forces to the rails at the guideway. The suspension of a vehicle by attractive magnetic forces is inherently unstable and consequently it is continuously adjusted by the strength of the suspending electromagnet from rail irregularity and bending of the guideway. To improve reliable tracking, it needs to get feedback signals without measurement delay time. In this paper the concept of feedback control system with Kalman Filter in EMS is proposed. The input signals in the feedback control system are an air-gap and an acceleration signal. The air-gap signal with noise from the gap sensor is transformed to the filtered air-gap signal y without measurement delay time by using Kalman Filter. The filtered air-gap signal is transformed to a relative velocity and a relative acceleration signal. Then it multiplies these values by gain matrix in order to get the actuator's reference voltage value. The simulation results show that the dynamic responses of the suspension system can be improved by reducing the influence of measurement delay time of air-gap signals.

Keywords – *Electromagnetic suspension, Feedback control, Kalman filter, Magnetic levitation*

Polarization effects on g_R-factors in odd-mass deformed nuclei

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Abstract

This research investigates the polarization phenomenon and its effects on the collective gyromagnetic ratio (g_R) in odd-mass deformed nuclei. We used the Rotational Invariant Quasiparticle Phonon Nuclear Model (RI-QPNM). The formulation includes an axially symmetric Woods-Saxon potential as mean-field, monopole pairing, residual spin-spin force, and the restoration terms for broken rotational symmetry choosing according to Pyatov's prescription. The model has a zero-energy solution corresponding to the rotational motion, which makes obtaining g_R-factors of the core possible. On the other hand, the remaining solutions lead to polarization in odd-mass nuclei, quenching both spin and angular momentum matrix elements and thus affecting the contribution of odd-particle to the g_R. It has been demonstrated that one should consider the polarization factor associated with both spin and angular momentum $\Delta K=1$ matrix elements to achieve quantitative agreement with the experimental data.

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Keywords — *Rotational gyromagnetic ratio, polarization factor, odd-mass nuclei, deformed nuclei, rotational invariance*

Understanding the low-energy electromagnetic dipole response in ^{155}Sm nucleus: A theoretical perspective

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Abstract

In this theoretical study, we investigate the low-energy electromagnetic dipole response of the ^{155}Sm nucleus by utilizing the Rotational, Translational & Galileo Invariant Quasiparticle Phonon Nuclear Model (RTGI-QPNM). Our aim is to investigate the contribution of electric dipole ($E1$) and magnetic dipole ($M1$) transitions to the low-lying part of the dipole spectrum and their impact on the fragmentation of the summed radiation widths in ^{155}Sm. Our findings suggest that while $M1$ transitions are responsible for most of the dipole strength in the low-lying part of the dipole spectrum, the contribution of $E1$ strength cannot be ignored in ^{155}Sm. Also, we have compared our theoretical results with the available experimental data, and the experimental spectra have been agreeably produced by theory.

Keywords — *Electromagnetic dipole, ^{155}Sm, scissors mode, electric dipole resonance, photo-absorption cross-section*

The detection of the Gamma-irradiation effects on electrical characteristics of Au/3% Gr-doped PVA/p-Si type Schottky structure

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Abstract

Considering that Schottky structures, which are semiconductor devices, are used effectively in satellite systems, biomedical devices, and nuclear plant devices, it is important to examine the effect of irradiation on electrical properties for these devices to work reliably/safely under radiation. In this study, basic diode characteristics such as shunt resistance, series resistance, ideality factor and potential barrier height of Au/3% Gr-doped PVA/p-Si type Schottky structure, were investigated for 0 kGy, 5 kGy and 10 kGy gamma-irradiation doses. The irradiation-dependent current-voltage (I-V) curve was used to compute these basic diode characteristics individually by the Thermionic Emission theory, Ohm's Law, Norde, and Cheungs' functions. It was observed that the ideality factor, potential barrier height, and series resistance values obtained by these methods were behaviorally the same despite small numerical differences. The small numerical differences are thought to be since each method is valid in different regions of the I-V curve. As seen in Table 1, it was observed that series resistance and ideality factor parameters decreased while potential barrier height values increased by the increase in the applied radiation doses. This behavior of series resistance has been attributed to the decrease/increase of the trapped free carrier density due to the defects caused by the gamma-irradiation effects. It was concluded that this change of ideality factor and potential barrier height parameters due to irradiation is an indication of deviation from Thermionic Emission theory and is because different current-transport mechanisms are effective together or alone. As a result, it has been revealed that the electrical properties of the Au/3% Gr-doped PVA/p-Si type Schottky structure are highly affected by the gamma-irradiation.

