# 12th Conference on Nuclear and Particle Physics

# NUPPAC' 22


**15-18 May 2022**
**Sharm el-Sheikh, Egypt**

# NUPPAC' 22

## Conference Scientific Sessions

**Sunday, 15 May 2022**

| | |
|---|---|
| 17:30 - 17:45 | Conference Opening |

**Monday, 16 May 2022**

| | |
|---|---|
| 9:30 - 11:00 | Session Oral-1 |
| 11:00 - 12:30 | Session PKL-1 |
| 14:30 - 16:00 | Session Oral-2 |
| 16:00 – 17:30 | Session Oral-3 |
| 16:00 - 17:00 | Session PS |

**Tuesday, 17 May 2022**

| | |
|---|---|
| 9:30 - 11:00 | Session Oral-4 |
| 11:00 - 12:30 | Session PKL-2 |
| 14:30 -15 :30 | Session RT |

**Wednesday, 18 May 2022**

| | |
|---|---|
| 9:30 - 10:30 | Conference recommendations |
| 10:45 - 11:00 | Conference Closing |

# NUPPAC' 22

## Conference Timetable

| Time | Sun., 15 May | Time | Mon., 16 May | Tue., 17 May. | Time | Wed., 18 May |
|---|---|---|---|---|---|---|
| 7:00 | Gathering AEA Site, Nasr City | 8:00-9:00 | Breakfast | Breakfast | 8:00-9:00 | Breakfast |
| 7:30 | **Departure Cairo** | 9:30-11:00 | **Oral-1** | **Oral-4** | 9:30-11:00 | **CS** |
| 11:00-11:30 | Mid-way Rest | 11:00-12:30 | **PKL-1** | **PKL-2** | 11:30-11:45 | Hotel Check- Out |
| 15:30 | **Arrival Sharm el-Sheikh** | 13:00-14:00 | Lunch | Lunch | 12:30 | **Departure to Cairo** |
| 15:30 | Hotel Check-In | 14:30-16:00 | **Oral-2** | **RT** | | |
| 15:30-17:30 | Lunch H Accommodation | 16:00-17:30 | **Oral-3** | Sharm | 16:00-16:30 | Mid-way Rest |
| 17:30-17:45 | **OS** | 16:00-17:00 | **Poster** | Attractions | | |
| 19:00-21:00 | Dinner | 19:00-21:00 | Dinner | Dinner | 19:00-19:30 | **Arrival Cairo** |
| 21:00-23:00 | Free Evening | 21:00-23:00 | Cult Evening | Free Evening | | |

### Programme abbreviations

| | | | |
|---|---|---|---|
| **OS** | Opening Session | **PS** | Poster Session |
| **PKL** | Plenary/Keynote Talks | **RT** | Round Table Discussion |
| **Oral** | Oral Session | **CS** | Closing Session |

# NUPPAC' 22

## *Conference Abstracts Arranged by Receiving Date*

(Numbered according to the list of abstracts on the conference web site)

**1-**

**DETERMINATION OF ATMOSPHERIC BOUNDARY LAYER HEIGHTS BY RADIOSONDE DATA** *(O1)*

**Medhat M. Abdelaal Soliman**

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The heights of atmospheric boundary layer (ABL) are considerable one of the most important parameters for meeting regulatory requirements and assessing the site for construction of nuclear power plants. Therefore, collecting the meteorological data from the Integrated Global Radiosonde Archive (IGRA) version 2, for City of Mersa Matruh, which are coastal city located about 240 km west of Alexandria. Based on parcel method, mixing layer height (MLH), is the lower bound of the ABL height, is computing by a dedicated computer program. The parcel method depends on the calculation of virtual potential temperature as well as other relevant moisture variables. The upper layer meteorological data for 2019 are used; the methodologies are presents with analyzing the results. Monthly mixing height data are recommending from Regulatory Guide 4.2, revision 3, for preparation of environmental reports for site permission of Nuclear Power Plants.

**2-**

**DESIGN AND CONSTRUCTION STATUS OF THE MU2E CRYSTAL CALORIMETER** *(O2)*

**Simone Donati**

*University of Pisa and INFN Pisa, Italy*

The Mu2e experiment at Fermi National Accelerator Laboratory searches for the charged-lepton flavor violating neutrino-less conversion of a negative muon into an electron in the field of an aluminum nucleus. The dynamics of such a process is well modeled by a two-body decay, resulting

in a mono-energetic electron with energy slightly below the muon rest mass (104.967 MeV). Mu2e will reach a single event sensitivity of about $3x10^{-17}$ that corresponds to four orders of magnitude improvement with respect to the current best limit. The calorimeter requirements are to achieve an energy resolution better than 10% and a timing resolution better than 500 ps at 100 MeV in order to provide the needed 𝜇/e particle identification, an online trigger filter while aiding the track reconstruction capabilities. It consists of two disks of undoped CsI crystals, each one read out by two large area UV-extended SiPMs. In this talk, the status of construction and QC performed on the produced crystals and photosensors, the development of the rad-hard electronics and the most important results of the irradiation tests done on the different components are summarized. The production of electronics is underway and we will summarize the QC test performed on the analog electronics and on the integrated SIPM+FEE units. Construction of the mechanical parts is also progressing well. Status and plans for the final assembly are also described. We expect to start assembly of the disk in summer 2021 assuming that the pandemics status will allow the INFN team to be present at Fermilab. In the meanwhile, a complete vertical slice test with the final electronics is in progress on the large calorimeter prototype, dubbed Module-0, at the Frascati Cosmic Rays test stand. First calibration and performance results will be shown.

**3-**

**ABOUT THE ENERGY SOURCE THE SUN** *(O3)*

**Slavik Avagyan**

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In the work, the mass of the Sun itself is substituted as the basis of the energy source of the Sun. Rather, the energy of its gravitational field. As you know, there are particles in outer space and, as it is believed, in each 1cm3 volume, on average, there is one hydrogen atom. Each body that is in this environment attracts these particles. Particles in the body's gravitational field acquire kinetic energy equal to

$$E = Mah\,, \qquad (1)$$

which is then transferred to the attracting body (star, planet, etc.) in the form of heat. Rather, the kinetic energy of the particles is converted to thermal energy. In the formula M is the mass of a particle, $a$ is the gravitational acceleration of a given body, h is the distance of a particle from a celestial

body. As a result, hydrogen atoms penetrating into the body transfer their kinetic energy in the form of heat. Thus, celestial bodies (stars, planets) provide their energy with the field of attraction, which they have created by their own mass.
The same mechanism inside the Sun generates its colossal energy (temperature).

