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Book of Abstracts

October 2009

Conference Sessions

Thursday, 12 Nov. 2009

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Thursday, 12 Nov. 2009

Session IKN1

IKN1-1 38

60 YEARS OF BROKEN SYMMETRIES IN QUANTUM PHYSICS.

Dmitry V. Shirkov

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A retrospective overview of the phenomenon of spontaneous symmetry breaking (SSB) in quantum theory, the issue that has been implemented in particle physics in the form of the Higgs mechanism.

IKN1-2 9

RESULTS FROM THE G0 PARITY VIOLATION EXPERIMENT CARRIED OUR AT JEFFERSON LABORATORY

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Among experiments looking for strangeness in nuclear systems, electron scattering parity-violation type experiments aim mainly at measuring the strange quark contributions to the form factors of the proton. They can be accessed by measuring asymmetry in longitudinally polarized electron elastic scattering on hydrogen. The parity-violating asymmetry is measured at the ~ 10**(-7) level of accuracy, and when combined with the electromagnetic form factors of the proton, the strange form factors can be determined. The full separation of form factors according to quark flavor requires measurements at forward angle on hydrogen and at backward angle on proton and deuteron. The experimental setups used for the G0 experiment in the two different configurations will be described. The status of the analysis and the current results will be presented and discussed in relation with other experiments past and planned.

The G0 forward angle measurement(2) detected the recoil proton with a segmented detector covering, for one incident energy, different Q2 bins ranging from 0.1 to 1.0 (GeV/c)**2. This measurement provided a linear combination of strange magnetic and strange electric form factors for each Q2. In the backward angle configuration, electrons were detected and just one Q2 value was covered at a given incident energy. Due to time limitation, only two cases have been studied: Q2 ~ 0.63 and 0.23 (GeV/c)**2. These values were chosen to be directly comparable with results from other experiments. By combining backward and forward configuration measurements it is possible to extract separately the electric and the magnetic strange form factors. The measurements are complete. The analysis, still in progress, will be described.

A few comments will also be made regarding some other aspects of physics accessible in simultaneous measurements: neutral current in N-Delta transition  parity violation in inclusive pi production and 2 photons contribution to elastic scattering.

IKN1-3 10

PYROLYTIC GRAPHITE AS A TUNABLE SECOND ORDER NEUTRON FILTER

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A study has been carried out on the neutron transmission through pyrolytic graphite (PG) crystals in order to check its applicability as an efficient tunable second order neutron filter. The neutron transmission have been calculated as a function of neutron wavelengths in the range from 0.01 nm up to 0.7 nm at various PG mosaic spread, thickness and orientation of its c-axis with respect to the beam direction The Computer package GRAPHITE has been used to provide the required calculation.

It was shown that highly aligned (1^{o} FWHM on mosaic spread) PG crystal ~2 cm thick, may be tuned for optimum scattering of 2^{nd} order neutrons within some favorable wavelength intervals in the range between 0.112 and 0.425 nm by adjusting the crystal in an appropriate orientation. .However, a less quality and thinner PG was found to almost eliminate 2^{nd} order neutrons at only tuned values of wavelength corresponding to the poison of the triple intersection points of the curves $(hkl)^{\pm}$ and $(00l)$.

Keywords: Thermal neutron filters, Pyrolytic graphite crystals

Session IKN2

IKN2-1 95

CALCULATIONS OF 8He+p ELASTIC CROSS SECTIONS USING MICROSCOPIC OPTICAL POTENTIAL

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An approach to calculate microscopic optical potential (OP) with the real part obtained by a folding procedure and with the imaginary part inherent in the high-energy approximation (HEA), is applied to study the 8He+p elastic scattering data at energies of tens of MeV/nucleon (MeV/N). The neutron and proton density distributions obtained in different models for 8He are utilized in the calculations of the differential cross sections. The role of the spin-orbit potential and effects of the energy and density dependence of the effective NN forces are studied. Comparison of the calculations with the available experimental data on the elastic scattering differential cross sections at the beam energies of 15.7, 26.25, 32, 66 and 73 MeV/N is performed and conclusions on the role of the aforesaid effects are made.

IKN2-2 43

PARITY VIOLATION IN QCD MOTIVATED HADRONIC MODELS AT EXTREME CONDITIONS

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We investigate the possibility of parity being spontaneously violated in QCD at finite baryon density and temperature. The analysis is done for an idealized homogeneous and infinite nuclear matter where the influence of density can be examined with the help of constant chemical potential. QCD is approximated by a generalized sigma model with two isomultiplets of scalars and pseudoscalars. The interaction with the chemical potential is introduced via the coupling to chiral quark fields as nucleons are not considered as point-like degrees of freedom in our approach (for a semi-quantitative discussion this should suffice). This mechanism of parity breaking is based on interplay between lightest and heavy meson condensates and it cannot be understood in simple models retaining the pion and nucleon sectors solely; in particular is essentially different from the old idea of pion condensation advocated originally by Migdal. We argue that, in the appropriate environment (dense nuclear matter of a few normal densities where quark percolation does not yet play a signicant role), parity breaking may be the rule rather than the exception.

IKN2-3 77

THEORY OF DIPOLAR ECHOES IN AMORPHOUS MATTER AT LOW TEMPERATURES:ANALOGIES AND DIFFERENCES WITH THE NUCLEAR SPIN ECHOES AND THE ROLE OF AN APPLIED MAGNETIC FIELD

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The phenomenon of Nuclear Spin Echo (NSE) in Nuclear Magnetic Resonance (NMR) will be reviewed and its relevance for the MRI medical diagnostics technique will be emphasized. Further, the theory of the phenomenon of Polarization Echo (PE) (also known as dipole echo) in amorphous matter will be discussed and the similarities and differences between NSEs and PEs will be considered. The experimental and theoretical situation in the study of PEs in amorphous solids at very low temperatures will be reviewed, when the presence of even weak magnetic fields presents a puzzling response on the PE amplitude. Whilst the current viewpoint is in favour of the role played by nuclear electric quadrupole moments in the material's nuclei coupling to the solid's tunneling systems, on the one side,

and to its nuclear magnetic dipole moments, on the other side, it will be shown that an entirely different - and simpler – explanation is possible.
Namely, our explanation takes into account the multiphase (amorphous + nanocrystalline) nature of the materials and the existence of anomalous multi-level tunneling systems within the network-modifying component of these amorphous solids. A tentative explanation for the so-called isotope effect on the PE amplitude in the presence of a magnetic field will be also proposed.

IKN2-4 85
A SEARCH FOR NEW PHYSICS IN A KAON DECAY
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The present theory of the electroweak interaction (referred to as “the Standard Model” has been very successful in explaining all presently observed experimental facts but we are not satisfied with the present state of this theory: it has too many arbitrary parameters; several of its predictions have not yet been confirmed experimentally. Nobody believes that this Standard Model is the final theory of the electroweak interaction. Also we would like to see a better unity in particle physics and the next step should be the confirmation of a unified theory of the electroweak and strong interactions.

It is hoped that the expected start of the Large Hadron Collider at CERN will soon be able to test several predictions of the electroweak theory; the first one would be the observation of the Higgs boson. Many other predictions will also be submitted to experimental tests. This approach consists in going to higher energies and is referred as to an exploration of the “energy frontier”. Another approach consists in using more modest accelerators, delivering particles at lower energies, but looking for observables which do not exist in the Standard Model. Here the experiments are aimed at the observation of small (sometimes very small) effects at much lower energies. This approach is referred to as the “precision frontier”. The aim of this approach is not to observe new particles but to observe small effects which will be used to put upper limits on theoretical predictions and possibly reject some of these predictions.
A long time ago, Sakurai, a Japanese physicist, proposed an experiment based on the measurement of the transverse polarization of the muon emitted in the following weak decay: positive kaon going to a neutral pion plus a positive muon plus a neutrino ($K+ !p0\mu+n\mu$).

In such an experiment it is impossible to detect the neutrino. The energy and direction of the neutral pion can be detected by observing the two gamma rays produced in its decay. The positive muon can be detected, its kinetic energy measured, and its (very small) transverse polarization measured by using a special polarimeter. In such an experiment the main problem is the contribution of spurious effects due to the inevitable imperfections of the detector. The elimination of these spurious effects is possible by exploiting symmetries in the conception of the detector and the data analysis.

A previous experiment was run at the KEK laboratory, located in Tsukuba, Japon, by using the existing synchrocyclotron and a specially devised detector. The experiment has been pushed to the best experimental limit: jPT j < 0:0050 (90 %C:L:). The new experiment will be run at the JPARC site (JPARC = Japan Proton Accelerator Research Complex). This facility will be able to produce many particle beams, including neutrinos. The kaon beams will be of much better quality (for example with a much lower pion contamination). The detector will be improved by using the experience gained in the previous experiment. The collection and analysis of the data will also benefit from the experience gained in the previous experiment. The new experiment should result in an improvement on the present limit by a factor of 20.

Session NSR1

NSR1-1 58
PROPERTIES OF NUCLEAR AND NEUTRON MATTER USING EFFECTIVE INTERACTIONS
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The binding energy, symmetry energy, pressure, incompressibility and the velocity of sound are calculated for asymmetric nuclear matter using Skyrme interaction SkO'. The behavior of these physical quantities is studied for different values of the asymmetry parameter ,the density and the temperature T. Good agreement is obtained in

comparison with previous theoretical estimates and experimental data. PACS number: 21.65. +f.

NSR1-2 89c

SCALING DESCRIPTION OF ELECTROMAGNETIC CASCADES FLUCTUATIONS AT INTERMEDIATE ENERGIES

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Electromagnetic cascades (EC) produced in a dense amorphous medium by high energy gamma quanta are an example of simple high-energy stochastic processes being at the same time of manifold meaning. In particular, the fluctuations of energy deposition in EC are closely related to the inaccuracy in determination of the direction and energy of the primary gamma quanta (GQ). Although the integral characteristics of the phenomenon are well understood for a long time (for example,[1]) the topic of fluctuations of EC developing in an active detector medium of limited dimensions has been formulated for the first time in [2]. Moreover, the problem of fluctuations in EC is interesting from the viewpoint of the scaling property of the effect [2]. The EC fluctuations can be separated into longitudinal (LF) and transversal (TF) ones. There are scarce experimental data and theoretical discussions especially on TF [2].

The longitudinal fluctuations [2, 3] are described by the probability that the fraction A (called a threshold) of the total EC energy is deposited in the medium up to the depth t assuming that the absorbent is sufficiently large in the lateral directions. Different approach to the problem consists in considering the probability distribution of the depth t, at which part A of the total EC energy is released. This approach is specific for the experimental arrangement when GQ or/and electrons are registered with detectors of limited dimensions. Similarly, the transverse fluctuations are defined [2, 3] by the statistical distribution of A deposited in a sufficiently long cylinder with the axis coinciding with the GQ flight direction. Another approach consists in determination of statistical distribution of the cylinder radius r, within which a part A of the total EC energy is released. That approach is suited for the experimental arrangement when high energy GQ or/and electrons are registered with a thin pixel detector like PANDA electromagnetic calorimeter [4].

In this work we modelled the LF and TF of energy losses in EC created in liquid xenon by gamma quanta of energy E_γ varying from 100 to 3375 MeV. The study was performed on 48000 cascade events simulated with the EGS code [5]. The results are shown in Figs. 1 and 2 as the dependence of standard deviation $\sigma(A)$ of threshold A versus A. Our results are also compared to the available experimental data [2]. We found that the suggestion [2] of approximate scaling of LF is at least qualitatively valid. Unfortunately, since it was not possible to distinguish experimentally the ionization effect in the central EC region, the energy scaling hypothesis of TF could not be confirmed.

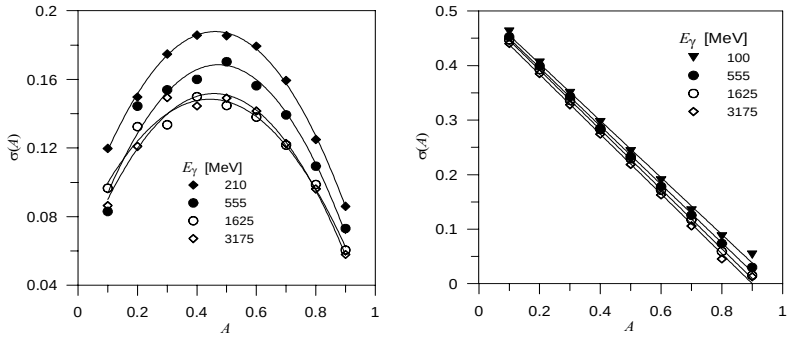

Fig. 1. Dependence of the standard deviation σ(A) of the longitudinal (left) and transverse (right) fluctuation on the threshold A for different energy E_γ of gamma quanta.

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NSR1-3 122

SCATTERING OF K{+}MESON FROM LIGHT NUCLEI AT INTERMEDIATE ENERGIES

K.M. Hanna, R.A.R. Ghobrial, Sh.M.E. Sewailem, H.O. Nafie and M.S.M. Nour El-Din,

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The scattering of K{+}-meson from H{2},Li{6},C{12},Si{28}and Ca{40}nuclei at incident kaon energies in the range 143-1000 MeV/c is studied. Differential and total cross sections are calculated in the frame of a semi-relativistic optical potentials constructed on the One-Body-Exchange (OBE) Julich group parameterization where the applied potential has two types of these parameterizations based on three/four exchanged mesons. Three different Yukawa and Yukawa-type meson functions are used the cross sections calculations.

NSR1-4 130

YIELD OF HIGH-SPIN ISOMERIC STATES IN REACTIONS INDUCED BY He ISOTOPES

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Recently investigations of high-spin isomeric states are developed in the context of the use of unstable nuclear beams. The probability of low-lying high-spin states production in the reactions with light neutron-rich projectiles is discussed.

The ratio of cross sections of a certain pair of isomeric states (high-spin and low-spin respectively) in one and the same nucleus allows one to obtain information on angular momentum dynamics of a preceding reaction and spin dependence of nuclear level density.

This dynamics depends on the properties of a target, projectile and emitted particles. The dependence of its yield on the projectile neutron number and the bombarding energy is studied.

Investigations of isomeric cross-section ratios (ICSR) in the reactions ^{114}Cd(alpha,p)^{117mg}In in the energy range 17-29 MeV were carried out by us earlier using off-beam measurements of induced activity of the isomeric pair [1]. The activation method is a reliable tool for identification of reaction products. Here we present for the first time our results improved through the handling of the activation data with the use of the optimal extraction formula from [2].