Keywords *– Gamma-irradiation, Ohm's law, Norde functions Cheungs' functions, Schottky structures*

Shape coexistence and shape/phase transitions in even-even nuclei

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Abstract

The subtle relation between shape coexistence (SC) and shape/phase transitions in even-even nuclei is explored by looking at the systematics of the B(E2) transition rates between the first excited state of angular momentum zero, which is the bandhead of the intruder band, and the first excited state with angular momentum two, which belongs to the ground state band. It turns out that shape coexistence should be expected in nuclei lying within the stripes of nucleon numbers 7-8, 17-20, 34-40, 59-70, 96-112 predicted by the dual shell mechanism of the proxy-SU(3) model, avoiding their junctions, within which high deformation is expected. Along major proton shell closures one sees SC due to neutron-induced proton particle-hole excitations, while SC due to proton-induced neutron particle-hole excitations is related to a first-order shape/phase transition from spherical to deformed shapes and appears away from major shell closures.

Keywords — *Shape coexistence, shape/phase transitions*

Detailed study of the astrophysical capture reaction α(d, γ)^{6}Li in a three-body model

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Abstract

The direct astrophysical capture reaction α(d, γ)^{6}Li is one of the most important processes for the solution of the lithium abundance problem in the Universe. Although the primordial abundance of the ^{6}Li element is much smaller than that of the ^{7}Li, it is necessary to estimate both primordial abundances separately. In present study the astrophysical S-factor, reaction rates of the direct α(d, γ)^{6}Li capture process, and the primordial abundance of the lithium isotope ^{6}Li are evaluated in a three-body model. The final ^{6}Li nucleus is described as a α+p+n three-body bound state in the Hyper-spherical Lagrange mesh method. At the long-wavelength approximation, E1 transitions are forbidden between isospin-zero states. Hence E1 radiative capture is strongly hindered in reactions involving N = Z nuclei but the E1 astrophysical S factor may remain comparable to, or larger than, the E2 S-factor. It was found that the theoretical iso-vector E1 capture due to the small iso-triplet component of the final ^{6}Li nucleus of about 0.5% is dominant at low astrophysical energies below 100 keV. The astrophysical S factor and the corresponding reaction rates computed in a three-body model are in a very good agreement with the recent low-energy experimental direct data of the LUNA collaboration. Not only the absolute values of the astrophysical S-factor and reaction rates, but also their energy and temperature dependences are reproduced, respectively.

The estimated primordial abundance rate ^{6}Li/H=(0.67±0.01)×10^{-14} within the three-body model is consistent with the data ^{6}Li/H=(0.80 ± 0.18)×10^{-14} of the LUNA collaboration.

Keywords *— Lithium abundance, three-body model, isospin forbidden E1-transition, astrophysical S-factor, reaction rates.*

Production of the vector boson and two Higgs bosons in the electron-positron collisions

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Abstract

Within the framework of the Standard Model, considering the arbitrary polarization states of the electron-positron pair, the differential cross section of the process of associated production of the vector boson and the Higgs boson pair is calculated. All Feynman diagrams with the vertex of three Higgs boson, two Higgs and two vector bosons, as well as with the vertex of two vector boson and one Higgs boson interactions are taken into account. The left-right and transverse spin asymmetries are determined. The characteristics features of the behavior of the polarization characteristics and the differential effective cross section of the reaction depending on the departure angles and particle energies are investigated. It is shown that the left-right spin asymmetry depends only on the Weinberg parameter while the transverse spin asymmetry $\boldsymbol{A_{\varphi}}$ is a function of the angles $\boldsymbol{\theta}$, $\boldsymbol{\varphi}$ and the scaling energies $\boldsymbol{x_z}$, $\boldsymbol{x_1}$ of particles. The transverse spin asymmetry is positive and at $\boldsymbol{x_z = 0.60}$ $(\boldsymbol{0.65})$ with increasing angle $\boldsymbol{\theta}$, it decreases (increases) and reaches a minimum (maximum) at an angle of $\boldsymbol{\theta = 90°}$, and with further increase in angle, the transverse spin asymmetry increases (decreases). Integrating over the departure angles of the particles, for the energy distribution of the Higgs boson is obtained formula. The dependance of the differential cross section on the scaling energy $\boldsymbol{x_1}$ at energy $\boldsymbol{\sqrt{s} = 500\ GeV}$ and various values of the variable $\boldsymbol{x_2}$ is stided. At $\boldsymbol{x_2 = 0.85}$ the differential cross section increases with the grows of the variable $\boldsymbol{x_1}$.