And why some of the celestial bodies are stars and some are planets? Since stars have a huge mass, the gravity of the star is so strong that it prevents the rapid removal of the resulting temperature. As a result, an excessively high temperature accumulates inside the stars, the destruction of atomic nuclei begins and colossal energy is released. And the star starts to "burn". According to the corresponding calculations, it turns out that the energy acquired by a celestial body from the attraction of hydrogen particles according to (1) is equal to

$$E = \int 10^6 m_H R_\infty R° GM r^2 4\pi r^2 (r - R°)\, dr, \qquad (2)$$

where $R_\infty$ - is the assumed boundary of the field of attraction of bodies, $R^o$ - is the radius of the body, $m_H$ - is the mass of the hydrogen atom, G is the gravitational constant $G$= $6.672x10^{-11} m^3.кg.s^2$), M is the mass attracting body. To consider the proposed model reliable, we calculate the energy acquired by the Sun.

For the Sun we have: $M$=M⊙=$10^{30}$ kg is the mass of the Sun; $R$∘=$6.96x10^8$ m -the radius of the Sun. $R_\infty$ -take the distance from the Sun to the planet Pluto, which is $R_\infty$=$6x10^{12}$ $m$. Then, according to formula (2), the energy received by the Sun will be $E$=$5.1x10^{32}$ $ergs$. And the total amount of energy emitted by the Sun per unit of time is equal to $E$=$3.8x10^{33}$ $ergs$.
Thus, for the Sun, the result is stunning — the energy acquired by the Sun and the energy emitted by the Sun are approximately equal. Thus, the proposed model about the source of the Sun's energy is substantiated by the fact that the energy acquired by the Sun and the energy emitted into the environment are equal.

**4-**

## ARBITRARY FRACTIONAL CHARGES IN THE COLLECTIVE EXCITATIONS OF THE GLASSY STATE OF MATTER *(O4)*

**Giancarlo Jug**
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As is well established, known elementary particles have electric charges that are e, (2/3)e or (1/3)e and sign + or -. However, in condensed matter physics collective excitations have been found that behave like elementary particles to all extents and purposes and, beside -e, +e, in the case of the two-dimensional electron gas in a strong magnetic field a plethora of fractional charges have been discovered: e/3, e/5, e/7 ... and some other multiples thereof.

In this talk I shall argue that in the case of glasses, common substances known to man since antiquity, low-lying excitations carrying arbitrarily small fractions of e (e/R with R typically a large real number) exist all the time at sufficiently low temperatures. This because of the real structure of glasses at intermediate-range length scales: not homogeneously disordered liquids that have become dynamically arrested, but cellular structures that are close-packed and contain fluid-like matter in-between the cells. These fluid atomic particles are charged -e, -2e etc. and spinless and attach themselves to the outer walls of solid-like nanoscopic-size cells that jam-pack and generate strong interactions amongst the trapped fluid particles. The strong correlation in the spaces between the better-ordered cells are responsible for the renormalized e/R charge of the elementary excitations in the spaces between the cells and R depends on the number of elementary ions on the walls and the ratio between electrostatic interactions and elementary tunneling parameters.

I will present experimental evidence for the existence of these new surprising elementary localized excitations in glasses and explain why their arbitrarily small charge allows for their treatment as independent collective degrees of freedom. The nature of the quasiparticles is akin to anyons and this represents a new development in quantum mechanics.

**5-**

**SYNTHESIS OF ELEMENTS FROM THE BIG BANG TO THE CURRENT EPOCH** *(O5)*

**M.N.H. Comsan**

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The Big Bang Model is known to complement our knowledge on universe and its evaluation over time. For this, the article outlines the universe epochs from the point of space-time singularity to the current time. It reviews the problem of accelerating expansion of the space (universe)

within the framework of the theory of General Relativity, and the role of dark energy in the GR cosmological constant Λ. The article also addresses the fundamental issues of nucleosynthesis and their relation to stellar evolution. It discusses the different processes, cycles and chains that are responsible for the formation of complex nuclei from the primordial hydrogen nuclei, and ending by the naturally occurring heavy elements.

**6-**

**INFLUENCE OF HEAT TREATMENT ON THE CRYSTALLITE SIZE, STRUCTURAL, ELASTIC AND MAGNETIC PROPERTIES OF COBALT FERRITE NANOPARTICLES** *(P1)*

**T.M. Ali[1], S.M. Ismail[1], N.I. Abu-Elsaad[2], M.A. Abdo[2], and M.Yehia[1]**

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The $CoFe_2O_4$ structure and magnetic characteristics were studied. The citrate nitrate combustion process was synthesized with cobalt ferrite. For all prepared samples, the x-ray diffraction analysis (XRD) illustrated a single phase cubic structure. The particle size has been found to depend heavily on the thermal treatment. The formation of nanoparticles with Spherical shape has been confirmed in high-resolution transmission electron microscopy (HRTEM). The two characteristic bands of ferrite have been observed by Fourier Transform Infrared Spectroscopy (FTIR). The M-H curve provided details about magnetic parameters such as magnetization of saturation and coercivity (Hc).

**7-**

**SPOT LIGHT ON EGYPTIAN REGULATIONS DEALING WITH DANGEROUS MATERIALS EMITTING IONIZING RADIATION** *(O6)*

**M.A.M. Gomaa**

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Egyptian nuclear and radiological laws and regulations are classified into two categories as follows: The pre 20l0 period which covered the period from 1960 till 2008, and the post 2010 period covering the period from 2010.The aim of the present work is to throw some light on the 2008

regulation dealing with dangerous waste materials emitting ionizing radiations. The 2008 regulation was issued by the decree of Minister of Electricity and Energy following Egyptian Environment Regulation Act issued in 1995.

In brief it recognize dangerous materials as waste materials if it activity concentrations exceeding exemption level. It categorized in three parts, these are:

1- Activity concentration in the used radioactive sealed and unsealed sources,

2- Activity concentration in Uranium and thorium waste ores,

3- Uranium , thorium and potassium specific activity of waste resulting from use of natural materials from different ores and metals and building materials which is excreted from the earth through mines and quarries.

Furthermore inter comparison between Egyptian activity concentration values is compared with latest values issued by international organizations such as ICRP, IAEA and the European legislations.

**8-**

**FAST NEUTRON DOSE DETERMINATION AND CHARGED PARTICLE IDENTIFICATIONS BY NTDS** *(O7)*

**E. H. Ghanim[1], S.M. Othman[2], A. Hussein[2], H. El-Samman[2] and A. El-Sersy[3]**

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In this work, nuclear track detectors, NTDs, (CR-39, CN-85) were used in charged particle identifications and dose determination. CR-39 etching conditions of 6N-NaOH at 60°C were used which lead to a value of 0.9 μm/hr and registration efficiency better than 90 %. CR-39 characterizations were carried out through detailed studies which relate alpha energies with both track diameter and critical angle of etching at different removal layers. CR-39; NTDs were used in the registration of fast neutron-induced-proton tracks as a result of neutron interaction with the constitute atoms of the detector. Induced-proton track density (ρ) was

studied with etching times at various fast neutron doses ($D_{fn}$) from 1.54 up to ≈44 mSv. The exponentially dependence between ρ and $D_{fn}$ was found at h≈11μm, were occurred and given by the formula: $D_{fn}$ = 1.27exp(0.067ρ)exp(0.067$\rho$). An empirical formula to relate proton energy, Ep and its (dE/dx)p in CR-39 was found to be Ep=170.031(dE/dx)−1.518.