Calculations of ICSR for the indicated reactions 114Cd (alpha,p)117mgIn, as well as unstable beam induced 112Cd(6He,p)117mgIn and 110Cd(8He,p)117mgIn reactions are performed using the code EMPIRE-II-19 [3].

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NSR1-5 148

THE NEW KIND OF THE NUCLEAR REACTIONS

Alex A. Zhmud

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The New Kind of the Nuclear Reactions is investigated and it is shown, that it is the good candidate for the future energy reactors. The new Reaction is based on the Proton-Neutron exchanges controlling and as the result the isotopes conversations.

It is shown also, that the new reaction can be used for the “near-by” elements transformations.

Session MCS

MCS -1 59

EFFICIENT SECOND ORDER ALGORITHMS FOR FUNCTION APPROXIMATION WITH NEURAL NETWORKS. APPLICATION TO SEXTIC POTENTIALS

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The problem of determining the analytical description for a set of data arises in numerous sciences and applications and can be referred to as data modeling or system identification. Neural networks are a convenient means of representation because they are known to be universal approximators that can learn data. The desired task is usually obtained by a learning procedure

which consists in adjusting the "synaptic weights". For this purpose, many learning algorithms have been proposed to update these weights. The convergence for these learning algorithms is a crucial criterion for neural networks to be useful in different applications.

The aim of the present contribution is to use a training algorithm for feed forward wavelet networks used for function approximation. The training is based on the minimization of the least-square cost function. The minimization is performed by iterative second order gradient-based methods. We make use of the Levenberg-Marquardt algorithm to train the architecture of the chosen network and, then, the training procedure starts with a simple gradient method which is followed by a BFGS (Broyden, Fletcher, Glodfarb et Shanno) algorithm. The performances of the two algorithms are then compared. Our method is then applied to determine the energy of the ground state associated to a sextic potential. In fact, the Schrödinger equation does not always admit an exact solution and one has, generally, to solve it numerically. To this end, the sextic potential is, firstly, approximated with the above outlined wavelet network and, secondly, implemented into a numerical scheme. Our results are in good agreement with the ones found in the literature.

Key words: *Function approximation, neural-networks, wavelets, BFGS algorithm, Sextic potential, Schrödinger equation.*

MCS -2 61

CHAINSOLVER AS SIMULATION TOOL FOR NUCLEAR TRANSMUTATION

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ChainSolver simulation code was developed to calculate numerical nuclear transmutation rate by giving the evolution of the different corposants presents in sample under neutron flux during irradiation period. In this paper we give a brief description of this simulation tool.

Keywords: ChainSolver, Simulation, Nuclear Transmutation.

MCS -3 81

ANALYSIS, VERIFICATION, AND BENCHMARKING OF THE TRANSIENT THERMAL HYDRAULC ITERTHA CODE FOR THE DESIGN OF ITER DIVERTOR

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An analytical study for the International Thermonuclear Experimental Reactor Thermal Hydraulic Analysis code (ITERTHA) is carried out for a copper divertor with a 5 mm tungsten tile. The influence of the incident heat flux, swirl-tape insertion in cooling channels as well as the coolant flow velocity on the divertor thermal response is analyzed and discussed. The ITERTHA code results are verified by the commercial finite element code, COSMOS. The heat transfer coefficients at the nodes located on the cooling channel wall are determined outside COSMOS code by the same methodology used in ITERTHA. A good agreement is achieved under different incident heat fluxes. The ITERTHA code is also benchmarked against the thermal-hydraulic calculation of the outer divertor of the Fusion Ignition Research Experiment, FIRE for an incident heat flux of 20 MW/m2 and coolant flow velocity of 10 m/s in a cooling channel of 8 mm diameter with swirl-tape inserts of 2 ratio and 1.5 mm thickness. The results show excellent agreement for both steady and transient states and prove the successful implementation of both the hydraulic and heated diameters of the swirl-tape channels in the used heat transfer correlations.

MCS -4 103

HARD WARE IMPLEMENTATION OF DIAMOND SEARCH ALGORITHM FOR MOTION ESTIMATION AND OBJECT TRACKING

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Object tracking is very important task in computer vision. Fast search algorithms emerged as important search technique to achieve real time tracking results. To enhance the performance of these algorithms, we

advocate the hardware implementation of such algorithms. Diamond search block matching motion estimation has been proposed recently to reduce the complexity of motion estimation. In this paper we selected the diamond search algorithm (DS) for implementation using FPGA. This is due to its fundamental role in all fast search patterns. The proposed architecture is simulated and synthesized using Xilinix and modelsim soft wares. The results agree with the algorithm implementation in Matlab environment.

MCS -5 116

WORST AIR CONCENTRATION FROM NON-GAUSSIAN PLUME MODEL

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The maximum ground level air concentrations due to elevated point source diffusion over simple terrain are estimated using herimitized advection diffusion equation for linear forms of the eddy diffusivities which is derived before by Essa et al. (2007). Also, the critical wind speed, critical plume height, critical downwind distance and critical vertical eddy diffusivity are also estimated. The results are applied with data taking from first reactor, Inshas, Egypt.

MCS -6 40

THREE DIMENSIONAL SIMULATION OF THIN FILMS GROWTH

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A simple three dimensional model are employed to investigate the relation between film microstructure and deposition condition (substrate temperature,deposition rate, deposition angle and substrate roughness). Increasing substrate temperature and deposition rate leads to fewer and smaller voids,smoother surface and higher film density. As the deposition angle increases,the film microstructure changes from a dense film with few voids to highly porous structure of well-formed columns. In this model, hard sphere travels in a straight line and relaxes on lattice point with longer catchment length. It is found that surface diffusion plays an important role in thin film growth and relaxation depends on the surrounding geometry of the previously deposited atoms. Using this model as a base for our calculations, the relation between deposition parameters and film structure is discussed in details and found to be consistent with measurements published in the literatures.

MCS -7 144

NEW MODEL OF ATOM AND RELATIVISTIC EFFECT

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The paper gives new model of atom structure which is based on new view of rotation and spinning of different charges, leading to expectation of existences of mouns of mass 20n where $n = i^2$, i change from 1 to 4 with Gaussian distribution. The relativistic effect explains defect of atom mass and the possibility of emission of mouns of ions through passing in spectrometer devices.

MCS -8 146

ARTIFICIAL NEURAL NETWORKS FOR HADRON HADRON CROSS-SECTIONS

M. El-Mashad, M.Y. El-Bakray, M. Tantawy and D.M. Habshy,

In recent years artificial neural networks (ANN) have emerged as a mature and viable framework with many applications in various areas. Artificial neural networks theory is some times used to refer to a branch of computational science that uses neural networks as models to either simulate or analyze complex phenomena and/or study the principles of operation of neural networks analytically. In this work a model of hadron-hadron collision using the ANN technique is present, the hadron-hadron based ANN model calculates the cross sections of hadron-hadron collision. The results amply demonstrate the feasibility of such new technique in extracting the collision features and prove its effectiveness.

Session RQP1

RQP1-1 21
STANDARD MODEL-FORBIDDEN DECAYS
Linda GHEGAL,
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In this contribution we discuss Standard Model-forbidden decays that can possibly serve as an experimental signature of space-time noncommutativity. We generate Feynman diagrams and amplitudes by using functions in FeynArts and we use functions in FeynCalc to handle these amplitudes then LoopTools for the numerical evaluation.

RQP1-2 31
ON THE ORIENTATION BARRIER DISTRIBUTION OF COLLIDING DEFORMED NUCLEI
M. Ismail and W.M. Seif,
Cairo University, Egypt

The effect of different multipole deformations on the Coulomb barrier distribution in the orientation degrees of freedom is studied. The demonstrated Coulomb barriers are calculated microscopically using the double folding model which is based on realistic density dependent nucleon-nucleon interaction. A simple straight forward method, presented in recent work, has been used to predict the distribution of barriers at arbitrary orientations in presence of different deformations far away the complicated numerical calculations. The proposed interpretation is related to the half density radius change of the deformed nucleus involved in interaction where the orientation Coulomb barrier parameters distributions show similar patterns to that of orientation deformed nucleus one. The orientation Coulomb barrier radius distribution follows the same variation of the deformed nucleus radius, while the barrier height distribution is directly proportional to it. This correlation allows a simple evaluation of the orientation barrier distribution which greatly helps us to estimate when the barrier parameters will increase or decrease and at which orientations they will be independent of the deformation. It helps also to estimate the optimum orientations for hot and cold fusion of colliding nuclei.

RQP1-3 54
INVERSE SCATTERING: REVISITED
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In this paper , and following the previous steps by Awin et al, inversion problem at high energies that the fundamental McIntyre parametrization of the S matrix , for heavy-ion collisions , will correspond to a Wood-Saxon-type optical model potential . The parameters of such a woods-Saxon potential are directly related to the corresponding parameters of the McIntyre parametrization . We used recent data for the phase shift analysis for the $^{12}C+^{12}C$ system in the energy range E_{lab}=240-2400MeV, moreover computations were carried out for three and five parameters . The inversion solution results were tested for the available experimental data and were found to be in good agreement.

RQP1-4 80
EXTENDED PARTICLE STRUCTURE, GAUGE FIELD AND CURVATURE
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In this work, we suggest applying the theorem of Noether to the extended particle. The structure of this last one is described by an internal wave function which takes into account the internal degrees of freedom of the particle. The theorem of Noether is applied to two levels, first time in the internal structure, what allows obtaining the equations of the internal wave function, then second time to the extended particle by introducing a gauge field. This field is then expressed in the help of a local curvature

RQP1-5 100a
PATH INTEGRAL TREATMENT FOR THE RABI OSCILLATIONS
M. Aouachria,
University of Batna / Algeria

The movement of the two-level atom interacting with magnetic field is studied using the path-integral formalism. The propagator is first of all

written in the standard form by replacing the spin by two fermionic oscillators; then it is determined exactly, and the transition probability is deduced.

RQP1-6 145

CO-CURRENT STRATIFIED GAS-LIQUID FLOW IN A HORIZONTAL PIPE WITH TWO DISCHARGING BRANCHES

Robert Bowden, Ibrahim Hassan, Wael Saleh

Concordia University, Montreal, Quebec, Canada

The discharge of a two-phase flow from a stratified region through single or multiple branches is an important process in many industrial applications including the pumping of fluid from storage tanks, shell-and-tube heat exchangers, and the fluid flow through small breaks in cooling channels of nuclear reactors. Knowledge of the two-phase flow distriubtion in branches is essential for the design and/or performance prediction of such thermal systems. In the present study, experiments were performed in an adiabatic horizontal pipe with co-current stratified gas-liquid flow and two simultaneous side and bottom oriented discharges. The study used air and water as the two fluid phases, operating at 312 kPa. The test section was scaled from a typical header/feeder in a Canada Deuterium and Uranium (CANDU) nuclear reactor with a pipe and discharge diameter of 50.8 mm and 6.35 mm, respectively. The study evaluates the effects of branch orientation with three branches oriented at 0 (side), 45 (inclined), and 90 (bottom) down from horizontal on the discharge two-phase mass flow rate and quality. In addition, the effect of pressure difference and hydraulic resistance across the branch run are investigated.

RQP1-7 150

EFFECT OF DIFFERENT SIZE DUST GRAINS ON THE PROPERTIES OF SOLITARY WAVES IN SPACE ENVIRONMENTS

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Propagation of nonlinear dust-acoustic (DA) waves in an unmagnetized collisionless dusty plasma consisting of dust grains obey power law dust size distribution and nonthermal ions are investigated. For nonlinear DA waves, a reductive perturbation method was employed to obtain a Korteweg-de Vries (KdV) equation for the first-order potential. The effects of a dust size distribution, dust radius and the non-thermal distribution of ions on the soliton amplitude, width and energy of electrostatic solitary structures are presented.

Keywords: Dust Acoustic Waves; KdV Equation; Power Law Dust Size Distribution.

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THE PHYSICS OF Mo-99 PRODUCTION

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Tc-99m is one of the most important radioisotopes used in nuclear medicine. It accounts for nearly 80% (28 0f 35 million) of all nuclear medicine diagnostic procedures worldwide. The importance of Tc-99m comes from its suitable physical and radioactive decay characteristics as well as appropriate chemical characteristics yielding to large number of radiopharmaceutical complexes that find their use in the diagnosis of organ functions and a wide range of other applications. Mo-99, the parent isotope of Tc-99m has many possible routes of production including high energy photons, neutrons and accelerated charged particles. Current Mo-99 production is highly monopolized with only five major international producers that accounts for ~ 95% of production. The article aims at presenting current status of Mo-99 production and the physics behind possible alternative production routes.

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AN OVERVIEW OF EGYPT HUMAN RESOURCES STRATEGY FOR THE NUCLEAR POWER PROGRAM

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Because of the limited fossil fuel energy resources and the almost fully utilized hydro energy, Egypt has been considering for sometime the introduction of nuclear energy for electric power generation.

Egypt initiated a nuclear energy program in the 1970s but it came to a halt following the Chernobyl accident in 1986. Since that time the government has commissioned several feasibility studies, which supported the case for embarking on the nuclear plan. Egypt's electricity demand has been increasing by almost 10% per year over the past decade, and with the economy in the midst of a period of sustained growth averaging some 7% per year, power consumption is likely to continue to increase rapidly. In September 2006 the Egyptian government announced that it is considering the nuclear energy as an option for electricity generation because of the improvement in nuclear safety and the pressures on the energy sector due to the sharp increase in oil prices. In Oct 2007 President Mubarak says Egypt is to build several nuclear power stations, relaunching a nuclear program frozen more than 20 years ago which represents Strong national commitment to the nuclear power programme. Following that a decree issued to establish a higher council for the peaceful use of nuclear energy.

The government will develop the program in cooperation with the International Atomic Energy Agency (IAEA) "within a framework of transparency and respect of commitments to the nuclear non-proliferation system." The current activities includes establishing the master plan of the nuclear program based on Milestones in the Development of a National Infrastructure for Nuclear Power, since policy decision has been taken, the concern now is directed to Phase 2: Preparatory work for the construction nuclear power plant for which the Human Resources Management plays a key role.