The possibility of measuring of the triple Higgs boson interaction constant, and the interaction constant of two Higgs bosons and two vector bosons is discussed.

Keywords *– Higgs boson, electron-positron pair, left-right spin asymmetry, transverse spin asymmetry.*

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The development and implementation of perspective technologies

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Abstract

Using of scientific achievements is one of ways to solve of growing requirement for energy, materials, products, and other. The development and implementation of perspective technologies is carried out in the field of nuclear physics, condensed matter physics, nanomaterial science, radiation physics, radiochemistry, agriculture, medicine, and biotechnology. In Uzbekistan, considering of actual directions of the physical science is being carried out of scientific investigations on nuclear physics and elementary particle physics, nuclear analytics and radiochemistry, condensed matter physics, radiation materials science, nuclear energy, nuclear medicine and ecology. For research purposes, the institute has the nuclear reactor with 10 MW power, the cyclotron with accelerated particles (protons) energy 20 MeV, the electron accelerator with 8 MeV energy, the neutron generator NG-150, and gamma-ray (Co-60) facility.

The nuclear reactor, the cyclotron and the neutron generator are the main facilities for conducting research on nuclear physics. Studies are carried out of content and composition of elements in substances at the nuclear reactor, X-ray fluorescent devices, mass spectroscopy, etc. For study on condensed matter physics, along with basic facilities (nuclear reactor, cyclotron, electron accelerator, gamma-ray facility), there are diffraction facilities, atomic force microscopy, energy dispersive spectroscopy, optical, electro physical and other devices and equipment's. It should be noted that many facilities are used in interdisciplinary research. One of these is the neutron radiography and tomography facility. The facility resolution is 280 μm at L/D=600 with a neutron flight distance 6000 mm and an entrance collimator diameter is 10 mm. The facility allows studying of the internal structure, presence of defects and their distribution in various objects, including objects of cultural heritage. On the fundamental research results, various technologies have been developed and production has been organized. For example, the topaz semi-precious stones refining technology has been developed, silicon doping, the institute is one of the world's leading exporters of radioisotopes (*I-125, Co-57, P-32, P-33, Lu-177, etc.*). Works carried out at the WWR-SM nuclear reactor to determine of the content of precious metals in rocks, drill bits are hardened at the gamma facility, medical devices and pharmaceutical raw materials are sterilized at the electron accelerator.

Constraining the nuclear symmetry energy using parity-violating electron scattering experiments

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Abstract

In this talk, I will discuss recent developments in the nuclear energy density functional (NEDF) theory, which provides a unified approach to studying and understanding the static and dynamic properties of atomic nuclei as well as the equation of state of nuclear matter. Until now, the NEDFs have mainly been parametrized using ground-state properties of nuclei, such as masses and charge radii, which are inadequate to constrain the isovector channels of the effective interactions. The recent parity-violating electron scattering experiments, CREX [1] and PREX-II [2], have provided new data on the parity-violating asymmetry, weak-charge form factors and neutron skin thicknesses of ^{48}Ca and ^{208}Pb that can provide valuable insights into the isovector channel of the NEDFs. By directly constraining the EDFs using experimental weak-charge form factors, we have uniquely constrained the isovector channels of the effective interaction for three different functionals [3]. We found that the results display contradictory findings between the new functionals based on CREX and PREX-II data. During this talk, I will discuss the implications of the experimental data on the optimization of the NEDFs and present our findings on nuclear symmetry energy, neutron skin thickness, and dipole polarizability.