Results of this study are discussed within the framework of nuclear track formation theories and etching mechanism in nuclear track detectors.

***Keywords:*** CR-39, NTDs, fast neutron, proton tracks, dE/dx, fast neutron dose.

**9-**

**NEUTRON INDUCED REACTIONS ON OBSERVATIONALLY STABLE TANTALUM ISOTOPES** *(O8)*

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Studies on $^{182}$Ta formation and de-excitation have been achieved. The thermal neutron cross-section for the $^{181}$Ta(n,γ)$^{182}$Ta reaction was measured by the activation method. The experimental samples with and without Cd shield case in 1 mm wall thickness were irradiated in an isotopic neutron field of the $^{241}$Am-Be neutron source. The induced activities in the samples were measured by high-resolution gamma-ray spectrometry of type HPGe detector. The thermal neutron cross-section for $^{181}$Ta(n,γ)$^{182}$Ta reaction has been obtained relative to the reference value, σo = 20.0$\pm$4 b for the $^{115}$In(n,γ)$^{116m}$In reaction as a single comparator. This result is discussed and compared with previous measurements and the evaluated data in ENDF and JENDL. The cross-section result obtained for $^{181}$Ta(n, γ)$^{182}$Ta reaction is in good agreement with the results of recent investigations.

**10.**

**SPECTROSCOPIC INVESTIGATIONS OF ELECTRON BEAM IRRADIATED POLYCARBONATE FILMS** *(P2)*

**M.F. Zaki[1] and A.M. Rashad[2]**

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**(Abstract not available)**

**11-**

**PHOTOPHYSICAL PROPERTIES OF POLYMERIC TRACK DETECTORS UNDER X-RAY IRRADIATION** *(P3)*

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In the present work, polymeric track detectors were irradiated with different doses of x-ray irradiation. The photophysical properties in the x-ray irradiated polymeric samples as a function of x-ray doses have been investigated. Different characterization techniques, UV-Vis spectroscopy, photoluminescence (PL) spectroscopy, and FTIR spectroscopy have been used. UVV's spectra of irradiated samples reveal that the optica l absorp tion increases with increasing the irradiation doses. The direct and indirect optical band gap was found to decrease from 3.4 and 2.81 eV for the pristine samples to 3.1 and 2.35 eV for that irradiated with x-rays at the heights irradiation dose, respectively. The number of carbon atoms per conjugated length (N) and the number of carbon atoms per cluster (M) has been estimated. An increase in both N and M with increasing irradiation dose was noticed. A remarkable decrease in PL intensity with increasing the x-ray irradiation dose was observed. This decrease is attributed to x-ray induced change in molecular structure and/or defects in the modified layer. The structural changes for unmodified and modified polymeric material have been studied.

**12-**

**EFFECT OF GAMMA RADIATION ON THE PHYSICAL PROPERTIES OF $La_{0.88}$ $Sr_{0.12}$ $Ga_{0.82}$ $Mg_{0.18}O_3$ PEROVSKITE OXIDE** *(P4)*

**Sh.I. Elkalashy, M.F. Zaki, T.V. Aksenova, V.A. Cherepanov and T.S. Soliman**

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$La_{0.88}Sr_{0.12}Ga_{0.82}Mg_{0.18}O_3$ (LSGM) perovskite oxide was synthesized by glycerol nitrate technique. The crystal structure, and surface morphology of the compound have been achieved. The samples were investigated by X-ray diffraction. The purity analysis of prepared LSGM was determined by XRF. A cubic structure dominated the structure of sample with space group (pm3m) for (LSGM). The oxides were exposed to different gamma-ray doses. X-ray diffraction analysis of oxides showed an increase in the crystalline sizes, whereas the dislocation density and microstrain decreased as the gamma dose increased. In this paper, the effect of gamma -ray radiation on (LSGM) perovskite oxide properties were studied.

**13-**

**DIRECT MEASUREMENT OF THE LOW ENERGY RESONANCES $^{22}Ne(\alpha,\gamma)^{26}Mg$ REACTION** *(O9)*

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$^{13}C(\alpha,n)^{16}O$ and $^{22}Ne$ $\alpha,n)^{25}Mg$ are considered the two important neutron sources for the s-process, but there is still uncertainty about the total available neutron flux for the s-process. $^{13}C(\alpha,n)^{16}O$ determines the neutron production in AGB stars while $^{22}Ne(\alpha,n)^{25}Mg$, which occurs during core helium and carbon shell burning, acts as the primary neutron source in massive stars. But the $^{22}Ne(\alpha,n)^{25}Mg$ reaction has a negative Q-value = - 4780.05 keV and hence operates only at high temperatures, e.g., the peak of helium burning, and during C-shell burning (if sufficient $^{22}Ne$ is available). Moreover, the neutron-producing role of $^{22}Ne(\alpha,n)^{25}Mg$ is complicated by the competing $^{22}Ne(\alpha,\gamma)^{26}Mg$ reaction, which has a positive Q-value = 10614.740 keV and therefore starts operating at relatively lower temperatures, before $^{22}Ne(\alpha,n)^{25}Mg$ can kick in. Hence it is important to investigate the reaction rate of $^{22}Ne(\alpha,\gamma)^{26}Mg$ in order to

put quantitative constraints on the neutron production for the weak s-process. It was experimentally observed by the direct measurements that the reaction rate for $^{22}Ne(\alpha,\gamma)^{26}Mg$ is strongly impacted by the low energy resonance at $E_{lab}$ = 828 keV, but the recent indirect measurements show that the resonance at $E_{lab}$ = 653 keV can appreciably impact the $^{22}Ne(\alpha,\gamma)^{26}Mg$ reaction rate. The measurement of both these resonances was performed at Sanford Underground Research facility (SURF), CASPAR. Preliminary analysis of the resonance strengths for these two resonances will be presented.