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SURPRISING THINKING PAUSE TO REMAINING DEVELOPMENT COUNTRIES, WITH USES SELF-SUFFICIENT IN NUCLEAR ECONOMIC DEVELOPMENT MANAGEMENT

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Energy economic management is the only quantity that in among all economic section is current, so affected every kind change in energy cost, macro-management and country economic even in world village (it means with negative and affirmative reaction, total society, aimed the country independence) it is clear, in reason, there is complicating relations especially in nuclear energy economic (for contradictory uses), it cannot considerate and account this following:

Providing (supplying) of demands of energy increasing from day to day for reaching to the more welfare (comfort) and depending of oil price increasing to the world crises and trend of ecology pollutions increasing is main challenges that governments are tacked with them in world village macro-management of countries (governments) with regard to the now crisis, providing of energy from fossil fuels (oil and gas) for above difficult solution, there is not away, except decreasing energy consuming with decreasing of citizen and industry. For these purpose, managements either must use price increasing politics that self will become people welfare decreasing or with uses of nuclear energy over come on above difficult.

Nuclear economic developing management in developed countries, from the first of seventy decade , danger of threat non-self sufficient countries in section of energy providing in front of (opposite) neighbor countries full of energy (Georgia now crisis), depending of energy providing crisis to introduce most next crisis's and also, Iraq and Afghanistan crisis's, in energy section, make us till have a research in relation with cause of permanent (stable) remaining of developed countries, and about self sufficient in section energy providing through nuclear, in front of countries, full of fossil fuel energy of third world (but dependent and non-permanent).

Keywords : Management – Economic – Village – Nuclear – OPEC – Capacity – Freedom.

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ELECTRON IMPACT L- AND M-SHELL IONIZATION OF ATOMS AT RELATIVISTIC ENERGIES

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We propose an extension of the modified simplified-improved-binary-encounter dipole (MRIBED) model [Uddin et al., Phys. Rev. A 72, 032715 (2005)], incorporating both the ionic and relativistic corrections, to investigate the L-and M-shell ionization of atomic targets with atomic numbers Z = 18-92 for L-shell and Au, Pb, Bi and U for M-shell at incident

energies up to 900 MeV. We also revisit our earlier model, GKLV [Haque et al. Eur. Phys. J. D 42, 203 (2007)], for the L-and M-shell ionization at these relativistic energies. The results from our extended version of MRIBED and GKLV models agree well with the experimental findings.

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ELECTRON ACCELERATION BY MICROWAVE RADIATION INSIDE RECTANGULAR WAVEGUIDE

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The dynamics of a charged particle (an electron, for example) in the fields of the electromagnetic wave is a basic problem in plasma physics. This subject has been a great interest due to its applications in the fields of laser – particle interactions, thermonuclear fusion, high energy particle physics, etc. Recently; considerable progress has been achieved to the problem of acceleration of the charged particle to the high energy.

Different mechanics could be used for achieving high energy gain through the direct acceleration by the fields of EM- waves, plasma or laser wake-field acceleration and beat–wave acceleration the direct acceleration scheme, as in microwave plasma interaction Experiments, has been realized by the Lorentz force.

The properties of the waveguides that they can guide the electromagnetic fields for very long distances can be made used for the particle acceleration. Therefore, in the present work, The Dynamics of an electron in the fields associated with TM-electromagnetic wave propagating inside a rectangular waveguide is analytically studied. We solve exactly the relativistic momentum and energy equations of a single electron which injected initially along the propagation of a microwave. In principle, it is shown that the energy of the electron can be accelerated in this environment. Expressions for the acceleration gradient and deflection angle are obtained. It is found that there is no deflection when the electron is injected from centre of the front of waveguide. Besides, the acceleration gradient and deflection angle are strongly affected by the parameters of microwave (intensity, frequency…etc) and the dimensions of the waveguide.

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STUDY OF MINIBAND STRUCTURES IN DIMER QUASIPERIODIC SUPERLATTICES

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Using the exact airy function formalism and the transfer-matrix technique, we have numerically investigated the effect introducing the dimer on the nature of the states across Dimer Fibonacci semiconductor superlattices on the miniband structure of the GaAs/AlxGa1-xAs superlattices. The introduction of the dimer model the transmission spectra reveal the appearance of miniband structure with a concomitant disappearance of the singularly localized states. This behavior is due to the interaction between the states of the dimer wells inside the potential and therefore the system is seen by the particle as two overlapped ordered structures in contrast to the disorder related to the structure of Fibonacci.

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THEORETICAL STUDY OF ION BEAM MIXING FOR BILAYER *Te/In* AND *Se/In*

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Ion beam mixing is studied theoretically for bilayer systems ***Te/In*** and ***Se/In*** irradiated by 400 keV of Argon ions with fluences ranging $10^{14} - 10^{16} ions/cm^2$. The nuclear stopping power and the maximum transferred energy to atoms of the upper layer by energy of Ar^+ ions and diffusion rate are calculated. The results of the nuclear stopping power are compared by TRIM computer code, which gives good coincidence data. The calculated results showed that the diffusion of ***Se*** atoms is larger than that for ***Te*** atoms, so that the mixing efficiency of the bilayer system ***Se/In*** is greater than the mixing efficiency of the bilayer system ***Te/In***, which agree with the experimental results. This study is a tool to determine the possibility of mixing between the upper layer and the lower layer for any bilayer system, before the preparation of samples and irradiated by experimentally.

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NEUTRON DIFFRACTION RESEARCHES OF CHARGE DENSITY WAVES IN LAYERED InSe

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In the paper the investigation of charge density waves (CDW) and deflection oscillations in layered crystal InSe in a wide temperature range of 10-300 K by neutron diffraction method is presented. The aspiration of layered solid states to the preservation ion minimal energy results in the transformation of three-dimensional (3D) electron gas of current carriers to 2D one. Changes of ion positions in a lattice occur. Spatial oscillations of charge density - charge density wave (CDW) appear. A phase transformation metal - semiconductor of Peierls type with a formation of forbidden gap E =10-20 meV in energy continuum of conduction band occurs. It allows to use InSe as a material for detectors of terahertz frequencies with analog control in the range (0.5 - 5) ŇHz [1]. The layered crystal InSe characterized by high anisotropy of the chemical bond (strong ionic-covalent bond in the plane of atomic layers and weak Van der Waals one between the layers) attracts a particular attention. InSe is the only layered crystal in which the sufficiently high electron or hole concentrations can be achieved. Bond anisotropy leads to 2D electron conductivity at temperatures below the critical one. In this case, current carriers with the average Hall concentration of about 1012-1014 cm-3 in the crystal are accumulated in 2D regions of ionic-covalent layers near the Van der Waals gaps. It leads to the surface concentration of electrons about 1011 cm-2, which enables an opportunity for the Shubnikov-de Haas effect to be observed [2.] Studies of InSe doped with 3d transition metals revealed its nonconventional magnetic properties [3].

At the further temperature decrease interatomic repulsion forces prevent ions attraction. Ions shift in a direction, perpendicular to a plane of a layer. A deflection waves appear that corresponds to occurrence of modes in phonon spectrum with a square dispersion law. The further downturn of temperature results in " freezing" of such modes i.e. disappearance deflection oscillations. The top temperature border of deflection waves appearence for InSe monocrystals is situated in the field of commensurate CDW formation (Ň ≈ 50 K). The control of electronic gas dimension can realized by means of temperature, superconducting intercalant [4], effect of light [5] or hydrostatic pressure [5]. The monocrystal in CDW regime can be considered as analogue of a superlattice [7].

The described features of layered structures are accompanied by an existence of negative coefficient of temperature expansion (NCTE). The latter is an object of this research. In1.03Se0.97 single crystals were grown by Bridgeman method. Samples have n-type conductivity and Hall current carriers concentration ~1015ńm-3 at 290 K. Phase analysis was carried out by X-ray diffraction technique which showed that the hexagonal InSe phase (P63/mmc) has lattice periods a=4.003Å and c=16.634Å

Neutron diffraction experiments were performed with the diffractometer DN-2 in the Frank Laboratory of Neutron Physics. DN-2 is the time-of-flight neutron spectrometer utilizing the 2D position-sensitive detector for data acquisition. The diffraction patterns were registrated at several various scattering angles and sample orientations for revealing peculiarities in the wavelength dependence of diffraction intensities. Interplane distances of InSe crystal lattice in the temperature interval 10-300 K were determined. It was established, that the structure of grown crystals and the synthesized powders corresponds to γ- polytypic InSe. Average values of coefficients of thermal expansion along main directions ń = 10.4810-6 Ę-1 and c = 12.9710-6 Ę-1 were calculated for interval Ň = 50 - 300 Ę. They agree with results of the X-ray researches carried out by authors earlier at Ň = 290 K [8]. Their ratio (c / ń ~ 1.24) reflects anisotropic character of bond forces in InSe layered crystal. In the field of temperatures 10-50 K NCTE ń = -2.210-6 K-1. The latter corresponds to excitation of deflection acoustic oscillations. The correlation of features for temperature dependences of interplane distances and diffraction maxima intensities was revealed. It was explained by formation of CDW in layered InSe single crystal.

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NAT1-2 18

ELEMENTAL ANALYSIS OF NATURAL AND SYNTHETIC EYE-LINER SAMPLES USING DIFFERENT ANALYTICAL TECHNIQUES

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Natural and Synthetic eyeliners (kohl) are popularly and traditionally used by women, men and children in many countries. Recent studies showed that kohl might have hazardous and toxic elements in its elemental composition, which can cause harmful impact on the health of its users. In order to obtain more information on the elemental contents of some natural and synthetic, commercially available kohl samples, we have performed Energy Dispersive X-ray (EDX), Atomic Absorption Mass Spectroscopy (AAMS) and for the powder form of one of the samples the elemental analysis using Thermal Neutron Activation Technique (ThNAT). The crystallographic phases rich in heavy and toxic elements were also identified using X-ray Powder Diffraction (XRPD) technique. The results indicate that among the studied samples, the highest lead containing sample is the natural unprocessed one taken from Africa, which was rich in Galena (lead sulfide); while the lowest concentration of lead was found in the synthetic sample taken from France. The present studies highlight the medical and environmental implication of using eye-liners.

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RADIOACTIVE MEASUREMENTS IN GAS-FLOW MANTLES USED IN EGYPT

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Different gas-flow lantern mantles were subjected to radiometric investigation to evaluate the radiological hazards arising from their usage. The results show that the Egyptian mantles contain mainly ^{232}Th with levels that ranging from 2862.80 Bq/ mantle up to 3897.15 Bq/mantle, while the China mantle has a low activity than the Egyptian mantle. The China mantle has a minimum value of about 1095.79 Bq/mantle while the maximum value was 1185.92 Bq/mantle The activity of each sample has been determined using two different techniques. In the first method gamma ray spectra were collected using gamma ray spectrometer, which HPGe detector with energy resolution of 2.0 keV at 1.32 keV of ^{60}Co, while in the second method the CR-39 nuclear track detector (TASTRACK manufactured by track analysis systems ltd.) was used. The results from the two techniques have a good agreement within the experimental errors.

Keywords: Thorium; Natural radioactivity; SSNTD.

NAT1-4 20

THIN FILM THICKNESS DETERMINATION USING INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS

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Thickness determination of thin gold films, deposited on aluminum substrates, was performed by instrumental neutron activation analysis. Thickness determination of thin gold films were made by using thin foils comparators obtained from Good Fellow standards. The irradiation facility (CNIF), based on four similar Am-Be (α, n) source with activity of about **700** GBq results in a neutron yield of about 1x10^7 n/s, was used to irradiate

samples. Natural indium foils were used for neutron flux monitoring during the experimental measurements. This arrangement can be used successfully for estimating thicknesses of ~ 0.7 μgm/cm^2. Thin film determination using neutron activation (NAA) is used to monitor the optical transmission measurements.

Keywords: Thin films thickness determination; NAA; target preparation.

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Na, Al, K, Mn, Mg, Br, Ca, AND Cl CONCENTRATION VALUES IN THE WHOLE BLOOD SAMPLES OF HUMAN CANCER USING SHORT TIME NEUTRON IRRADIATION FACILITY OF ET-RR-2

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The National Cancer Institute of Egypt submit us with 18 blood samples (11 Breast),(2 Prostate),(2 Colon),(1 Pancreatic),(1 Ovarian) and one samples from random person to estimate the concentration values of Na, Al ,K , Mn , Mg ,Br and Cl. The pneumatic irradiation rabbit system (PIRS) built in the vertical thermal column of the ET-RR-2 reactor is used for short time irradiation at constant power. Elemental concentrations were estimated from measurements of the gamma ray spectra of the product short lived isotopes in the samples. The thermal to epithermal neutron flux ratio was calculated f (169) at irradiation position. The obtained concentration was calculated using k_0 standardization method. Fortran and Axel programs were constructed for the determination of neutron fluxes and for elemental concentration values .For sake of comparisons the obtained results, the elemental concentrations of the random sample using (k_0- NAA) compared with the concentrations obtained by (ICP-MS) technique.

Keywords: Whole Blood / k_0 Standardization / Activation Analysis /Cancer.

NAT1-6 13b

BUILDUP FACTOR CALCULATION IN WATER FOR 5MeV GAMMA-RAY USING MCNP4c CODE AND CONSIDERING BREMSSTRAHLUNG EFFECT

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Buildup factors, that are important in reactor shielding, were calculated using various types of gamma interaction with water up to depth of 10 mean free paths (mfp). Also, the Bremsstrahlung effect was studied in the absence of coherent scattering by MCNP4c code for an isotropic point source in water with a spherical shield. Using the latest cross sections available in MCNP4c code, the improved buildup factors were calculated. The buildup factor calculations using MCNP4c code led to less than 10 percent error compared to the experimental data.

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THERMOLUMINESCENCE STUDIES OF SOME TLD MATERIALS AND ITS USABILITY IN RADIATION MEASUREMENTS

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(Abstract Not Available)

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CALIBRATION OF SINGLE HIGH PURITY GERMANIUM DETECTOR FOR WHOLE BODY COUNTER

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A new Accuscan II single germanium detector for whole body counter was installed in NRC (Egypt). The current paper concerned on calibration of

single high purity germanium detector for whole body counter. Physical parameters affecting on performance of whole body counter such as linearity, minimum detectable activity and source detector distance, SDD were investigated. Counting efficiencies for the detector have been investigated in rear wall, fixed diagnostic position in air. Counting efficiencies for organ compartments such as thyroid, lung, upper and lower gastrointestinal tract have been investigated using transfer phantom in fixed diagnostic and screening positions respectively. The organ compartment efficiencies in screening geometry were higher than that value of diagnostic geometry by a factor of three. The committed dose equivalents of I-131 in thyroid were ranged from 0.073 ± 0.004 to 1.73 ± 0.09 mSv and in lung was 0.02 ± 0.001 mSv.