Keywords *— Nuclear energy density functional, parity-violating electron scattering experiment, neutron skin thickness.*

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Isotopic dependence of (n, α) reaction cross sections for Fe and Sn nuclei

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Abstract

The (*n, α*) reactions play an important role for the energy generating and the synthesis of chemical elements in the stars, as well as for nuclear engineering and medical applications. In this study, the isotopic dependence of (*n, α*) reactions cross sections have been studied. Model calculations of the cross sections are based on the statistical Hauser-Feshbach model for Compound reactions in TALYS implementation, using global optical model potential that is additionally adjusted by the (*n, α*) cross section data for ^{54}Fe and ^{118}Sn. The calculations of (*n, α*) reactions in Fe and Sn isotopes provide the insight into their isotopic dependence and properties over the complete relevant range of neutron energies. The results show the evolution of the cross sections with pronounced maxima at low-mass isotopes, and rather strong decrease for neutron-rich nuclei consistent with the reduction of the reaction *Q*-value and increased contributions from other exit channels from compound nucleus. The analysis of the Maxwellian averaged cross sections at temperatures in stellar environment shows that while the (*n, α*) reactions contribute for the low-mass isotopes, in neutron induced reactions with nuclei with neutron excess, γ and neutron emission dominate.

Keywords — *Cross section, (n, α) reactions, isotopic dependence*

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Rapidity distributions of nuclei and hypernuclei

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Abstract

Rapidity distributions of light nuclei and hypernuclei are benchmarked by using hybrid models including the Ultra-relativistic Quantum Molecular Dynamics Model (UrQMD) and Dubna Cascade Model (DCM) together with Statistical Multifragmentation Model (SMM). As a conclusion, results are in agreement with HADES and STAR experimental data and very promising for the further investigations in the facilities such as FAIR, LHC, and NICA.

Keywords — *Rapidity, UrQMD model, DCM model, SMM model.*

Investigating few-body systems in 2D materials: Adapting Faddeev Method from nuclear physics

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Abstract

This talk explores the development of a generalized framework for studying the bound states of three-charged-particle systems in two dimensions by adapting the Faddeev scheme, which is well-established in the context of few-body nuclear systems. We formulate three coupled Faddeev integral equations to compute binding energy and wave functions for three distinct mass particles interaction with three different pair interactions. We address the numerical challenges associated with repulsive potentials and outline various screening methods employed to overcome these issues. As a practical example, we showcase the numerical outcomes for a negative trion, consisting of two electrons and one hole, situated within a Molybdenum Disulfide monolayer.

Keywords — *Three-body bound states, Faddeev equations, 2D materials.*

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Utilization of some boron containing minerals as fast neutron shielding in nuclear power plants

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Abstract

In this study,3 different boron-doped minerals concentrations shielding materials of cross-sections of calculated with the help of the MCNP program for the use of neutron shielding in nuclear reactors. In addition, some physical and chemical properties, properties, and usage areas of these minerals are given. MCNP can be called as the calculation of physical events using probability distribution functions. Deterministic methods answer the question of what the average response is resulting from interactions in the system when the transport of particles in the system is examined. For this purpose, boron, which has many uses the compounds made by the minerals and the places where these compounds are used are investigated. Neutron shielding is most effective is the nucleus of the shield material has about the same mass as the neutron. This makes hydrogen rich materials excellent neutron shits. There needs also to be something to absorb the neutrons, boron being the poison of choice. We have investigated fast neutron shielding properties of Vimsite ($CaB_2O_2(OH)_4$), Sussexite ($Mn^{+2}BO_2(OH)$and Veatchite ($Sr_2B_{11}O_{16}(OH)_5(H_2O)$ samples simulation process. Recently shielding is an important issue because of neutrons which have many applications today do not harm living tissue. Different compounds, alloys and composites are usually preferred against neutrons as shielding material.