**14-**

**ANALYTICAL STUDY OF ARCHITECTURAL DESIGN FOR NUCLEAR POWER PLANTS** *(P6)*

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This paper aims to study the architectural design and components of nuclear power plants (NPPs). Its main objective is to set general guidelines for architects who will design these plants. They should be aware of the basics of nuclear facilities designs and components. An onshore nuclear power plant consists of a nuclear reactor, a control building, a turbines building, cooling towers, service buildings (an office building & a medical research center) and a nuclear & radiation waste storage building. The paper is also focusing on the simulation system (simulator). It aims to study the architectural principles and standards used in designing and planning of onshore nuclear power plants. In drawing up a master plan of an onshore nuclear power plant, the methods used in town planning should be used. These methods are centralized, linear, radial, clustered and grid. This paper aims also to study the special features of the master plan of an onshore nuclear power plant. The buildings in an onshore nuclear power plant should be segregated according to the levels of radioactivity in each one of them. There are cold areas, warm areas and hot areas. Furthermore, this paper aims to study the recent design concepts of offshore (ocean) nuclear power plants to help the engineers from different departments who will design t hese plants. The development of design concepts of offshore nuclear power plants have continued due to initiatives taking place in France, United States, Russia, and South Korea. Submerged - Type Offshore NPP designed

by a research group in France and Gravity Based Structure (GBS) - Type Offshore NPP designed by a research group in South Korea have been studied. In addition, Floating (Spar Type) Offshore NPP designed by a research group in United States of America and Russias first Floating Offshore NPP (Akademik Lomonosov) utilizing the (PWR) technology have been studied. At the end of this paper, conclusions and recommendations on the architectural aspects of nuclear power plants are revealed. This paper is important as it reveals the need to study nuclear facilities and give recommendations to the architects on how to deal with these vital facilities that have an increasing demand on the international, regional and national levels.

**15-**

**OPTICAL PROPERTIES OF POLYVINYL ALCOHOL - CARBOXYMETHYL CELLULOSE BLEND FILMS AT THE PRESENCE AND ABSENCE OF GAMMA-RAY EFFECT** *(P7)*

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Polymeric materials have a significant role in people's life due to their pivotal role in the improvement of their lives. Nowadays, ionizing radiations are powerful tooling to amendment the physical and chemical properties of polymeric materials. The gamma-irradiation is one of the common methods used to modify the physical properties of polymeric materials for high technology applications. After the interaction of gamma-rays with polymeric materials, a complex phenomenon occurs, such as intermolecular crosslinking, formation of free radicals, releasing of hydrogen atoms, oxidation process, formation of unsaturated bonds, and degradation process. Polyvinyl alcohol, carboxymethyl cellulose, and their blends were prepared by the casting method. The films were exposed to 100 kGy gamma-ray to identify their sensitivity to gamma radiation. The films

were exposed with Co-60 gamma-source at room temperature with energies in the order of 1.173 and 1.332 MeV, and dose rate 541.6 Gy/h. The irradiation was carried out in Nuclear Research Center (NRC), EAEA, Cairo, Egypt. FTIR spectroscopic analyses were performed to reveal the characteristics of functional groups. The optical properties were investigated using a UV-visible spectrophotometer. This work aimed to study the structural and optical properties of PVA, CMC, and PVA-CMC blends in the absence and presence of a gamma-ray effect. UV-visible spectra show a shift toward the lower photon energy for all films after exposure to 100 kGy gamma-ray. This may be attributed to the creation of defects in the irradiated films. The optical bandgap of the pure PVA, pure CMC, and PVA-CMC blend was found to decrease after irradiation with 100 kGy. The optical band gap decreases from 5.78 eV to about 5.71 eV as blending with 12% CMC, and for each polymer film, pure PVA or pure CMC or PVA-CMC blend, the optical band gap decreases when exposed to 100 kGy gamma-ray. The refractive indices of the pure PVA, pure CMC, and PVA-CMC blend were investigated before and after irradiation with 100 kGy gamma-ray. The refractive indices of all films experimentally did not change at the visible and near-infrared regions when exposed to gamma-ray. Whilst the change was observed in the UV reg ion (200 -400 nm) and the refractive index increase. The refractive index of pure PVA increases from 1.965 to 2.258 for blending with 4% CMC and increases up to 2.355 for blending with 12 % CMC (at 600 nm). All these values slightly decrease in the visible region when exposed to gamma-ray. The obtained results, with tuned optical band gaps and high refractive indices, can be used for anti-reflection coating and in optoelectronic components.

**16-**

**NEW THOUGHTS, SUGGESTIONS, AND RESULTS ABOUT THE MYSTERIOUS WORLD OF ELEMENTARY PARTICLES, DARK MATTER, AND DARK ENERGY** *(O10)*

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Physics has worked on each one of the following three tasks for at least eighty years. Complete the list of elementary particles. Describe dark matter. Describe dark energy. We discuss proposed progress and results regarding each one of the three tasks. Our work has bases in extensions to

accepted modeling techniques. That our specifications for new elementary particles, dark matter, and dark energy seem to explain data might suggest usefulness for our results.

Along with pointing to all known elementary particles, our modeling points to the following possible elementary particles – a spin-zero inflaton, a spin-one boson that associates with Pauli repulsion, three zero-charge analogs to quarks, three heavy neutrinos, a graviton, a possible spin-3 relative of the photon, and a possible spin-4 relative of the photon. Some dark matter might be hadron-like particles that include gluons and the zero-charge analogs to quarks. Some dark matter might be heavy neutrinos. However, such notions of dark matter would not necessarily explain observed ratios of dark matter effects to ordinary matter effects. Observed ratios of dark matter effects to ordinary matter effects include one-to-0-plus, 5-plus-to-one, 4-plus-or-minus-to-one, 1-to-one, and 0-plus-to-one. We suggest that most dark matter associates with five of six isomers of essentially all elementary particles except the graviton and possible higher-spin zero-mass bosons. The five all-dark-matter isomers plus the ordinary-matter-centric isomer's dark matter (likely the hadron-like gluons-plus-zero-charge-quark-analogs) help explain the observed ratios. The isomers differ enough that our work likely comports with observations about the Bullet Cluster collision of two galaxies. Our description of dark energy comes from a decomposition of gravity into multipole components. The monopole, quadrupole, and possible 16-pole components are attractive. The dipole, and octupole components are repulsive. We suggest five eras regarding the rate of expansion of the universe. The first era features bringing together some form of energy, based on the 16-pole components. The second era features a Big Bang bounce, based on the Pauli-repulsion boson. The third era associates with the word inflation and features the inflaton particle and octupole repulsion. The fourth era (for which people have much observational data) lasted for some billions of years and features quadrupole attraction. The fifth, or current, era features dipole repulsion. An aspect of the dipole repulsion might explain recent "large-scale tensions" between data and widely used modeling. A similar notion of eras suggests insight about galaxy formation. Our modeling suggests results regarding elementary particle properties. We suggest a tau mass for which several calculated standard deviations fit within one measured standard deviation. Rest energies for at least two of the three neutrinos would be 3.4 hundredths of one eV. Rest energies for the zero-charge quark-like particles would fit within a range from 6.8 to 106 MeV.

The heavy neutrinos would have rest energies that exceed six thousand GeV and that might exceed two billion GeV. The squares of the masses of the Higgs, Z, and W bosons might satisfy ratios of 17 to 9 to 7. Our modeling points to perhaps deeper-than-expected relationships between measurable properties – such as charge, magnetic moment, mass, and moments of inertia – and between such properties and our list of known and would-be elementary particles.