Keywords: Whole body counter, Germanium detector, Transfer phantom, diagnostic, Screening, Calibration.

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RADIATION-MEASURING DOSIMETRIC SYSTEMS BASED ON VITREOUS CHALCOGENIDES

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Vitreous chalcogenides (VCh) are known to be perspective in their functionality, associated mainly with a number of externally-induced optical effects. Recently, it was shown that principally new type of optical functionality can be revealed in some kinds of VCh, namely their high-energy industrial dosimetric application [1,2].

In respect to this functionality, the radiation-induced shift (darkening) of fundamental optical absorption edge for VCh can be described through radiation-sensitive parameter determined as maximal relative change in optical absorption coefficients before and after gamma-irradiation [3].

Unfortunately, the above radiation-sensitive parameter is unstable decaying monotonically with a time to some residual value, sufficiently restricted the accuracy of the measured absorbed doses. In order to ensure a higher accuracy of the developed dosimeters, we shall try to study compositional features of these time-instability effects in As- and Ge-based VCh in the framework of coordination-coordinate model. Within this model, the metastable state is presented by parabola, splitting into three metastable sub-states in respect to different kinds of coordination topological defects created in VCh under irradiation. The first quasi-parabola corresponds to conjugate defect pairs (the intimate valence alternate pairs) in the form of charged under-coordinated atoms, created as a result of radiation-induced destruction of initial heteropolar covalent bonds. These defects are unstable relaxing with time into ground non-defect state owing to renovation of initial heteropolar bond or into second metastable state, which corresponds to conjugate defect pairs in the form charged under-over-coordinated atoms, created due to new homopolar bond formation. So the latter way is developed as bond-changed switching.

The mathematical modelling procedure applied to relaxation of radiation-induced effects testified that post-irradiation relaxation kinetics can attain two principally different forms in dependence on various type of coordination topological defects created in As-and Ge-based VCh under irradiation. It was established, in the case of under-coordinated atoms typical for As-based VCh the relaxation kinetics tends to monomolecular single-exponential one, while in the case of under-over-coordinated atoms character to Ge-based VCh the relaxation kinetics tends towards bimolecular one.

Thus, different compositional features of the observed time-instability radiation-induced darkening effects should be taken into account in order to ensure a higher accuracy of the developed dosimeters.

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AN ESTIMATION OF A PASSIVE INFRA-RED SENSOR' PROBABILITY OF DETECTION

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Passive Infera-Red (PIR) sensors are one of many detection sensors are used to detect any intrusion process of the nuclear sites. In this work, an estimation of a PIR Sensor's Probability of Detection of a hypothetical facility is presented. sensor performance testing performed to determine whether a particular sensor will be acceptable in a proposed design. We have acess to a sensor test field in which the sensor of interest is already properly installed and the parameters have been set to optimal levels by preliminary testing. The PIR sensor construction, operation and design for the investigated nuclear site are explained. Walking and running intrusion tests were carried out inside the field areas of the PIR sensor to evaluate the sensor performance during the intrusion process. 10 trials experimentally performed for achieving the intrusion process via a passive infera-red sensor's network system. The performance and intrusion senses of PIR sensors inside the internal zones was recorded and evaluated.

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THE STUDY ON MEDICAL RADIOGRAPHY USING THE FILM DENSITOMETER

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The paper presents the physical method to trace (spot) the tumour formations in the brest area and the pelvis area on basis of the related area X-ray examination. The process is based on and employing a MULTIDATA System (USA) densitometer connected to a RTD-4 software computer (version 5.2). The advantages of the method rest with the high-accuracy targeting (spotting) of the tumour, of its boundary & sizes and the elaboration of a proper treatment procedure.

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FARMER IONIZATION CHAMBER CALIBRATION USING Co-60 AND Sr-90 SOURCES

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The work presents the dosimetric calibration method for a Farmer ionization chamber, using UNIDOS secondary standard dosimeter, supplied by PTW and two radioactive sources: Sr-90 and Co-60. The calibration method for a Farmer ionization chamber, using both sorces is described. Also a comparison is made between the results obtained, with for both sources. The values obtained after the measurements, show a measurement uncertainty of 2 – 5 %. The measurements were conducted in the Secondary Standard Dosimetry Laboratory at High Energy – STARDOOR in INFLPR and CAMRID in IFIN-HH.

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INSTRUMENTATION FOR NPP RADIATION SAFETY MONITORING

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The ultimate goal of the NPP radiation monitoring is to provide the personnel and the population with the information on possible threat. This is information on the safety barriers integrity and some other issues relating the nuclear energy production safety:

- The ensuring of the nuclear energy utilization safety needs early warning on the emergency possibility. The presence of certain radio nuclides in the NPP technological medium is used as such an indicator of the safety barriers integrity.
- The RadWaste management needs waste characterization before the disposal or long-term storage.
- The radioactivity level in the human body and the environment is the final indicator of the nuclear energy utilization safety.

- The personnel dose monitoring is the powerful instrument for the dose control and ALARA principle implementation.

During almost two decades RPE «ATOMKOMPLEXPRYLAD» (AKP) produces spectrometry instrumentation, which supports solving most of these problems. Basing on national and international safety standards and own gained experience we formulated our tasks of radiation safety monitoring, and determined general company line of the instrumentation development.

NPP safety barriers integrity monitoring

The cladding of the reactor assemblies' pins is the second NPP safety barrier. Once the cladding is damaged, certain portion of the fission products releases to the cooling water of the water-cooled reactor. The specific activity of the iodine isotopes 131 to 135 is the measure of the cladding integrity.

We developed and implemented STPK-01 spectroscopy complex for the continuous reactor coolant monitoring. It consists of the special water pipeline, electrically cooled HPGe detector, multichannel analyzer, industrial computer with specialized software for the system control and spectroscopy information processing. The complex is linked to the NPP LAN. It is used at 3 Ukrainian NPPs.

The third NPP safety barrier is the premier contour border. The steamgenerator (SG) tubes' leak is the main path for the radioactivity release.

For monitoring of the SG tubes integrity we developed the "AZOT-16-PG" complex. It consists of scintillator NaI(Tl) detector, multichannel analyzer, industrial computer with specialized software for the system control and spectroscopy information processing. As the detector is rather sensitive to the temperature, it is termostabilised using heat tubes and Peltier cooler. Imbedded Am-141 source is used for the system stability control.

A lot of examinations and tests during 4 years showed high reliability of the complex. It is implemented at Khmelnitsky NPP.

RadWaste management

Under any conditions NPP produces significant amount of radwastes.

Low and medium waste represent the main radwaste stream as to the volume.

Saturday, 14 Nov. 2009

Session HEP1

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INCLUSIVE PION PRODUCTION IN RELATIVISTIC pA AND AA COLLISIONS

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Experimental study on the production of pions at Synchrophasotron accelerator is reviewed, covering pion spectra and multiplicity distributions. Emphasis is placed on our progress in characterizing the conditions of nuclear matter, by employing particle production observables. Further, the information derived from the ITagedorn temperature of the system emitting pions is critically examined, along with a discussion of the sources responsible for pion emission in the reaction, as revealed by particle spectra and yields.

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SPIN AND MODEL IDENTIFICATION OF Z' BOSONS IN LEPTON-PAIR PRODUCTION AT THE LHC

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Heavy resonances appearing in the clean Drell-Yan channel may be the first new physics to be observed at the proton-proton CERN LHC. If a new resonance is discovered at the LHC as a peak in the dilepton invariant mass distribution, the characterization of its spin and couplings will proceed via measuring production rates and angular distributions of the decay products. We discuss the discrimination of the spin-1 of Z' representative models (SSM, LR, ALR, E_6) against the Randall-Sundrum graviton resonance (spin-2) and a spin-0 resonance (sneutrino) predicted in R-parity violating SUSY, with the same mass and producing the same number of

events under the observed peak. To assess the range of the Z' mass where the spin determination can be performed to a given confidence level, we focus on the angular distributions of the Drell-Yan leptons, in particular we use as a basic observable an angular-integrated center-edge asymmetry. The spin of a heavy Z' gauge boson can be established with center-edge asymmetry up to the Z' mass of 3.0 TeV, for an integrated luminosity of 100 fb^{-1}, or minimal number of events around 110. We also examine the distinguishability of the considered Z' models from one another, once the spin-1 has been established, using the total dilepton production cross section. With some assumption, one might be able to distinguish among these Z' models at 95% C.L. up to the Z' mass of 2.1 TeV.

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COHERENT-PAIR APPROXIMATION IN THE LOGARITHMIC QUARK MODEL

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The Logarithmic chiral sigma model with quark fields and elementary pion and sigma fields is used to describe static properties of the nucleon. The Lagrangian is based on the chiral SU(2)×SU(2) symmetry. The field equations have been solved in coherent-pair approximation. A comparison is made with the results in the original model, the mean-field chiral solution model, and the Skyrme model.

Keywords: quark sigma model, Coherent-Pair Approximation, nucleon properties.

HEP1-4 25

STUDY OF BACKWARD RELATIVISTIC HADRON EMITTED IN ^{4}He AND ^{7}Li INTERACTIONS WITH EMULSION AT 2A GcV

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A comprehensive snidy on ^{4}He interactions with emulsion nuclei at (2. IA GcV) are carried out in comparison with those belonging to Li at nearby energy (2.2A GeV). Throughout, such investigation, two sufficient statistics of inelastic interaction events are picked up [^{4}He (2066) and ^{7}Li. (1003)] The average experimental mean free paths for ^{4}He and ^{7}Li as well as the corresponding theoretical predicted values due to Glauber multiple scattering theory' are presented. The general features of the two ion beams are caught using, the average multiplicities of different secondaries produced in the forward hemisphere of interactions FHS at ($\theta_{Lab} < 90^{o}$) and in backward hemisphere BHS at ($\theta_{Lab} > 90^{o}$**).** The multiplicity distributions of the produced relativistic particles are displayed. Checking up the effect of target size, impact parameter and centrality, representative parameters are used to categorize the statistical sample of events. In the light of the mentioned categories the study is processed. The experimental results are reviewed in tile framework of the modified cascade model to identify its ability for application.

HEP1-5 78

MONTE CARLO STUDIES OF HADRON PRODUCTION IN e+e- COLLISIONS

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When electron and positron beams are made to collide inelastically, virtual particles produced decay into particle-antiparticle pairs like lepton anti-lepton or quark-antiquark. The system of quark anti-quark pairs further evolves into stable or unstable hadrons. The unstable hadrons decay into either unstable or stable products through different decay modes. The mechanism in which hadrons are formed is a complicated process that can not be fully investigated through perturbative QCD. In this regard, perturbative QCD and fragmentation models/hadronization models used in Monte Carlo event generators, and detector simulators like; GEANT4 are collectively very helpful in exploring several important aspects of the process of hadron production.

HEP1-6 108a

LASER ELECTRONACCELERATION IN RELATIVISTIC REGIME

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Starting from the record laser peak power of 1.25 PW and radiation peak intensity of 10^{21} 10 W/cm^{2} produced at LLNL using the chirped pulse amplification (CPA) laser technology, the paper explores the domains and

their limits for laser electron acceleration up to 5 GeV in the relativistic energy regime, eE0λ0 > 3 MeV, where e is the electron charge and E0 and λ are the electric field and wavelength of the laser radiation. The research work focused on laser electron acceleration in order to use as electron sources for the synchrotron radiation and free electron laser.

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RESEARCH STUDIES PERFORMED USING THE CAIRO FOURIER DIFFRACTOMETER FACILITY

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The article presents the results of the research studies performed using the Cairo Fourier diffractometer facility (CFDF), within 10 years after it was installed and put into operation at the beginning of 1996. The main components of the CFDF were supplied by the IAEA according to the technical assistance project EGY/1/022. The present report is the second, as the first one was published at the beginning of 1997, and was about the performance of the CFDF, and its main characteristic parameters. Plenty of measurements were performed, since then; yielding several publications, both in local and international scientific periodicals; and 8 M.Sc. & Ph.D. degrees from Egyptian Universities. Besides, a new approach for the analysis of the neutron spectra measured using the CFDF; applying especially designed interface card, along with its proper software program, instead of the reverse time of flight (RTOF), Finnish make, analyzer originally attached to the facility. It has been verified that the new approach can successfully replace the RTOF analyzer; significantly decreasing the time of measurement; and saving the reactor's operation time. Besides, a special fault diagnostic system program was developed and tested for caring and handling the possible failures of the CFDF. Moreover, measurements were carried out for the diffraction spectra; emitted at different points of one of the samples, for industry; when it was scanned across the neutron beam of the CFDF, in order to study the residual stress after welding.

NRP1-2 11

NEUTRON TRANSMISSION OF GERMANIUM POLY- AND MONO-CRYSTALS

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The measured total neutron cross-sections of germanium poly- and mono-crystals were analyzed using an additive formula. The formula takes into account the germanium crystalline structure and its physical parameters. Computer programs have developed in order to provide the required analyses. The calculated values of the total cross-section of polycrystalline germanium in the neutron wavelength range from 0.001 up to 0.7 nm were fitted to the measured ones at ET-RR-1. From the fitting the main constants ofthe additive formula were determined. The experimental data measured at FT-RR-l of the total cross-section of high quality Ge single crystal at 4400 K, room, and liquid nitrogen temperatures, in the wavelength range between 0.028 nm and 0.64 nm, were also compared with the calculated values **using** the formula having the same constants. An overall agreement is noticed between the formula fits and experimental data.

A feasibility study is done for the use of germanium in poly-crystalline form, as cold neutron filter, and in mono-crystalline one as an efficient filter for thermal neutrons. The filtering efficiency of Ge single crystal is detailed in terms of its isotopic abundance, crystal thickness, mosaic spread, and temperature. It can be concluded that the 7.5 cm thick ^{76}Ge single crystal (0.10 FWHM mosaic spread) cooled at liquid nitrogen temperature is an efficient thermal neutron filter.