Keywords*: Cross-Sections, Boren, Nuclear Fission, Nuclear Power Plane, Neutron Shilding, MCNP*

Solutions of Klein-Gordon equation with Woods-Saxon potential through PQR method

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Abstract

In relativistic calculations, the Klein-Gordon equations are encountered in quantum field logic and in a sequence program. Since the Schrodinger equation does not consider special theory of relativity, it is insufficient especially in subatomic particle calculations. In relativistic Quantum Mechanics, the Klein-Gordon (KG) equation has many applications. Lately, there have been many discussions on KG equation with different types of potentials by using several methods to explain relativistic QM systems. The most important feature and originality of our studied that until this time the studies required numerical and complex and high mathematics. But the proper quantization rule (PQR) method developed by converting the exact quantization rule (EQR) into simpler basic integrations, especially for the calculation of complex energy spectra with nuclear potential. In this study, the radial part of the KG equation is solved for Woods-Saxon potential by using the PQR method within the Pekeris approximation to the centrifugal potential term. The energy eigenvalues are calculated.

Keywords – *Woods-Saxon potential, Exact Quantization Rule, Nuclear Potential, Relativistic Quantum, Klein-Gordon Nikiforov-Uvarov Method*

Investigation of the ground-state *M*1 moments in ^{229,231}Th isotopes

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Abstract

In this study, we have used the Quasiparticle Phonon Nuclear Model (QPNM) approach to calculate the magnetic dipole moments of the ground state with $5/2^+$ in the ^{229,231}Th isotopes. Our calculations show that the ground-state magnetic moment of ^{229}Th is obtained as μ=+0.428 μ_N (for rotational gyromagnetic ratio g_R=0.31), which is in good agreement with the experimental value of μ=+0.46±0.04 μ_N (for g_R=0.309±0.016) [1]. Similarly, the ground-state magnetic moment of ^{231}Th has been calculated as μ=+0.461 μ_N, which has not been experimentally measured yet. Our theoretical calculations provide insights into the magnetic properties of these nuclei and can guide future experimental studies. The good agreement between the calculated and experimental values for ^{229}Th gives confidence in the accuracy of the QPNM approach in predicting the magnetic moments of nuclear states.

Keywords *— M1 moment, QPNM, ^{229,231}Th*

Reference

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Magnetic moment inference and modeling of $^{53-81}$Cu nuclei with Anfis

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Abstract

This study includes the investigation of the magnetic properties of odd-mass Cu nuclei, which are very popular in biomedical applications. With the Adaptive Neuro-Fuzzy Inference Systems (Anfis), a hybrid artificial intelligence model, inferences were made about the magnetic moments of the $^{53-81}$Cu isotopes with odd mass numbers. For this inference system, 600 nuclei were trained (R^2= %0.986) and 200 nuclei were tested (R^2=%0.99). Two successful processes encouraged inferences about odd-A Cu isotopes that do not have experimental magnetic moment values in the literature. The very small, calculated error rate (RMSE=0.002%) supports the reliability of the inference result about ^{53,55,79,81}Cu isotopes without experimental magnetic moment data. The compatibility of ground-state spin values and magnetic moments of these isotopes is discussed with surface graphics. These inference results were also supported by a theoretical method, the Quasiparticle-Phonon Nuclear Method (QPNM).

Keywords — *Anfis, Magnetic Moment, $^{53-81}$Cu, Artificial İntelligence, QPNM*

Distribution of dipole excitation up to 10 MeV: The case of ^{124}Xe nucleus

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Abstract

In this paper, the Pygmy dipole resonance (PDR) and the Spin-flip resonance (SFR) in even-even γ-soft 124Xe isotopes have been investigated within Translational + Galilean Invariance (TGI-) and Rotational Invariance (RI-) Quasiparticle Random Phase Approximation (QRPA), respectively. In this context, fragmentation of the PDR and SFR states were investigated up to 10 MeV. Our TGI-QRPA cross-section results show a similar trend to the available experimental data. According to RI-QRPA results, the spin-flip M1 strengths exhibit a broad distribution between 5 and 10 MeV and occupy 11 % of the total dipole strength.

Keywords *— Pygmy dipole resonance, Spin-flip resonance, Translational + Galilean Invariance, Rotational Invariance, QRPA.*

Future Circular Collider (FCC) project

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Abstract

This presentation includes some information about "The Future Circular Collider (FCC)" project exploring concepts and technologies for the next generation of powerful particle colliders. Also, the FCC scenarios for three different types of particle collisions as FCC-hh, FCC-ee, and FCC-he are mentioned for comparison, which is supported by EuroCirCol Project.