**17-**

**SPIN PHYSICS DETECTOR AT NICA** *(O11)*

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The Spin Physics Detector (SPD) collaboration proposes to install a universal detector in the second interaction points of the Nuclotron-based Ion Collider Facility (NICA) that is under construction at the Joint Institute for Nuclear Research (Dubna) to study the spin structure of the proton and deuteron and the other spin-related phenomena with polarized proton and deuteron beams at a collision energy up to 27 GeV and luminosity up to 1032 cm2 s-1. In the polarized proton-proton collisions, the SPD experiment at NICA will cover the kinematic gap between the low-energy measurements at ANKE-COSY and SATURNE and the high-energy measurements at the Relativistic Heavy Ion Collider, as well as the planned fixed-target experiments at the LHC. The possibility for NICA to operate with polarized deuteron beams at such energies is unique. The SPD is planned to operate as a universal facility for comprehensive study of the unpolarized and polarized gluon content of the nucleon, via the measurement of specific single and double spin asymmetries. Polarized quark PDFs and fragmentation functions can be accessed via the production of high-pT hadrons. The results expected to be obtained by the SPD will play an important role in the general understanding of the nucleon content and will serve as a complementary input to the ongoing and planned studies at RHIC, and future measurements at the EIC (BNL) and fixed-target facilities at the LHC (CERN). Other polarized and unpolarized physics is possible especially at the first stage of NICA operation with reduced luminosity and collision energy of proton and ion beams.

**18-**

**TUNING THE PHYSICO-CHEMICAL PROPERTIES OF ALPHA IRRADIATED POLY ALLYL DIGLYCOL CARBONATE BY THERMAL ANNEALING** *(O13)*

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**(Abstract not available)**

**19-**

**A QUASIPARTICLE MODEL FOR QGP WITH THE EFFECT OF MAGNETIC FIELD** *(P8)*

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In the past few decades, various efforts have been made to study the different thermodynamical properties of quark gluon plasma (QGP) phase. The exact prediction for their properties under different physical conditions is the matter of debate till now. In our present work, we have used two different approaches to introduce the effect of magnetic field on the properties of QGP. In first approach we have phenomenologically introduced certain modification in coupling constant of a quasiparticle model based on earlier literature. On the other hand, in second approach, we have used the idea of landau quantization of energy level again in a quasiparticle model. In both the approaches, we have calculated various thermodynamical quantities. Besides this, we have also analyzed the variation of magnetization with respect to temperature and chemical potential and further made some exertion to study the effect of parameters on energy and pressure in both relativistic and nonrelativistic case. Eventually, we have compared our findings of present work with the respective results of various other models. Keyword: Quark gluon plasma (QGP), Quantum chromodynamics (QCD), Thermodynamical properties and quasi-particle model.

**20-**

**EFFECT OF EXTERNAL MAGNETIC FIELD ON THE IDEAL HADRON GAS** *(P9)*

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In the field of nuclear and particle physics, study of hadronic system is one of the trending topic. Among lots of prevailing model, the ideal hadron gas model is the most applicable in all of them. This work deals with the effect of external magnetic field on the numerous thermodynamical properties of hadronic system. We have examined the effect of strong magnetic field on different thermodynamical properties of hadron gas, considering the hadronic system as an ideal gas. We have used the concept of quantization of energy level of charged particle in presence of magnetic field according to Landau quantization. In this work, we have analyzed the effect of magnetic field for both relativistic and non- relativistic cases and remark the effect of relativistic and non- relativistic consideration on the pressure, energy density, entropy density and also different transport properties etc. Further, we have compiled our work by noticing the variation of magnetization with respect to tempera ture and chemical potential and made some effort to seeing what are the other parameters that could control the hadronic systems energy and pressure in both relativistic and non-relativistic cases. At last we have compared our result with various respective models and observed the differences.

***Keywords:*** Hadronic system, Quantum chromodynamics (QCD), Landau quantization, thermodynamical properties.

**21-**

**CYBER SECURITY FRAMEWORK FOR TRANSPORT OF NUCLEAR MATERIALS** *(P10)*

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Transport of nuclear material and Radioactive sources by its landscape increase to the risk of accidents with the potential for radiological

coverages that might affect the safety of people and property. Moreover, the nuclear and Radiological facilities can suggestively decrease this risk, moderate threats, and grow their general asset protection preparation during the Transport of rad ioactive and nuclear Materials. According to these aspects, this study proposes a cyber-security framework for security and safety issues in the information technology systems (ITS) which carries several security technologies to be able to communicate in real-time and integrate the information concerning the physical protection system, which integrated in the vehicle. Furthermore, categorization of security and safety schemes in ITS and their limitations discussed with various parameters. The PPS, communication overhead, suppliers, customers, the control room, latency, and various types of cyber security attacks analyzed. This study leverages new researchers for challenges and opportunities related to security and safety in ITS. To evaluate the performance of the proposed approach framework by using probabilistic risk assessment by applying the resources and systems to security schedules based on the threat to the materials and the likely significances if the threat materializes.

**22-**

**MINERALOGICAL AND RADIOLOGICAL INVESTIGATION IN ALLOUGA MINE, ABU ZENIMA AREA, SOUTHWESTERN SINAI, EGYPT** *(P11)*

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Radon concentration and the specific radioactivity of $^{226}$Ra, $^{232}$Th and $^{40}$K in the ALLOUGA mine at Abu Zenima area, Southwestern Sinai, Egypt were determined using (EDA) device and gamma ray spectrometry in order to assess the associated radiation hazard impacts. The mean radon concentration inside the mine was found to be 122.7160.781 and the mean activity concentrations of $^{226}$Ra, 232Th and $^{40}$K were found to be 212.633.01, 75.801.13 and 553.566.43 Bq.kg-1 respectively. These values exceed the maximum international limits. Radium equivalent (Raeq), the external hazard index (Hex), the internal hazard index (Hin), the representative level index (Iγ), dose rate, annual effective dose, excess lifetime cancer risk (ELCR) and annual gonadal dose equivalent

(AGDE) were estimated and discussed. Further investigations of the samples have been performed using X-ray fluorescence and remarkable concentrations of K, Al, Fe, Ca, Ti, Rb and Zr have been observed.