NRP1-3 84a

BURNUP AND CRITICALITY ANALYSIS OF CARBON COATED PARTICLE FULE IN HTR-10 REACTOR

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HTR-10 is a modular high temperature gas cooled reactor. The reactor has a unique capability to provide coolant with high temperature for a variety of industrial heat applications and also for efficient electrical power generation. Fuel elements used are the spherical type fuel element

with carbon coated particles. The reactor equilibrium core contains about 27,000 spherical fuel elements forming a pebble bed that is 190 cm in diameter and 197 cm in average height. The spherical fuel elements move through the reactor core in a multipass pattern. The fuel element spherical ball diameter is 6 cm, the fuel zone occupy 5cm diameter with enrichment 17%. The fuel zone contains large number of UO_2 fuel kernels. UO_2 fuel kernel is coated with different layers of SiC and PyC.

Two models are designed to analyze the burnup and criticality of the spherical fuel element, homogeneous and heterogeneous models. The results of the two models are compared with each other and with published results. MCNPX computer code is used to simulate the burnup processes in conditions similar to reactor operations.

NRP1-4 107

MODELING OF CORE HEATUP FOLLOWING LARGE LOSS OF COOLANT ACCIDENT (LOCA) IN TANK TYPE RESEARCH REACTOR

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In this paper, Lumped-Parameter model is used to simulate the transient thermal behavior of ETRR-1 tank type research reactor following large Loss Of Coolant Accident (LOCA). The case of the most severe LOCA leading to a complete uncover of the core is considered. The main purpose of this paper is to predict the average fuel temperature of ETRR-1 fuel elements following total loss of water for different power levels of the fuel element and different convective heat transfer coefficients.

A computer program has been developed to calculate transient temperatures of the uncovered core cooled by natural convection of air in the core coolant channel. The fission fragment heat decay versus time, starting from the moment of the coolant loss is used in the calculations. Results obtained from the calculations show that the maximum fuel temperature will never exceed under any conditions the melting point temperature of the cladding which is about 587 C.

NRP1-5 141

STOCHASTIC NEUTROM TRANSPORT IN A SEMI-INFINITE MEDIUM WITH REFRACTIVE-INDEX DEPENDENT BOUNDARY FOR PURE-TRIPLET SCATTERING

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Stochastic Neutron transport problem for pure-triplet scattering, in participating half-space medium is proposed. The medium is assumed to be random with binary Markovian mixtures (e.g. Neutron transport in boiling water reactor, where the water is present in such reactor in two phases, water and vapor) described by Markovian statistics. The specular reflectivity of the boundary is angular-dependent described by the Fresnel's reflection probability function. The problem is solved at first in the deterministic case, then the solution is averaged using the formalism developed by Levermore and Pomraning, to treat particles transport problems in statistical mixtures. Some physical quantities of interest such as the reflectivity of the boundary, average neutron energy, and average neutron net flux are computed for various values of refractive index of the boundary.

Keywords: Neutron transport, Stochastic media, Gaussian statistics, Refractive index dependent Specular-reflecting boundary.

NRP1-6 142

NEUTRON PROPAGATOR ON LIGHT ELEMENTS NUCLEI.

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The present report suggests the method and device for propagation of neutrons in LAH, hydroxiberyllates and other lithium compounds by heat neutrons irradiation.

If, for example, we enrich lithium hydroxiberyllate (Li2[Be2(OH)4]) with 6Li or deuterium, i.e. produce (6Li3)2[Be2(OD)4], and expose this chemical compound to heat neutrons, then we can with a high level of probability expect the following nuclear reactions:

1. 6Li3(n,t)4He2 with emitted triton energy of approximately 3.5 MeV, that is more then enough for thermonuclear DT-reaction;

2. D(t,n)4He2;
3. High energy neutron which was emitted during reaction (2) decelerates at deuterium and, in its turn, can cause reaction (1);
4. More of that, alpha-particles which were emitted during reactions (1) and (2) can evoke αn-reaction on beryllium;
5. Emitted during reaction (4) neutrons while decelerating at deuterium can evoke reaction (1).

Thus the considered pattern produces a chain of interrelated nuclear reactions, which under certain conditions can result in neutron propagation.

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ARU -1 30

QUALITY ASSURANCE AND QUALITY CONTROL ACTIVITIES RELEVANT TO SITE QUALIFICATIONS AND CONSTRUCTION OFNUCLEAR POWER PLANT

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Several activities should be accomplished before starting actual construction of a nuclear power plant. These cover the planning and scheduling activities as well as a variety of other functions necessary to facilitate site work. Site features~ weather data, soil and subsoil tests, site access data, etc. and availability of services are required. Responsibility for site development which spreads among the utility/sub-contractors of the utility, the constructor/ sub-contractors/ local companies/ telephone/ water and sewage companies/ and the railroad serving the area have been discussed and covered In the present work. The present work also describes the permits for a nuclear unit include the construction permit which is issued by the Nuclear Regulatory Commission after submitting a safety analysis report from the Utility.

ARU -2 82

HEAVY ION TOF-ERDA TECHNIQUE FOR STOPPING POWER APPLICATION OF HEAVY IONS CROSSING THIN MYLAR FOIL

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An experimental method based on heavy ions elastic recoil detection analysis coupled with time of flight spectrometer (HIERDA_TOF-E) have been used to measure energy loss of charged particles in thin absorber. During just a few days of beam time we have measured stopping power of heavy ions in Mylar, for 28Si, 27Al, 24Mg, 19F, 16O, 12C, 9Be and 7Li ions over a continuous range of energies, in the energy range 100-600 keV/amu. For this, different samples (Si, MgO, AlO, LiF, C and BO) were irradiated with a 27.5 MeV Kr beam. The energy loss of the recoil atoms was measured with and without additional foils placed in front of surface barrier detector. The energy of individual ions is determined from its TOF data; the exit energy after the stopping foil is measured using a Si detector, for which every channel has been calibrated using the TOF data without the stopping foil present. The experimental stopping data have been compared to those predicted by SRIM-2008 (The Stopping and Range of Ions in Matter) computer code and to the compiled data published by Helmut Paul. Deviations around stopping maximum are observed.

Keywords: Stopping power; Time-of-.flight, energy elastic recoil detection analysis.

ARU -3 90b

HIGH-ENERGY IRRADIATION EFFECTS IN AMORPHOUS CHALCOGENIDE SEMICONDUCTORS: A REVIEW ON RECENT PROGRESS

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The state-of-the-art in the field of high-energy irradiation effects (IE) in amorphous chalcogenide semiconductors (AChS) including the greatest achievements of numerous scientific schools in the former Soviet Union are analysed in details starting from the first pioneer experiments performed yet in the early 60-s up to complex and comprehensive research in the Institute of Materials of Scientific Research Company "Carat" (Lviv, Ukraine) and National Centre for Radiation Research and Technology (Cairo, Egypt).

The first announcements of I.A. Domoryad (Institute of Nuclear Physics, Tashkent, Uzbekistan) on mechanical properties of AChS modified by ^{60}Co γ-irradiation with average energy of 1.25 MeV refers to the early 60-s [1]. It was shown that, contrary to radiation tests of S.R. Ovshinsky under A ChS-based ovonics, the bulk glassy Se, As_2S_3, As_2Se_3 and their simplest quasibinary compositions were quite sensitive to 0.1-10 MGy absorbed doses, the detectable thermally-reversible changes being observed in microhardness, Young's module, internal friction and geometrical dimensions.

These results were rather semi-empirical, since any exact data on microstructural origin of IE have not been obtained. So this problem have been reconsidered at the beginning of the 80-s by some territorial scientific-research centers in the former Soviet Union. The greatest progress was achieved by scientific group of Sh.Sh. Sarsembinov (Kazakh State University, Alma-Ata, Kazakhstan) engaged in accelerated electrons effect on optical and electrical properties of As- and Ge-based AChS [2]. It should be emphasized that this scientific group was the first put forward one of the most practically important ideas on the electron-induced modification of AChS. They also tried to study the physical nature of the observed IE with IR spectroscopy, ESR and positron annihilation techniques, but surface damages caused by accelerated electrons did not allow them to do this directly at short- and medium-range ordering levels.

Some attempts to study IE produced by extra-high doses of γ- and reactor neutron irradiations were made by L.F. Konorova et al. from A.F. Ioffe Physical-Technical Institute (St.-Petersburg, formerly – Leningrad, Russia) [3]. However, despite of a great number of experiments performed, their significance remained relatively poor because of essential complications in radiation treatment conditions, such as uncontrolled thermal misbalance during irradiation resulting in specific structural transformations like to crystallization, segregation and phase separation. The most important conclusion was on chemical interaction between intrinsic structural fragments and absorbed impurities, stimulated by prolonged irradiation.

The similar results on radiation-induced impurity processes have been put forward by scientists from National Centre for Radiation Research and Technology (Cairo, Egypt) too [4,5]. It was shown, in part, that additional weak absorption bands associated with oxygen-based impurities appeared in the powder of mixed Ge-As-Se-Te AChS, irradiated by ^{60}Co γ-quanta with 0.25 MGy dose. In contrast to previous research, the smaller absorbed doses (no more than 0.34 MGy) did not allow to observe the stronger changes. The microstructural origin of the observed IE was connected with specific defect centers (broken or dangling chemical bonds, vacancies, non-bridging atoms, chain ends, etc.), created owing to atomic displacements by secondary electrons.

In early 80-s, the complex and comprehensive experimental study of IE in AChS based mainly on arsenic sulfide has been started in the Institute of Materials of Scientific-Research Company "Carat" (Lviv, Ukraine). Apart from a great number of experiments on IE (their compositional, dose, temperature and spectral dependences), the physical nature of the observed radiation-structural transformations was treated using IR Fourier spectroscopy, EPR and mass-spectrometry data [6-10]. The observed IE were explained by two interconnected processes, the first one being coordination topological defect formation associated with covalent bond switching, and the second one being chemical interaction between intrinsic structural fragments and absorbed impurities. Having developed the model of radiation-induced defects, theoretical principles of topological-mathematical simulation for destruction-polymerization transformations in complex AChS-based systems were introduced. The previously stated idea on radiation modification attained new sense and possibility for AChS using in industrial dosimetry was justified.

The recent results on dynamic behavior of high-energy IE in AChS were considered to develop the unique phenomenological model describing externally-attained metastability in topologically disordered solids.

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ARU -4 119

PRODUCTION Mo-99 IN THE FEDERAL STATE UNITARY ENTERPRIZE "KARPOV INSTITUTE OF PHYSICAL CHEMISTRY" ORDINARY AND ALTERNATIVE TECHNOLOGYES

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The "Karpov" institute has been producing radionuclide ^{99}Mo since 1985 year based on the nuclear research reactor WWR-c. The target of highly enriched uranium (HEU) is irradiated with a neutron flux for further chemical extraction of ^{99}Mo. There are two radiopharmaceutical products containing ^{99}Mo, they are:

- ^{99}Mo solution;
- ^{99}Mo /^{99m}Tc generator.

When administered together with an organic application, radionuclide ^{99m}Tc is an efficient diagnostics technique of the afflicted internal organs. The method enables to make thorough visual examination of the organs by means of gamma-chamber.

The generator contains ^{99}Mo radionuclide which produces ^{99m}Tc isotope as a result of radioactive decay. Generator design enables to eluate ^{99m}Tc in physiological solution of sodium pertechnetate a short time before it is injected.

Flexibility of the design makes generator ready-for-use after several and simple preparation steps. Reliable biological protection is provided. Generator communications are reliable to ensure only sterile air inside.

1.1. ^{99m}Tc generator KSU-3 is intended for multiple generation of (^{99m}Tc) sodium pertechnetate sterile solution (eluate) for radiopharmaceutical application and for preparation of ^{99m}Tc -labeled radiopharmaceuticals using special reagents.

1.2. Applications of (^{99m}Tc) sodium pertechnetate in nuclear medicine include brain, thyroid and saliva gland scintigraphy, examination of lung perfusion. ^{99m}Tc -labeled radiopharmaceuticals: selective examination of liver, lungs, bones, kidneys, etc.

1.3. ^{99м} Tc generator KSU is reliable, easy to use and competitive with the best analogs existing worldwide.

There is alternative method of Mo-99 production technique on basis of solution reactor. The "Karpov" institute has good experience of collaboration with "Kurchatov" institute in field of Mo-99 producing (reactor "Argus"). Some Tc-generators was send in to the clinics and the test results are good. At this moment "Karpov" institute increasing the amount of total activity Mo-99 by improving WWR-c technology and developing solution reactor technology.

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NEW AND POWERFUL ENERGY DEVELOPMENT IN 21 CENTURY FUSION OR FISSION

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The quick growth of nuclear economy form 1972 to 1976 among industrial countries (at the time of forming OPEC and rising the price of oil)and much attention to the part of nuclear melting &atomic accelerators from recent years(at the time of further rise of oil price)has inspired us to search about the reason of connecting two above mentioned subjects (rising the price of fossil fuel and consuming new energy)in industrial countries and the lack of connecting these two subjects in the third world countries &their less connection in the developing countries.

On the hand, lasting nuclear projects in the third world countries (such as Iran),present changes in the developed countries (those in 1973at the time of rising the price of oil)&the decline of the nuclear economy in the world aggravated the situation**.**

Keywords: nuclear economy, nuclear power plant, cast of nuclear electricity, nuclear melting, opportunity cast, passing through the nuclear economy.

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HIGH-ENERGY ELECTRON BEAM APPLICATION TO AIR POLLUTANTS REMOVAL

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The advantage of electron beam (EB) process in pollutants removal is connected to its high efficiency to transfer high amount of energy directly into the matter under treatment. Disadvantage which is mostly related to high investment cost of accelerator may be effectively overcome in future as the result of use accelerator new developments. The potential use of medium to high-energy high power EB accelerators for air pollutants removal is demonstrated in [1]. The lower electrical efficiencies of accelerators with higher energies are partially compensated by the lower electron energy losses in the beam windows. In addition, accelerators with higher electron energies can provide higher beam powers with lower beam currents [1]. The total EB energy losses (backscattering, windows and in the intervening air space) are substantially lower with higher EB incident energy. The useful EB energy is under 50% for 0.5 MeV and about 95% above 3 MeV. In view of these arguments we decided to study the application of high energy EB for air pollutants removal. Two electron beam accelerators are available for our studies: electron linear accelerators ALIN-10 and ALID-7, built in the Electron Accelerator Laboratory, INFLPR, Bucharest, Romania. Both accelerators are of traveling-wave type, operating at a wavelength of 10 cm. They utilize tunable S-band magnetrons, EEV M 5125 type, delivering 2 MW of power in 4 μs pulses. The accelerating structure is a disk-loaded tube operating in the $\pi/2$ mode. The optimum values of the EB peak current I_{EB} and EB energy E_{EB} to produce maximum output power P_{EB} for a fixed pulse duration τ_{EB} and repetition frequency f_{EB} are as follows: for ALIN-10: E_{EB} = 6.23 MeV; I_{EB} =75 mA; P_{EB} = 164 W (f_{EB} = 100 Hz, τ_{EB} = 3.5 μs) and for ALID-7: E_{EB} = 5.5 MeV; I_{EB} = 130 mA; P_{EB} = 670 W (f_{EB} = 250 Hz, τ_{EB} = 3.75 μs).