The determination of ^{238}U, ^{232}Th and ^{40}K radioactivity concentrations of some healing and spa water in Bitlis

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Abstract

In this study, 25 medicinal water samples were collected from some hot springs, drinking and mineral water sources (17 different sources of healing water) in the center and districts of Bitlis. Radioisotope activity concentration levels of ^{238}U, ^{232}Th and ^{40}K of the collected samples were determined. Obtained data were compared with literature data and UNSCEAR values and interpreted.

Keywords — *Medicinal water sample, radioisotopes, Bitlis*

The determination of ^{222}Rn gas radioactivity concentrations of some healing and spa water in Bitlis

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Abstract

In this study, 25 medicinal water samples were collected from some hot springs, drinking and mineral water sources (17 different sources of healing water) in the center and districts of Bitlis. Radioisotope activity concentration levels of ^{222}Rn of the collected samples were determined. Obtained data were compared with literature data.

Keywords — *Medicinal water sample, radon, Bitlis*

Comparing the concentration of radon in the old and new residential houses in Karabük city / Türkiye using the passive method

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Abstract

This study is an update of the little information about Radon concentration available for Karabük region, especially the old residential houses, 10 old residential houses and 15 modern houses were selected in the summer season and 10 old and the same new houses in the winter season. 180 CR-39 track detectors, four detectors for each house, were suspended in the living and sleeping rooms for a period of one month. The detectors were then collected and chemically etched. The results indicated that the average radon concentrations in the old houses (with a range of 82.884 to 113.083 Bq/m^3) were higher than in the modern ones (with a range of 55.884 to 77.581 Bq/m^3) by 52.78% in the winter season, and 39.78% in the summer season (with a range of 34.845 to 60.487 Bq/m^3) and (with a range of 32.215 to 51.282 Bq/m^3) respectively. This is due to the nature of the building materials used and the style of construction (where we find glass facades that occupy larger areas in modern houses). The radioactive indices of radon gas were also calculated, so they were higher in the old houses than in the modern houses, but we find both are less than the values recommended by scientific institutions [UNSCEAR & ICRP].

Keywords — *CR-39 Detector**, Radon, Old residential houses.*

Nuclear structure of even-even $^{100-128}$Cd isotopes under the framework of IBM-1

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Abstract

The interacting boson model (IBM-1) is actively used to investigate the nuclear structural properties of even-even isotopes. In this work, some nuclear structural properties such as energy levels and electromagnetic transition probabilities of even-even $^{100-128}$Cd isotopes along isotopic chain were studied by using IBM-1 model. The parameters of the suitable model Hamiltonian were fitted to experimental energy levels by analyzing the energy ratios along isotopic chain. The calculated energy levels and B(E2) values are in good agreement with the experimental ones. This study also includes the analysis of deformation parameters to see the geometrical behavior of given isotopes.

Keywords — *Cd isotopes, energy levels, B(E2) values, IBM-1 model.*

U1F transition Log*ft* value for As-74 isotope by pn-QRPA

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Abstract

The weak interaction is one of the four fundamental forces found in nature. It plays an important role in many astrophysical processes such as strong, electromagnetic, and gravitational forces [1]. It is well known that β decay processes are very important to understand the weak interaction processes and the nuclear structure. Although there are many theoretical and experimental studies on allowed β transitions in the literature, scientists have not shown the same interest in forbidden transitions [2]. In β decays, the energy spectrum is characterized by transitions and change in parity, where the total angular momentum in the daughter and parent nuclei differs by ΔJ = 2 units. Such decays are known as unique first forbidden (U1F) decays [3]. It was concluded that U1F transitions contributed significantly to beta decay half-lives [4]. The 2^+ ground state of As-74 decays to the 0^- ground state of Ge-74 with a probability of 66% [5]. This is a transition of the first forbidden unique type. In this study, the ft values and reduced matrix elements for the ΔJ = 2 transitions for the As-74 nuclei were calculated using proton-neutron Quasiparticle Random Phase Approximation (pn-QRPA) model. The Woods-Saxon potential is used in our calculations. The calculated the pn-QRPA formalism results were compared with the experimental results and discussed.