**23-**

**ELECTROSTATIC SURFACE MODES IN QUANTUM ELECTRON-HOLE PLASMA** *(O14)*

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In recent years, the plasmas physics has been widely studied and different research has been presented. Recently, several studies of quantum plasmas have appeared in the literature. Plasma can be regarded as quantum when the quantum nature of its particles significantly affects its macroscopic properties. There has been a great interest in investigating physical properties of quantum plasmas since the quantum plasmas can be found in various nano-scale objects such as nano-wires, quantum dot, and semiconductor devices as well as in dense laser produced plasmas. The excitation of electrostatic surface waves on a semibounded quantum plasma-vacuum interface parallel to an applied magnetic field with electron-hole degeneracy will be investigated. The wave equations of the electrostatic potential and both of the perturbed electron and hole plasma densities have been solved analytically. By using quantum hydrodynamic (QHD) model and the Poissons equation with appropriate boundary conditions, the general dispersion relation of these surface modes has been obtained. It is also solved and studied numerically for different cases of plasmas (magnetized or unmagnetized, classical or quantum). We have found that the density ratio of hole-electron plasma plays essential role on the dispersion of the modes along the wavelength beside the quantum and magnetic field.

**24-**

**CROSS-SECTION EVALUATION OF THE THERAPEUTIC RADIONUCLIDE $^{103}$Pd: DIFFERENT PRODUCTION ROUTES USING COMMERCIAL CYCLOTRONS** *(O15)*

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$^{103}$Pd radionuclides are widely used in internal radiotherapy, especially in the treatment of prostate cancer. We evaluated the proton and deuteron-induced reactions on rhenium, that is, $^{103}$Rh(p,n)$^{103}$Pd, $^{103}$Rh(d,2n)$^{103}$Pd. Nuclear model calculations were performed using the EMPIRE 3.2.3 code to validate the literature experimental data. The application of these data, particularly in calculating integrated yields, was discussed. The examined methods were compared from the point of view of practical application to produce $^{103}$Pd. The $^{103}$Rh(p,n)$^{103}$Pd reaction is the preferred method.

**25-**

**DEVELOPMENT OF GENIE2000 INTEGRATED MODULE FOR PROTON ACTIVATION ANALYSIS** *(O17)*

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Genie2000 program represents a proficient environment for analysis of gamma spectra. It equipped with many algorithms for identification of gamma peaks and deduction of their corresponding isotopes activity, considering the interference among energetically-closed gamma emissions. However, it does not include enough capabilities for activation analysis experiments. Current research work intends to perform the calculations related to the proton activation analysis in the framework of the Genie2000 environment. Inclusion of such calculation, in addition to other program capabilities, can reduce the time-consuming steps and significantly enhance the routine processes during the proton activation analysis.

**26-**

**MULTIFUNCTIONAL RADIOACTIVE ZnO/$NiFe_2O_4$ NANO-COMPOSITE FOR THERANOSTIC APPLICATIONS** *(O18)*

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A set of $ZnO/NiFe_2O_4$ were prepared with different concentrations of NiFe2O4 (0-25 wt. %). The magnetic hyperthermia of the samples were investigated using AC magnetic field. It was noticed that the determined specific absorption rate (SAR) was increased from 6.5 W/g at 5 wt. % to 110 W/g at 25 wt. %, which represents about 40 % of that for pure $NiFe_2O_4$. The sample of 15 wt. % Ni-ferrite was selected for irradiation with 14.7 MeV proton beam at the cyclotron to convert some of its constituents to dia gnostic radioisotopes. As a result of proton induced reactions on Zn and Ni, several short-lived medical radioisotopes were produced such as $^{68}Ga$ (67.6 min), $^{66}Ga$ (9.4 h), $^{67}Ga$ (78.3 h) and $^{61}Cu$ (3.3 h). The irradiated sample was analyzed at short and long cooling periods post irradiation using high resolution γ-ray spectroscopy coupled with High Purity Ge detector (HPGe). Based on the decay data, all the γ-ray spectral lines were identified and correlated with their origin. Then, the radioactivity at end of bombardment (EOB) for each isotope was determined. The radioactive yields for positron emitters $^{68}Ga$ (263.86 MBq/A.h) and $^{66}Ga$ (33 MBq/A.h) were the highest values. Very low activity levels were detected for the other medium and long half-life radioisotopes (0.03˗5 MBq/A.h). The combined magnetic properties and radiotracer isotopes in the prepared composites may allow a novel methodology for simultaneous treatment and diagnostic of cancer cells.

**27-**

**INVESTIGATIONS OF THE STRUCTURAL AND MAGNETIC PROPERTIES OF M-TYPE BASR HEXAFERRITES SYNTHESIS BY SOL-GEL AUTO-COMBUSTION METHOD** *(P12)*

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Single-phase polycrystalline Ba1-xSrxFe12O19, 0  x  1, hexaferrites have been prepared using the sol-gel method. The crystal structure was well analyzed based on the study of the X-ray neutron diffractions. The structure is hexagonal with P63/mmc space symmetry group. The magnetic structure implies that the $Fe^{3+}$ cations are magnetically active. They are located at five nonequivalent crystallographic sites, which have tetrahedral (Fe3-4f1), octahedral (Fe1-2a, Fe4-4f2, and Fe5-12k), and

trigonal bipyramidal (Fe2-2b). More different techniques such as scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), and thermal analysis were used to characterize the studied samples. The magnetic hysteresis loops were performed at room temperature. The substitution of Ba ions by Sr ions enhances the thermal stability and the magnetizations of hexaferrites.

**28-**

**FLUX AND POWER DISTRIBUTION ANALYSIS FOR HTR-10 REACTOR CORE LOADED WITH URANIUM OXIDE** *(O19)*

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MCNP6 computer code is used to model HTR-10 core reactor. $UO_2$ fuel is used. We determined the Flux and power distribution for normal core loaded by $UO_2$ fuel pebbles of the reference HTR-10 reactor. The results show an analogue between the thermal flux distribution and the power distribution, where the thermal neutrons are responsible on causing the fission, and hence production. The thermal flux has its maximum value at the core center and decreases as we move away from the center. The thermal flux is increased near the reflector because the neutron reflector scatters back (or reflects) into the core many neutrons that would otherwise escape. The neutrons reflected back into the core are available for chain reaction (reflector savings).

**29-**

**TREATMENT OF GRAPHENE IN NON-COMMUTATIVE GEOMETRY AND ITS THERMAL PROPERTIES** *(O20)*

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In this paper, we study the (2+1) massless Dirac equation under the influence of an external magnetic field in non-commutative geometry. Where we obey the system to a simple transformation in order to get the energy eigenvalues and their corresponding wave function. More than this, we deal with the system at high regime temperature T by the partition

function Z, to notice that the system has been influenced by the studied geometry.