This paper presents a special designed installation, named SDI-1, and several representative results obtained by high energy EB application to SO_2, NOx and VOCs removal. The SDI consists of the following units: a gaseous mixture preparation system; a high energy EB source (ALIN-10 accelerator); an EB reactor (EBR) and a gas analyzer (TESTO 350-XL gas analyzer for SO_2 and NOx and a system of 3 gas analyser types for VOCs: TLV Panther Industrial Precision PID Monitor, Gas Chromatograph Fisons 8330 and Buck Scientific, Multiple Gas Analyser #1). The EBR is designed like a Faraday cage in order to permit the EB average current monitoring during gaseous mixture irradiation. It consists of two concentric stainless steel cylindrical vessels: a gas and electrically insulated inner vessel (EIIV) of 0.2 m inner diameter and 2.967 m long and a grounded outer vessel (GOV) of 0.28 m inner diameter and 3.145 m long. The EB is introduced in the EBR through two entrance windows, EBW-1 (for GOV) and EBW-2 (for IIV), made of 100 μm-thick aluminum foils. During the experiments, the electron beam average was up to 26 μA. For experiments with VOCs a bed with 0.04 m thick V_2O_5 catalyst layer was installed at the bottom area of the EIIV. The best obtained results are: 99.7% removal efficiency for SO_2 and 85.5%

removal efficiency for NOx with a reactor input energy density (RIED) of 0.216 kJ/L, and 77.2% decomposition efficiency and 87.1% oxidation efficiency for toluene removal at RIED of 0.81 kJ/L.

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APPLICATION OF ELECTRON ACCELERATORS IN CONJUNCTION WITH MICROWAVE SOURCES IN MEDICAL STUDIES

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Electron beams (EB) are presently used, in addition to the routine conventional radiotherapy techniques, for cancer specialized therapies (intensity modulated radiation therapy [1] and total body electron irradiation [2]), the irradiation of blood and blood components, vaccine preparation, and other. Microwaves (MW) are presently used for therapeutic applications in cardiology, urology, surgery, ophthalmology, cancer therapy, and others, and for diagnostic applications such as cancer detection, organ imaging, and more [3]. The reported data show that low dose-all body irradiation with ionizing as well as with nonionizing irradiation may enhance the tumoricidal effects of radiation or chemotherapy, overcome acquired drug resistance and can stimulate certain components of the immune system that may aid in destroying cancer cells. These data suggested that application of low-dose total body EB+MW irradiation in conjunction with chemotherapy could contribute by novel effects to the cancer therapies. In view of this argument two specifically designed radiation exposure devices (REDs) were carried out for separate, successive and simultaneous irradiation with EB of 6.23 MeV and MW of 2.45 GHz in vivo (RED-vivo) and in vitro (RED-vitro) for the following medical studies: 1) The effects of low-dose EB+MW total body irradiation without/with drugs administration on the C57 BL/6 mice bearing malignant melanoma (MM); 2) The effects of separate and simultaneous MW and EB irradiation on MM cells culture without/with drugs incubation and on human blood components (proteins and cells) irradiated in samples of integral blood from healthy donors and from donors with MM. Both REDs consist of the following units: 1) An accelerated EB source: ALIN-10 electron linear accelerator of 6.23 MeV and adjustable absorbed dose rate from 0.002 Gy s^{-1} up to 70 Gy s^{-1} (built in the NILPRP, Bucharest, Romania); 2) A special designed exposure chamber that permits inside separate, successive or simultaneous irradiation with EB and MW; 3) A microwave source of 2.45 GHz and adjustable output power (0-50 W), generated as 10 ms pulses at 50 Hz repetition rate. The main conclusions of our work are: 1) The EB+MW+drugs procedure is a promising MM therapy that beside other known combined MM therapies could contribute by novel effects if EB, MW and drug application sequences and doses are optimized; 2) The human blood components behavior exposed in the integral blood samples to different irradiation modes and doses depends on the MM stages and thus could be used as a new diagnostic test, that beside other known tests, will help to follow-up patients with MM.

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IKN3-1 66

BOSE-EINSTEIN CONDENSATE IN NUCLEI – THEORY AND EXPERIMENT

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In the present work the possibility of the concept of Bose-Einstein condensation (BEC) in light and intermediate nuclei was considered. As was shown, different types of theory give different conditions for the

phase transition to the BEC state. The most important question from this point of view is value of nuclear density for this transition. According to the accurate quantum-mechanical calculations this value should be much smaller than it is for the nucleus in the normal state [1]. From the other hand, some kinds of the models give the opposite results for this [2]. There are the theories which consider the properties of alpha-cluster wave function [3] and more sophysticated mechanisms of the BEC formation. In this work the comparison between these theories, including the present approach, and experimental data was discussed as well as a systematic of the experimental results which we can explain from the BEC point of view.

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IKN3-2 124

LOW-ENERGY INTERACTION OF ANTI-KAONS

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Central importance for the physics of strong interaction has the dynamics driven by chiral symmetry breaking in low-energy QCD.

High precision measurements of the antikaon interaction with nucleons and nuclei - like SIDDHARTA at LNF/Italy and E17 at J-PARC/Japan - open the way to study the low energy regime of strong interaction involving strangeness.

Especially interesting are nuclear systems (KNCs, kaonic nuclear clusters) involving strangeness and bound by the strong force. At present this topic is in lively discussion and the search for KNCs is conducted in new experiments (e.g. FOPI at GSI, AMADEUS at LNF, E15 at J-PARC). An international scientific network (LEANNIS) in Hadronphysics2 of the European Framework Program FP7 will bring together experimentalists and theorists for joint work on the antikaon interaction with nucleons and nuclei. This talk will give an overview on open problems and will present research activities in this challenging field. The progress in precision spectroscopy of kaonic atoms will be discussed in detail.

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SPALLATION NEUTRON PRODUCTION IN EXTENDED TARGETS INITIATED BY ELECTRONUCLEAR REACTIONS

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Increasing interest displayed recently in electro-nuclear reactions is inspired by the conception of using of electron beams for neutrons and gamma rays generation in extended heavy targets. Such a neutron source is considered, in particular, to be promising for various important problems of future nuclear power, mainly in connection with the topics of deeply subcritical energy production, radioactive waste transmutation and incineration, as well as for the reactor shielding and material radiation hardness investigation. For this purpose the study of space-energy distribution of neutrons and gamma rays produced by electrons of energy stretching over a specific great nuclear dipole resonance is of principal meaning. In order to investigate this problem in more detail we performed the calculations of space-energy spectra of neutrons and gamma rays generated in different heavy spallation target compositions of W, Pb and U by electrons of energy from 15 MeV to 1 GeV [1, 2]. Our calculations have been done by using both MCNPX and FLUKA codes.

The obtained spectra are compared with the similar ones produced by 660 MeV and 1000 MeV protons in the same targets and the conclusion is made that these spectra are very similar in the region of lower energies (0-10 MeV) for the same target compositions. An example is depicted in Fig.1. In particular, the shape of spectra of neutrons created both by protons and electrons in this energy region having especial practical meaning are sufficiently comparable to be used as a spallation neutron source for several aims like transmutation and incineration of fission products.

Although the yield of neutrons produced this way amounts to 0.32 neutrons per electron whereas the yield of neutrons generated by protons at the same kinetic energy of 1 GeV and in the same cylindrical lead target (60cm long and 60cm in diameter) is 34 neutrons per proton, the electrons accelerators are much cheaper and simpler then hadronic ones. Moreover,

they have along with it other prospectus applications, for example, as a base of free electron lasers.

Fig.2 shows the comparison of neutrons spectra calculated by using MCNPX code [3] with experimental data [4] for primary electrons in the energy range of 15MeV to 40MeV in copper and lead cylindrical targets.

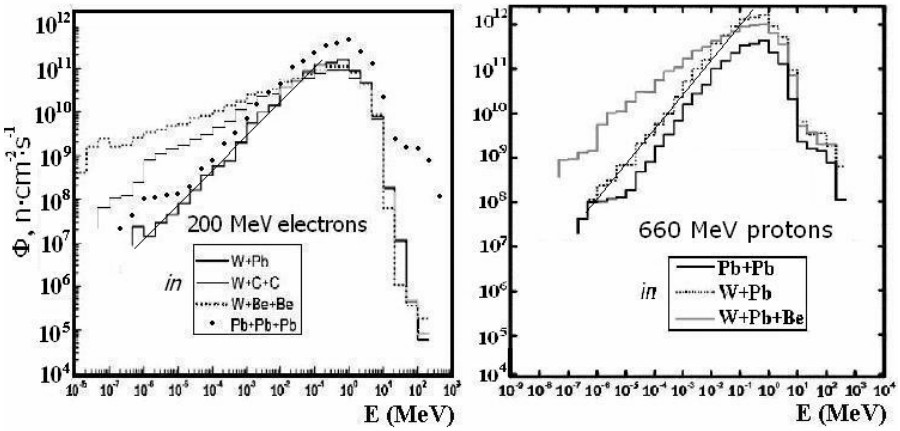

Fig.1. Energy spectra of neutrons produced in W and Pb central target rods of the assembly by 200 MeV electrons (left) and 660 MeV protons (right). Straight lines illustrate the fitting function $(\Delta\Phi/\Delta E) \sim E^{0.81+/-0.01}$ [1, 2]. Calculations have been performed by using MCNPX code.

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2. A. Polański and B. Słowiński. *Generation of Neutrons in Heavy Extended Targets by Elections of Energy from 30 MeV to 1000 MeV*. Talk delivered at the XIX International Baldin Seminar on High Energy Physics Problems "Relativistic Nuclear Physics and Quantum Chromodynamics", Dubna, Russia, 29 September - 4 October, 2008. Book of abstract, p.90.

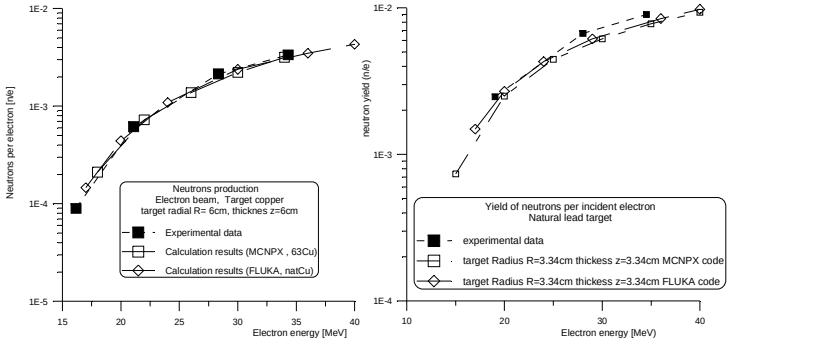

Fig.2. The yield of neutrons per incident electron as a function of energy of electrons impinging on a cylindrical copper target of 6cm long and 12cm in diameter (left) and on a lead cylindrical target of 3.3cm long and 6.68cm in diameter (right). The number of entries with MCNPX code is 10000 and with FLUKA code is 100000 in both cases.

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BULK - SAMPLES PGNAA WITH ISOTOPIC NEUTRON SOURCES

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An overview is given on research towards the Prompt Gamma-ray Neutron Activation Analysis (PGNAA) of bulk-samples. Some aspects in bulk-sample PGNAA are discussed, where irradiation by isotopic neutron sources is used mostly for in-situ or on-line analysis. The research was carried out in a comparative and/or qualitative way or by using a prior knowledge about the sample material. Sometimes we need to use the assumption that the mass fractions of all determined elements add up to 1. The sensitivity curves are also used for some elements in such complex samples, just to estimate the exact percentage concentration values. The uses

of ^{252}Cf, ^{241}Arn/Be and ^{239}Pu/Be isotopic neutron sources for elemental investigation of: hematite, ilmenite, coal, petroleum, edible oils, phosphates and pollutant lake water samples have been mentioned.

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COMPARATIVE ANALYSIS OF AVERAGE CHARACTERISTICS OF π^-– MESONS AND PROTONS PRODUSED IN NONCENTRAL AND SEMICENTRAL CTa-COLLISIONS AT 4.2 AGeV/c

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Comparative analisis of average characteristics of π^- – mesons and protons produced in noncentral and semicentral CTa - Collisions at the momentum of 4.2 AGeV/c is performed. The angular dependence of the temperature of nuclear matter T is studied. One centre and two centre production mechanisms are considered. The results obtained are compared with the Dubna version of the cascading model (DCM) and with the results of other works.

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INVESTIGATION OF THE PROTON INDUCED REACTIONS ON TIN AT LOW ENERGIES

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Radioactive isotopes of antimony could be produced from proton induced reactions on tin isotopes. At low energy, (p,n) reactions are the only open channel. Measurements are performed for proton reactions with ^{124}Sn in the energy range between 9.0 and 18.0 MeV. Evaluations of the remaining possible reactions are performed and compared with each other. The cross sections are calculated theoretically by the EMPIRE-II code for ^{124}Sn(p,n)^{124}Sb reaction. However, the calculations failed to agree with the experimental results. A recommended evaluation is given and the thick target yields are calculated from the evaluated approximations.

Keywords: Excitation Function/ Stacked-foil Technique/ Nuclear Model Calculations.

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SYSTEMATICS OF THE (p,n) EXCITATION FUNCTIONS BELONGED TO SEVERAL ISOTOPES AT ENERGIES < 60 MeV

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Proton induced charge exchange reactions were studied in mass numbers from 11 to 238. The overall excitation functions of (p,n) reactions show a systematic variation with atomic mass and charge of the nucleus in connection with nucleon binding energy. Excitation functions are maximum within the proton energy range from 9 to 12 MeV with long high energy tail. The more probable occurrence of proton induced charge exchange reaction in medium weight nuclei is attributed to its extra binding energy per nucleon than other nuclei. It is observed that the high energy tail of the excitation function shows a linear relation in the double logarithmic scale.

The slope of the linear part is an integer number depending on which the reaction partners are in a vicinity of shell closure or not.