Keywords — *Beta decay, U1F transition, pn-QRPA, Pyatov Method, Woods-Saxon potential.*

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Investigation of $I^{\pi}=1^{-}$ excited states properties in neutron-deficient ^{162}Yb nucleus

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Abstract

Excitations in neutron-deficient nuclei are still largely unstudied and are an unresolved issue for future research. Within the context of the Translational and Galilean Invariant Quasiparticle Random Phase Approximation (TGI-QRPA), we have investigated the dipole strengths for the neutron-deficient ^{162}Yb nucleus from the low-lying energy region to the giant dipole resonance (GDR) energy region and calculated the total E1 photo-absorption cross sections for the nucleus. In this work, we present the results for the E1 transition parameters of the ^{162}Yb nucleus for the first time and compare them to other theoretical results.

Keywords — *TGI-QRPA, 162Yb, electric dipole.*

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Gamow-Teller transition Logft value for Pd-114 isotope

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Abstract

GT transitions are one of the most common types of spin-isospin-type weak interactions in atomic nuclei [1]. Gamow-Teller (GT) transition is one of the Allowed beta decay processes and the isospin selection rule is $\Delta T = 0, \pm 1$. Along with giving information about the nuclear structure, GT transitions are also important for our understanding of many processes in nuclear astrophysics [2]. In this study, the Gamow-Teller transition properties of the Pd-114 isotope were investigated. In the literature, there are studies on beta decay modes of Palladium A=114-120 isotopes using Quasiparticle Random Phase Approximation (QRPA) formalism [3]. The beta decay of the 0+ ground state of Pd-114 is dominated by the beta decay to the 1+ ground state of Ag-114. Allowed Gamow-Teller (GT) transition was estimated using the Pyatov Method (PM) and Schematic Model (SM) for even-even neutron-rich isotopes of palladium. GT-force and loft values were also compared with experimental results and studies in the literature.

Keywords *— Beta decay, Gamow-Teller transition, pn-QRPA, Pyatov Method, Woods-Saxon potential*

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77	Najm Abdullah Saleh	Saleh	University of Duhok	Iraq	Speaker
78	Mehmet	Dağ	Karabük University	Türkiye	Speaker
79	Necla	Çakmak	Karabük University	Türkiye	Participant
80	Huseyngulu	Quliyev	The National Aviation Academy of Azerbaijan	Azerbaijan	Speaker
81	Boburbek J.	Tukhtaev	Physical-Technical Institute of Uzbekistan Academy of Sciences	Uzbekistan	Participant
82	Sh. A.	Khudaiberdyeva	Institute of Physics and Technology, Satbayev University	Kazakhstan	Participant
83	Alper	Köseoğlu	Karadeniz Technical University	Türkiye	Participant
84	Arslan	Mehmood	University of Wah	Pakistan	Participant
85	Asim	Ullah	University of Wah	Pakistan	Participant
86	Rubba	Tahir	University of Wah	Pakistan	Participant
87	Andriana	Martinou	Institute of Nuclear and Particle Physics, NCSR	Greece	Participant
88	Spyridon	Peroulis	Institute of Nuclear and Particle Physics, NCSR	Greece	Participant
89	Theo	Mertzimekis	National and Kapodistrian University of Athens	Greece	Participant
90	Nikolay	Minkov	Institute of Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences	Bulgaria	Participant
91	K.	Mohseni	Departamento de Física, Instituto Tecnológico de Aeronáutica	Brazil	Participant
92	T.	Frederico	Departamento de Física, Instituto Tecnológico de Aeronáutica	Brazil	Participant
93	D.	R. da Costa	Departamento de Física, Universidade Federal do Ceará	Brazil	Participant
94	A. J.	Chaves	Departamento de Física, Instituto Tecnológico de Aeronáutica	Brazil	Participant
95	Aysuhan	Ozansoy	Ankara University	Türkiye	Participant
96	Saim	Selvi	Retired - Independent Researcher	Türkiye	Participant
97	Adem	Pehlivanlı	Kırıkkale University	Türkiye	Participant
98	Sefa	Ertürk	Niğde Ömer Halisdemir University	Türkiye	Participant
99	Osman	Yılmaz	Middle East Technical University	Türkiye	Participant