**30-**

**THE USE OF ION IMPLANTATION FOR SYNTHESIZING OF SOME A3B5 TRIPLE SEMICONDUCTORS AND THEIR ANALYSIS BY LASER RAMAN SPECTROSCOPY** *(O21)*

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When bombarding semiconductor surfaces with energy particles, there is a distruction of the crystalline structure. When doped in large doses, the crystalline structure goes into an amorphous state. With subsequent thermal or laser treatment, the crystal structure is restored. When we bombard a semiconductor with neutral ions, the chemical formula of the crystalline target does not change. Ions fit into the spaces between the nodes and form various types of point or cluster defects. In proportion to the increase in dose, complete amorphization occurs. When we bombard a semiconductor with replaceable impurity ions, in some combination (target - ion), it is possible that a complex unit of a new formula has arisen. We produced the bombardment of the GaAs target with phosphorus and aluminum ions. Also, Ionic implantation of GaP with arsenic, nitrogen and aluminum ions was performed. We produced Ionic implantation at room and 4000C temperature. We investigated and analyzed the surfaces modified by ion implantation using laser Raman spectroscopy method. We were shooting spectra at room temperature. Laser Raman spectrometer is a laboratory-type laser system, which we built on the base of the double monorometor of the DFS-24. The focal length of the spectrometer is 800 mm, the light power is 9.8, the dispersion is 0.45 nm. To excite the spectra, we obtained radiation of 488.0 and 514.5 nm wavelengths of argon laser. We have discovered that, in the first stage of implantation of GaAs with phosphorus, a triple amorphous compound of GaAsP was formed on the surface GaAs. In the case of implantation with aluminum, the amorphous triple compound GaAlAs was synthesized. It turned out to be interesting implantation of GaP. When implanting it with arsenic and nitrogen, we did not find a triple-compounds with laser Raman spectroscopy. When implanting with aluminum in two different doses, we fixed that formed two amorphous thin

layers of GaAlP different composition. After thermal processing of the synthesized layers, the spectra show that amorphous triple systems are gradually transformed into crystalline triple compounds.

**31-**

**THEORETICAL INVESTIGATION OF STRUCTURAL AND ELECTRONIC PROPERTIES OF MOLYBDENUM DICHALCOGENIDES MONOLAYERS AND LITHIUM ADSORPTION ON THEIR SURFACES** *(P13)*

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It is important to improve the high-efficient anode materials for Li batteries, which require the large capacity, high stability and mobility. The research carried out in this study mainly concerns the transition metal dichalcogenide anode MoX2 (X=S, Se, Te). Structural, electronic and thermoelectric pr operties of MoX2 monolayers have studied using DFT method. In this regard, it concluded from the calculation of the cohesive energy that the level of stability increases from MoTe2 to MoSe2 also from MoSe2 to MoS2. All three compounds are semiconductors with direct band gaps in the range of 1 to 1.8 eV. We have studied the adsorption behavior of lithium on the three different transition-metal dichalcogenide monolayers MoX2 (X=S, Se, Te). We found that Li adsorbed on MoS2 rather stronger than other considered MoX2 materials. We also studied the effect of the increasing number of adsorbed Li atoms, and we determined the most preferred adsorption sites for the Li atom. Our results indicate that these materials can be a promising anode material for high-performance Lithium ion batteries.

**32-**

**DOUBLE-BETA DECAY AND LORENTZ VIOLATION** *(O22)*

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Double beta decay (DBD) is a currently hot research topic as it can offer a wide range of physics investigations beyond the Standard Model (BSM). These refer to some fundamental neutrino properties, yet unknown (neutrino nature is it a Dirac or a Majorana particle, the neutrino absolute mass and mass hierarchy, number of neutrino flavors, etc.), conservation of the lepton number and validity of Lorentz and CP symmetries, as well as to different BSM mechanisms that can contribute to the neutrinoless double-beta decay. In my talk, Ill first summarize the current challenges facing the DBD study. Then, Ill refer in particular to the growing interest in testing the Lorentz invariance violation (LIV) in DBD. Such investigations are currently been conducted in several large experiments as EXO, GERDA, SuperNEMO, CUORE and CUPID-0, and are based, on one side, on precise measurements of the electron spectra and their angular correlations in two-neutrino double-beta decay and, on the other side, on reliable theoretical calculations of these spectra. Ill presents the theoretical formalism and precise calculation of the single, summed energy and angular correlation electron spectra, along with their deviations due to LIV. Next, Ill show different signatures of LIV that can be investigated in DBD experiments and the current constraints of the coefficient that governs the LIV strengths. Finally, Ill propose an alternative, new method to constrain this coefficient through the measurement of the angular correlation coefficient, and show that future DBD experiments can improve these limits significantly.

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**33-**

**MODELING AND ASSESSMENT OF RADIOACTIVE IODINE DISPERSION INSIDE EGYPTIAN RADIOISOTOPE PRODUCTION FACILITY** *(O23)*

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Air quality is very important topic in radioisotope production facility. It is mandatory for some operators to be available behind hot cell to practice some activities concerning maintenance and operation. One of these tasks is redundant transferring Radioiodine from cell to QC lab and vice versa for measurements. Contamw is a simulation model from NIST (National Institute of Standards and Technology) is used to predict $^{131}I$ concentration in air in hot cell and area of operator behind the cell in emergency case. Emergency is described by dropping small amount of $^{131}I$ on cell floor. The model predicts the elapsed time for exhaust system to remove contaminants to dedicated filter and protect operator from inhalation. An emergency statue is also studied in case of opening $^{131}I$ cell door hole (20 cm) by operators to pick the sample for quality control tests. Pressure interference occurs in this situation permitting some Iodine traces in the area under consideration. Ventilation system is responsible to evacuate and removes all radioactive species to settle inside dedicated filters to clean the area and keeps it in permissible safe limits.

**34-**

**NUCLEAR SECURITY ENHANCEMENT FOR A TYPICAL NUCLEAR FUEL FABRICATION FACILITY WITH ENRICHED URANIUM** *(P14)*

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In uranium fuel fabrication facilities with low enriched uranium 20% which uses in research reactors, large amounts of radioactive material are present in a dispersible form. This is particularly so in the early stages of the fuel fabrication process. In addition, the radioactive material encountered exists in diverse chemical and physical forms and is used in conjunction with flammable or chemically reactive substances as part of the process. Thus, in these facilities, the main hazards are potential criticality and releases of uranium hexafluoride ($UF_6$) and $U_3O_8$, from which workers, public and the environment should be protected. Nuclear facilities are vulnerable to terrorist attacks or thefts of nuclear material, especially for fissile materials which can be used for nuclear weapons. In Nuclear Fuel for Research reactors typically use a form of uranium that is more highly

enriched (20 %) than that used for power reactors, which may be a more attractive target for theft. For this reasons, It is very Important to improvement the nuclear security for Nuclear Fuel Fabrication Facility to prevent any Sabotage or threat against the facility or radioactive material. The operations with the fissile materials such as $^{235}U$ introduce the risk of a criticality accident that may be lethal to nearby personnel and can lead the facility to shutdown. Therefore, the prevention of a nuclear criticality accident or the sabotage in these facilities should play a major role in the design of a nuclear facility. The objectives of criticality safety are to prevent a self-sustained nuclear chain reaction and to minimize the consequences. In this paper we will perform the nuclear security system exists in the facility and discus the weak points appear in the facility. And then we will be proposed the upgrade the nuclear security in this facility to overcome these weak points.