Keywords: Nuclear Reactions, Excitation Function, Charge Exchange

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RADIONUCLIDES PRODUCED BY PROTON INDUCED REACTIONS ON In AND Mn TARGETS AT LOW ENERGY

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Cross section study for proton induced reaction on natural Indium and Manganese targets were performed. Excitation functions for the ^{nat}In(p,x)^{113}Sn, ^{nat}In(p,x)^{114m}In, ^{115m}In, ^{nat}Mn(p,x)^{55}Fe, ^{nat}Mn(p,x)^{54}Mn and ^{nat}Mn(p,x)^{51}Cr from threshold up to 18 MeV protons have been measured experimentally by the stacked- foil technique, and high resolution HPGe

gamma spectrometry have been used. Two stacks were irradiated by proton beam with energies 14.7 and 18 MeV for both Mn and In targets on the MGC-20 Cyclotron at The NRC, AEA, Egypt. The theoretical analysis of the excitation functions has been done employing both ALICE-IPPE and EMPIRE-3 codes. Theoretical calculations agree well with the experimental data as well as the previous measurements.

Keywords: Excitation function, Stacked-foil technique; Natural Targets; HPGe-Detector; Nuclear Model Calculations.

NSR2-5 60

EVALUATION OF TECHNETIUM TRANSMUTATION RATE IN THERMAL AND FAST SPECTRUM

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Technetium transmutation into stable noble Ruthenium in Petten high flux researches reactor and in the experimental fast reactor JOYO was numerically calculated using ChainSolver code. The obtained results are compared with those obtained experimentally.

Keywords: Transmutation, Technetium, ChainSolver.

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SEARCH FOR P-ODD CP-VIOLATING EFFECTS IN NUCLEAR GAMMA TRANSITIONS

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Recently CP-violation effects are observed in heavy-flavor systems only. Search for analogous effects in light-quark systems is based mainly on the measurements of the permanent electric dipole moment (PEDM) of neutron, proton, atoms, and molecules. There are both P-even and P-odd terms of the Lagrangian of the Standard Model or more general Lagrangian producing CP-violation effects. PEDM measurement is a tool for study the P-odd one which is ordinary called PT-noninvariant. Investigations of correlations of products of nuclear processes offer alternative to PEDM measurements. Moreover the list of diagrams contributing to the discussed effect is significantly wider in this case. In addition there are some effects which enhance both CP-violating and CP-conserving P-odd effects in nuclei by one and the same way.

In the last two decades the basic idea of the discussed experiments was to measure the analyzing power of the collision of polarized neutron with polarized La target at resonance energy 0.75 eV. Unfortunately the attempts to get rid of huge final state interaction (FSI) effect simulating T-noninvariance have not met with success.

In the present talk various schemes of measurement of PT-invariance break up effects in gamma-transitions induced by decay of radioactive isotopes or by (n, gamma)-reactions are discussed. FSI effect is incomparably smaller in these cases. It is shown that in the majority of examples the scheme based on the measurement of linear polarization of the gamma-radiation of an aligned sample proposed in [1] looks optimal for such measurements. The alignment may be created by a strong magnetic field at low temperatures or turns out to be determined by registration of coincident of the gamma-quantum with a preceding (subsequent) particle of a cascade.

The transitions convenient for such studies and the schemes in which the measurements could be successfully realized are analyzed. The efficiency of a particular example is determined by the (measured or estimated) value of the P-odd effect in a certain gamma-transition, peculiarities of spectrum of a source (or reaction), choice of a detector scheme, and possibilities to produce intensive gamma source. A wide range of promising examples is considered. Some versions of such experiments look capable to reduce upper limit of the PT-noninvariant effect achieved in nuclear experiments [2] by several orders of magnitude and approximate it to the level of upper limit attained recently in PEDM measurements at list for isovector PT-noninvariant amplitude.

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THE NEW KIND OF THE NUCLEAR REACTIONS

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The New Kind of the Nuclear Reactions is investigated and it is shown, that it is the good candidate for the future energy reactors. The new Reaction is based on the Proton-Neutron exchanges controlling and as the result the isotopes conversations. It is shown also, that the new reaction can be used for the “near-by” elements transformations.

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HYPERFINE MAGNETIC ANOMALY IN EUROPIUM ISOTOPES

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The investigation of the hyperfine structure in optical spectra of atoms and ions using laser spectroscopy is the powerful tool for the study of the nuclear structure, in particular, for determination of changes in mean square charge radii and multipole moments of nuclei. Systematic studies with long chains of isotopes gives the information on trends in behavior these parameters of nuclear structure and provides the basis for the development of theoretical models, including models describing more fine effects, like hyperfine anomaly and distribution of magnetization in nuclei. In this work, results of the investigation of the hyperfine structure of 151,152,153,154,155 Eu isotopes measured for the atomic transition 4f76s2 8S7/2 → 4f76s6p 6P5/2 with a wavelength of 564.58 nm are presented. Values of changes in mean square charge radii, nuclear moments, and the hyperfine magnetic anomaly of these isotopes were determined. These results were obtained using the method of laser-induced resonance fluorescence in the atomic beam. The experiments were performed on the laser spectrometer at the Laboratory of Nuclear Reactions of JINR, Dubna. The specific feature of nuclei in the chain 151-155Eu is the sharp jump in the deformation between N = 88 and N = 89. For example, in the isotopic pair 151,153Eu, the value of the hyperfine magnetic anomaly 151Δ 153=0.76(4)% is directly related to the observed jumping the deformation in the transition region. This experimental result was proved by recent calculations, based on the particle–rotor model, which thus take into account the variation in the deformation. The second specific feature in the chain 151 - 155Eu is the addition of the uncoupled neutron to the nucleus 152Eu and 154Eu which increases the fraction of the spin component in the magnetic moment of the nucleus and results in the increase in the average radius of distribution of the electric current and the induced magnetic moment. The obtained values of the hyperfine magnetic anomaly for some investigated isotopes turned out to be unusually large, much larger than most known anomalies. These values of the hyperfine magnetic anomaly reflect the considerable difference of the distributions of the nuclear magnetism in the compared nuclei.

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A NEW PSDPF INTERACTION TO DESCRIBE THE 1ħω INTRUDER STATES IN sd SHELL NUCLEI

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The properties of normal positive parity states, called also 0ħω states, in sd shell nuclei are well described using the shell model with USD (USDA or USDB) interactions. In addition to these states, there is a set of intruder negative parity states named 1ħω states, which are well known experimentally. Such states result from the promotion of one nucleon from the p to sd shell or from the sd to pf shell. There does not exist a consistent description of these states. To study them, we must enlarge the model space from the 0ħω sd space (16O core) to the full p-sd-pf space allowing one nucleon jump (1ħω space, 4He core). This extension of the valence space requires the development of a new interaction compatible with the new space. It is the main aim of our work to determine such an interaction for the first time. The construction of our new interaction followed the three following steps using the codes Antoine and Nathan: The first step was the choice of the primary interactions for each major shell p, sd and pf, and for the cross-shells p-sd and sd-pf. These interactions are: CK (p shell), USDB (sd shell), SDPF-NR (pf and sd-pf cross-shell) and PSDT (p-sd cross-shell). We have used all these interactions to get our initial PSDPF0 interaction, then we have adjusted the single particle energies (SPE) to obtain the 0ħω

states of the single particle nuclei 17O and 41Ca and we have adopted the SPE of the CK interaction that describe well the sequence of 5He levels.

The next step was the modifications of the cross-shell monopole parts of the PSDPF0 interaction responsible of the 1ħω excitations to improve the description of some key states in N=Z and Z+1 nuclei. These modifications were done without changing the 0ħω states in 17O and 41Ca keeping thus fixed the energies of all 0ħω states through the sd shell. The resulting interaction is named PSDPFB. The last step was the improvement of PSDPFB to get a more consistent description of the intruders. This is done using a fitting procedure of all the parameters (SPE, cross monopoles and multipoles) to obtain the final version of our interaction called PSDPF.

The PSDPF interaction reproduces well both positive and negative parity states in nuclei through the sd shell. There are some discrepancies in the middle of sd due to the large number of valence nucleons. In this case, the wave functions of the intruders are strongly mixed, and thus very sensitive to the nature of the 1ħω excitations. Some results of calculated spectra and electromagnetic transition probabilities will be presented and compared to data reported in the literature.

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QUARK-LIKE MODEL AND NUCLEAR BINDING ENERGY

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Following our previous presentation of a new three-fold symmetry for derivation of the magic numbers of nuclei based upon a quark state model of nuclei, here the nuclear binding energy is obtained from such new perspective. From this point of view since each nucleon is made of three quarks, the binding energy of nuclei contains a volume term proportional with 3A (A is mass number). By considering the asymmetry in the number of up and down quarks and also coulomb correction, a new formula is presented that calculates the nuclear binding energy in terms of only N and Z numbers for all nuclides.

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STUDY OF ISOSPIN DEPENDENCE OF NUCLEAR LEVEL DENSITY

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In this study, the single-particle level densities are calculated by using the isospin dependent nuclear level density (NLD) formula. The calculations are performed using the experimental data for 28Al achieved from 27Al (n,γ) 28Al resonances. The average excitation energy of the 28Al levels in this reaction is E=7.95 MeV. The isospin of these levels is found, T=1 by fitting the experimental data with the NLD formula which is in good agreement with the isospin conservation. The NLDs at the excitation energy, E=20MeV was calculated and the maximum possible isospin in the range from ground state up to excitation energy, E=20MeV was estimated.

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ICNIRP LIMITS OF EXPOSURE TO STATIC MAGNETIC FIELDS OCCUPATIONAL AND GENERAL PUBLIC

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In its latest Guidelines ICNIRP limits of exposure to static magnetic fields are reported(2009). For occupational purposes the limit is 2 T for exposure of head and trunk while limit of exposures of limbs is 8 T. For General public , exposure of any part of the body is 400 mT. The aim of the present study is to review and discuss the new guidelines.

RAR1-2 55

ASSESSMENT OF GAMMA ACTIVITY OF BUILDING MATERIALS COMMONLY USED IN UPPER EGYPT

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Gamma activity and natural radionuclides (^{226}Ra, ^{232}Th and ^{40}K) content in some building materials, soil, sand, redbrick, clay brick, limestone and ceramic commonly used in Upper Egypt is presented in this paper. Measurements were done by using gamma spectrometry (NaI(*Tl*) 3"x 3"). Concentrations of natural radionuclides (C_{Ra}, C_{Th} and C_K), radium equivalent (Ra_{eq}), activity concentration index *(I),* the specific dose rates in door (D) and the annual effective dose (D_E) due to gamma radiation from building materials was calculated. Concentrations of natural radionuclides (^{226}Ra, ^{232}Th and ^{40}K) are in usual range and below maximal permitted values. The lowest value of *(I)* is 0.19 for sand while the highest one is 0.88 for ceramic. The ranges of (D_E) are in between (0.035 and 0.852 mSv), it is below maximal permitted values, so that examined materials could be used for construction of new buildings (for interior and external works) as well as for covering of pavements, floors, etc.

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RADIOMETRIC CHARACTERIZATION OF SAND IN NORTHEAST SINAI

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Thirty-eight locations covering an area of 350 km^2 in northeast Sinai were investigated by γ-ray spectroscopy using a 50% HPGe detector. The limits of area are Al-Arish North, El-Hasana South, El-Oga East, and El-Gifgafa West. The range of activity concentrations of ^{238}U, ^{234}Th, ^{226}Ra, ^{232}Th and ^{40}K are 0.6–35.2, 3.9–22.6, 4.7–29.6, 4.7–23.9, and 108–295 Bq/kg for sands, respectively. ^{137}Cs in the region ranged from 0.1–8.0 Bq/kg. No major difference between the studied area and that previously investigated in the costal area in North Sinai. Reliable correlations (R^2 = 0.8–0.9) among ^{238}U, ^{234}Th, and ^{226}Ra isotopes was obtained. On the other hand, low correlation (R^2 = 0.6–0.7) was obtained from the analysis of the isotopes of ^{238}U-seies and ^{232}Th. No evidence of correlation between the concentrations of radioisotopes and pH contents, TOM, and grain size were found. The soil-plant transfer factor are <0.2, <0.2, 1.5, and 0.7 for ^{226}Ra and ^{232}Th, ^{40}K, and ^{137}Cs, respectively. The wild vegetations collected from the studied area have average concentrations of 1.9, 1.4, 1.3, 254, and 0.3 for ^{234}Th, ^{226}Ra, ^{232}Th, ^{40}K, and ^{137}Cs, respectively. The average concentrations of ^{226}Ra, ^{232}Th, and ^{40}K in water samples collected from five wells are 0.02, 0.02, and 1.1 Bq/l, respectively. The average absorbed dose rate for the sand samples were calculated to be 19.4 nGy h^{-1}. The Ra_{eq} activities of the sands are lower than the recommended maximum value of 370 Bq kg^{-1} criterion limit of Ra_{eq} activity for building materials.

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RADIATION EFFECTS IN PHYSICAL AGEING OF BINARY As-S(Se) GLASSES

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It is well known that high-energy irradiation is able to modify structural relaxation processes far below glass transition in chalcogenide glasses (ChG) leading to their significant radiation-induced physical ageing. This effect has been comprehensively studied in Se-based glasses [1,2], where radiation-induced defect formation processes are negligible. In contrast, the similar effects in S-based glasses rely on the formation of metastable coordination topological defects leading to long-wave shift in the fundamental optical absorption edge. However, impact of radiation treatment on physical ageing processes in these materials remains out of the scope.

In the present paper, we first compare the radiation-induced physical ageing effects in binary As-Se [1] and As-S glasses as typical representatives of ChG widely used in photonics and optoelectronics. These glasses were irradiated with gamma-quanta under ambient conditions with a few Gy/s power and ~3 MGy accumulated dose. The physical ageing effects were monitored by differential scanning calorimetry (DSC) measurements using NETZSCH 404/3/F microcalorimeter.