**35-**

**THEORETICAL STUDY OF VARIOUS FLUIDS ON THE TRANSIENT PERFORMANCE OF A TWO-PHASE CLOSED THERMOSYPHON (TPCT)** *(O24)*

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The importance of a passive cooling technique for a nuclear reactor has recently been demonstrated. As a result, a passive cooling mechanism for the nuclear reactors using two-phase thermosyphon was proposed. The transient thermal behavior of the two-phase closed thermosyphon has been described using a mathematical model (TPCT). The working fluids in this investigation include water, acetone, heptane, and toluene. The impact of these various fluids on TPCT performance is predicted. According to the data, the water reaches faster to steady state in evaporator. As the Acetone has the greatest temperature ($52^0$C) and the highest heat transfer coefficient (160 W/m$^2$.K) under the same conditions. Acetone has double the heat transfer coefficient of heptane and is slightly closer to water. Water has the lowest wall temperature ($240^0$C) and the highest heat transfer coefficient (3350 W/m$^2$ K) in the condenser. Water has a three-fold higher heat.

**36-**

**SIMULATION OF MINIMUM BIAS EVENTS USING PYTHIA8** *(P15)*

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**(Abstract not available)**

**37-**

**URANIUM ENRICHMENT VERIFICATION USING THERMAL/FAST FISSION YIELD RATIO SIGNATURE** *(O25)*

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Uranium is of the most important fissile materials; therefore its interrogation is of great importance. For this verifying the declared information on uranium in a sample with that which actually exists represents an experimental challenge. The intent of this work is to use the difference in fission product yield ratio values to identify fissile and fertile compositions of uranium material. A compact 5 Ci Am-Be isotopic neutron source is used as an active neutron interrogation source to provide information on thermal and fast neutron-induced fission on $^{235}$U and $^{238}$U, respectively. The experiment aims to use a selected database of observed delayed gamma-ray measurements from short-lived fission products which are suitable to derive the fission yields that are to be used to certify the enrichment of uranium samples. The fission products were identified based on delayed gamma-rays measured using a high-efficiency (70%) HPGe detector. The obtained complex gamma spectra were analyzed and the peaks were assigned as fingerprints to the corresponding fission products. This method makes possible the use of differences in fission product yield ratios between them to identify changes in fissile and fertile compositions (enrichment/depletion) of uranium material. Analytical expressions are derived to relate the fission yield ratio ($^{235}$U,FP) / ($^{238}$U,FP) values versus the enrichments for $^{92}$Y, $^{91}$Sr, $^{92}$Sr, $^{88}$Kr, $^{105}$Ru , and $^{101}$Tc as good indicators for enrichment determination.

**38-**

**UNCERTAINTIES CALCULUS IN NEUTRON ACTIVATION ANALYSIS - IMPROVING THE METHOD PRECISION** *(O26)*

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Neutron Activation Analysis, $k_0$-standardization is a powerful tool in calculation of elemental concentration of different kind of samples. Using the TRIGA research reactor as a thermal neutron source, the samples are irradiated and subsequently measured using a hyper-pure germanium crystal detector. The deconvolution of gamma ray spectra is made using GENIE 2000 software. The uncertainties calculation of the obtained results has been done using KRAGTEN method, very specific tool for neutron activation analysis equations. The paper underlines the key role of expressing a high precision of results.

**39-**

**DISCRET GRAVITY** *(O27)*

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Null four-vectors of General Relativity (GR), suggest mathematical developments. Two of them are presented. It is reminded that in GR a privileged frame exists, which is the frame in which time elapses the most. It is showed that a particle generates locally a space-time deformation, which transforms this privileged frame according to the boost associated with its velocity in this frame. From this remark in physics and those mathematical developments, the motivation as well as the first developments of a new and discrete relativity appears naturally. It uses a four-momentum instead of the stress-energy tensor for calculation of space-time structure. It is showed that the surrounding effect prevailing in [1] appears also as the inner part of such a model. Under an unifying assumption, this surrounding effect appears in particle physics as well and suggests a scheme for a possible solution of the Yang-Mills Millennium problem.

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**40-**

**PRODUCTION AND STUDY OF NEUTRON RICH HEAVY NUCLEI, GALS SETUP** *(O28)*

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A new setup, based on stopping nuclei in the gas cell and subsequent resonance laser ionization and separation by magnetic field is under stage of realization at Flerov Lab. JINR. This setup is devoted to synthesis and study of new neutron rich heavy nuclei formed in low energy multi-nucleon transfer reactions. The heavy neutron rich nuclei are very important for nuclear physics investigations, for the understanding of astrophysical nucleosynthesis and r-process. In this region is located the closed neutron shell N=126 which is the last so-called waiting point. Study of the structural properties of nuclei along the neutron shell N = 126 could also contribute to the present discussion of the quenching of shell gaps in nuclei with large neutron excess. A creation and launch of this facility will open a new field of research in low-energy heavy-ion physics, and new horizons in the study of unexplored north-east area of the nuclear map. It could be helpful also for finding a new way for production of heavy and super heavy nuclei. The current status of this setup will be discussed.

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**MICROSCOPIC ANALYSIS OF THE PION-NUCLEUS SCATTERING IN THE ENERGY RANGE OF 130-290 MEV** *(O29)*

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Elastic cross sections are calculated and compared with the data on pion scattering on Carbon, Calcium, Nickel and Plumbum nuclei in the energy range from 130 to 290 MeV. To this end, both the folding optical potential (OP) and the local modified Kisslinger-type OP were calculated,

and then the pion-nucleus cross sections were obtained by solving the Klein-Gordon equation to account for the relativization and distortion wave effects. Fairly good agreement with experimental data was obtained for both models of OP. The essential in-medium effect on the parameters of the pion-nucleon amplitude was established since the pion is scattered not on a free but on a bound nuclear nucleon.

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**Notes**

# NUPPAC' 22

**Notes**

# المؤتمر الثاني عشر للفيزياء النووية والجسيمية

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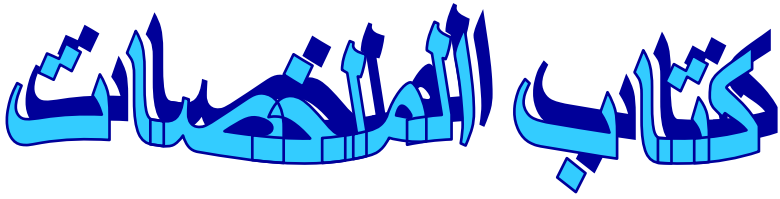


**١٥–١٨ مايو ٢٠٢٢**

**شرم الشيخ، *جمهورية مصر العربية***