It is shown that high-energy gamma-irradiation leads to additional physical ageing in AsxSe100-x ChG with x < 30 over the one caused by natural storage at normal conditions [1,2]. This effect is shown on DSC traces as an increase in the glass transition temperature and endothermic peak area in the vicinity of glass transition region. At the same time, no measurable gamma-induced changes in DSC traces were recorded for compositions with x less 30. This behaviour correlates well with absence of a so-called short-term natural physical ageing in AsxSe100-x ChG with x more 30 [3]. Binary AsxS100-x ChG stored at normal conditions during 1 year did not show any significant physical ageing for x between 30 and 42 compositions either. However, despite structural similarity of main constituent building blocks (pyramids and chalcogen chains), the AsxS100-x ChG possessed completely different compositional behavior of physical ageing under gamma-irradiation. Contrary to selenide glasses [1,2], gamma-irradiation of AsxS100-x ChG caused a sharp increase in the endothermic peak area in the vicinity of glass transition region for the investigated compositions with x between 30 and 40. Using the analogy with natural and gamma-induced physical ageing effects in AsxSe100-x ChG with x less 30, it is concluded that structural network of these gamma-irradiated AsxS100-x ChG relaxes in a new thermodynamic state, which is closer to equilibrium of supercooled liquid exhibiting a well-pronounced gamma-induced physical ageing. The nature of the observed phenomenon is explained within the modified configuration-coordinate diagram.

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SCATTERD IONIZING RADIATIONS FROM LOW ENERGY FOCUS PLASMA AND RADIATION DOSIMETERY ASSESSMENT

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An investigation of scattered ionizing radiations emission from a low energy plasma focus (0.1 kJ Mather type) device operating with different gases are studied. The radiations emission was investigated using time-integrated and time-resolved detectors. The present plasma focus device is powered by a capacitor bank of 1 μF at 18 kV maximum charging voltage. The correlation of radiation intensity with filling gas pressure indicates that the X-ray and corpuscular emission are maximized at the optimum pressure for the focus formation at peak current. The conclusion of this work gave some details about the radiation protection recommendations for the radiation workers in the field of the plasma focus machines.

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RADIOLOGICAL IMPACT OF RADIOACTIVE IODINE DISCHARGE AFTER HYPOTHETICAL NUCLEAR ACCIDENT

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A modeling was performed in this study for iodine isotopes discharge from a hypothetical nuclear research reactor of thermal power of 20 MW, due to hypothetical severe nuclear accident in case of loss of ventilation system. The committed effective doses CED for the public around the reactor site was calculated for various atmospheric stability classes, Pasquill categories (A-F), using health physics HOTSPOT 2.06 code. The model was applied for three cases; without explosion of water, with explosion of water, and fusion in air. The results in the first case show that the receptor received CED lower than the permissible dose at any downwind distance from the reactor. In the second case, the receptor located within the distances 1.2 Km to 4.5 Km from the reactor received CED slightly more than the permissible dose. And for the third case, the receptor located within 50 Km from the reactor received CED more than the permissible dose. All the previous results of CED be! long to the reactor site stability class (F).

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HEU AND LEU FULE SHIELDING COMPARATIVE STUDY APPLIED FOR SPENT FULE TRANSPORT

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INR Pitesti owns and operates a TRIGA dual-core Research Reactor for material testing, power reactor fuel and nuclear safety studies. The dual-core concept involves the operation of a 14 MW TRIGA steady-state, high-flux research and material testing reactor at one end of a large pool, and the independent operation of an annular-core pulsing reactor (TRIGA-ACPR) at the other end of the pool. The steady-state reactor is mostly used for long term testing of power reactor fuel components (pellets, pins, subassemblies and fuel assemblies) followed by post-irradiation examination.

Following the general trend to replace the HEU fuel type (High Enriched Uranium) by LEU fuel type (Low Enriched Uranium), in the light of international agreements between IAEA and the states using HEU fuel in their nuclear reactors, INR Pitesti have been accomplished the TRIGA research reactor core full conversion on May 2006. The HEU fuel repatriation in US in the frame of Foreign Research Reactor Spent Nuclear Fuel Return Programme effectively started in 1999, the final stage being achieved in summer of 2008.

Taking into account for the possible impact on the human and environment, in all activities associated to nuclear fuel cycle, the spent fuel or radioactive waste characteristics must be well known. Shielding calculations basic tasks consist in radiation doses calculation, in order to prevent any risks both for personnel protection and impact on the environment during the spent fuel manipulation, transport and storage.

The paper is a comparative study of LEU and HEU fuel utilization effects for the shielding analysis during spent fuel transport. A comparison against the measured data for HEU spent fuel, available from the last stage of the spent fuel repatriation, is presented. All the geometrical and material data related on the spent fuel shipping cask were considered according to the NAC-LWT Cask approved model. The shielding analysis estimates radiation doses to shipping cask wall surface, and in air at 1 m and 2 m, respectively, from the cask, by means of 3D Monte Carlo MORSE-SGC code. Before loading into the shipping cask, TRIGA spent fuel source terms and spent fuel parameters have been obtained by means of ORIGEN-S code. Both codes are included in the ORNL's SCALE 5 programs package.

^{60}Co radioactivity is important for HEU spent fuel; actinides contribution to total fuel radioactivity is low. For LEU spent fuel ^{60}Co radioactivity is insignificant; actinides contribution to total fuel radioactivity is high. Dose rates for both HEU and LEU fuel contents are below regulatory limits, LEU spent fuel photon dose rates being greater than the HEU ones. The comparison between HEU spent fuel theoretical and measured dose rates in selected measuring points shows a good agreement, the calculated values being greater than the measured ones both to cask wall surface (about 34% relative difference) and in air at 1 m distance from the cask surface (about 15% relative difference).

Keywords: *TRIGA fuel, spent fuel transport, shipping cask, shielding analysis, photon dose rates.*

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RECENT RESULTS WITH A COLD CATHODE ION SOURCE SYSTEM

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The operational parameters of a cold cathode ion source such as electrical discharge voltage, electrical discharge current and output ion beam current are measured at different pressures using nitrogen gas. The efficiency of the ion source has been determined at different pressures using nitrogen gas. The properties of plasma established in the ion source which operates at gas pressure in the range 10^{-4} – 10^{-3} mmHg have been investigated using a single Langmuir probe. The Langmuir probe consists of a cylindrical tungsten wire isolated by ceramic insulator except small part of 2 mm length and 1 mm diameter and place facing the plasma inside the ion source. It has been electrically biased to positive or negative voltage to collect electron and / or positive ion currents. Langmuir probe current voltage characteristics are obtained at different pressures in the range from 7 x 10^{-4} to 3 x 10^{-3} mmHg

using nitrogen gas. The plasma parameters inside the ion source such as, electron density, electron temperature, plasma kinetic pressure and plasma frequency have been determined using nitrogen gas.

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SURFACE MODIFICATION OF METALS USING PLASMA TORCH

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Low temperature plasma nitriding of 304L stainless steel is performed using a home made low power direct-current plasma torch. Plasma nitriding is carried out in temperature range of 300– 550°C for 1 to 4 hours, in various N_2–H_2 gas mixture ratios at about 5 Torr pressure and torch power 300 Watts. The effect of treatment time, temperature and working gas composition on the microstructure and mechanical properties of plasma nitrided surface layers is investigated. The microstructure, phase composition and micro hardness profile of the nitrided surface layers are characterized by optical microscopy, scanning electron microscope (SEM), X-ray diffraction (XRD) and Vickers micro hardness tester. The results show that plasma treatment for 1 – 4 h over a temperature range of 300 – 550°C yields nitride case depth of 20 – 50 μm and the hardness of the nitrided layer is in the range of 700 – 1250 HV. Plasma nitriding of stainless steel samples at about 475°C in 70 % of nitrogen admixed with hydrogen at 5 torr shows the maximum increase of hardness 1220 HV which is about four times that of untreated layers. The XRD pattern confirmed the formation of an expanded austenite γN phase, due to the nitrogen incorporation into original lattice and forms supersaturated face center cubic phase. In addition preliminary results for aluminum nitriding is also shown.

Keywords: plasma Nitriding / Surface Processing / Plasma Torch.

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MODIFICATION OF PROPERTIES OF SUBSTANCES UNDER RADIATION

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It is known that when radiation as for example UV or RF electromagnetic waves meet a living organism, some interaction can take place so that living matter is described as no homogeneous and slightly conducting dielectric The wave in the material is absorbed, refracted and diffracted.

Then possible physical modification of the matter under radiation as resulting interaction can have a consequence biological effects.

This is why the heating by microwaves of a living tissue, constituted in major part of water, place gives with a thermoregulation and possibly with a damage of fabric if the rise in temperature is too intense or is prolonged.

Basically the interaction between material and radiation depends on the dielectric properties through the permittivity and the electrical properties described by the electrical conductivity but also the length of wave compared to dimensions of the organization, of the form of this one, of polarization, and so on.

The aim of this work is to propose an original modelling which can be able to analyze pure matter behaviour and how this matter can be affected when it is under radiation .The understanding of model allow us some predictions and interpretations using no destructive measurement of permittivity and conductivity

The proposed method leads to comparison of pure and affected substances with acceptable results.

Key words: radiation UV, RF waves, permittivity, conductivity.

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RADIATION-STRUCTURAL METASTABILITY IN AMORPHOUS SEMICONDUCTOR DESCRIBED WITHIN CONFIGURATION-COORDINATE MODEL

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The unified configuration-coordinate model describing radiation-induced structural transformations in amorphous semiconductors like to chalcogenide glasses was developed. Within this model, all kinds of externally-induced effects are divided in two main groups – the under-irradiation or transient effects (in-situ) and post-irradiation ones (ex-situ). The latter is also known as post-irradiation physical ageing, they occurring at ambient (natural physical ageing) or thermal restoration conditions (thermally-induced physical ageing) and can be described as a system of externally-activated radiative and non-radiative disturbances, followed by relaxation towards thermodynamic equilibrium. Structural units of glass-forming matrix are supposed to be in the one of the next three states: ground (the most thermodynamically equilibrium state), excited (the transient state) and structurally-modified (the metastable state) ones, interconnected by vertical radiative (non-radiative) and thermally-activated over-barrier tunnelling transitions. The first element of the developed configuration-coordinate model is associated with ground or initial structural state, representing itself as multi-well quasi-parabola, the deepest parabolic-like state corresponding to the most stable atomic equilibrium within glass-forming network. This state can be occupied by atoms in local configurations appeared during prolonged physical ageing under natural conditions. This process tending sometimes more than a few decades occurs through long-term structural shrinkage to eliminate additional free volume. The second element of the proposed configuration-coordinate model corresponds to the excited sate, it being transient between ground and metastable ones. It should be noted this short-term state is always single-well despite a variety of external influences applied. Only vertical radiation-induced transitions between ground sub-states and excited state are possible. The third element of the developed configuration-coordinate model associated with metastable state is presented by parabola, splitting into three sub-states (quasi-parabolas) in respect to different kinds of specific structural defects. The developed configuration-coordinate model agrees well in its main features with known other ones proposed to describe radiation-induced metastability in amorphous semiconductors [1-2]. But, in contrast, it allows predict new externally-induced effects caused by combined high-energy irradiations (both photonic and corpuscular ones), as well as thermal-, photo- and natural-storage influences.

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POST-IRRADIATION INSTABILITY DYNAMICS IN QUASI-BINARY As/Sb TRISULPHIDE GLASSES

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The radiation-induced dynamics effects were studied in gamma-irradiated (constant radiation field conditions with 1-2 MGy accumulated absorbed dose) chalcogenide glasses of mixed quasibinary As/Sb sulphide glasses using optical spectrometry in the range of fundamental optical absorption edge and positron annihilation lifetime (PAL) techniques. It was shown that high-energy gamma-irradiation of the studied chalcogenide glasses caused the low-energetic shift of their fundamental optical absorption edge, the effect being known as radiation-induced darkening. This darkening was unstable decaying monotonically with time to some residual value after irradiation switching-off. In such a way a so-called dynamic component appeared in contrast to static one, which left unchangeable in all glasses during prolonged time after irradiation. It was established that the dynamic component of radiation-induced optical effects gradually decayed, the more pronounced changes being observed in Sb-rich glasses.

Simultaneously, for above samples were tested by PAL method, the results being treated in terms of high-measurement statistics for more than 5 millions of elementary annihilation events accumulated during more than one day. The values of average positron lifetimes were taken as numerical

criterion for occurred radiation-induced changes. The effect of increase in average positron lifetime was observed in all irradiated samples under investigation testifying in a favour of coordination topological charged defects.
The observed dynamic radiation-optical changes were explained well by compositional dependence of atomic compactness in the studied system.

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ELECTRON BEAM DIAGNOSIS AND DYNAMICS USING DIADYN担 PLASMA SOURCE

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This paper is presenting results obtained with the DIADYN installation after replacing its vacuum electron source (VES_LV) with a plasma electron source (PES_LV). DIADYN is a low energy laboratory equipment operating with 10 to 50 keV electron beams and designed to help realize non-destructive diagnosis and dynamics for low energy electron beams but also to be used in future material irradiations. The results presented here regard the beam diagnosis and dynamics made with beams obtained from the newly replaced plasma source. We discuss both results obtained in experimental dynamics and dynamics calculation results for electron beams extracted from the SEP_LV source.

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BIODEGRADABLE POLYELECTROLYTES OBTAINED BY RADIATION POLYMERIZATION

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Polyelectrolytes are water-soluble polymers carrying ionic charge along the polymer chain. Depending upon the charge, these polymers are anionic or cationic. The inherent solid - liquid separating efficiency makes these polyelectrolytes a unique class of polymers which find extensive application in potable water, industrial raw and process water, municipal sewage treatment, mineral processing and metallurgy, oil drilling and recovery, etc. Also, due to their ability to produce advanced induced coagulation, a considerable amount of bacteria and viruses are precipitated together with the suspended solids. Especially the acrylamide polymers are very efficacious for water treatment but acrylamide is a toxic monomer and therefore their use are governed by international standards that provide the residual acrylamide monomer content (RAMC) in them be less than 0.05%. Under these circumstances our attention was focused on the following research steps that are presented in this paper:
1) Preparation of a special class of polyelectrolytes, named Pn, with very low RAMC values, based on electron beam (EB), microwave (MW) and EB+MW induced co-polymerization of aqueous solutions containing appropriate mixtures of acrylamide (AMD) and acrylic acid (AA) monomers (AMD-AA co-polymers). The Pn were obtained by radiation tehnology with very small RAMC (under 0.01%) as well as in a wide range of molecular weights and charge densities. Very low AMD monomer content of Pn is due to the major advantages of radiation induced polymerization in aqueous solution containing monomers. Due to water presence in the EB irradiated system, irradiated water radicals facilitate the polymerization process and increase rate and level of monomers conversion in co-polymers. Also, once again, by the presence of water, which absorbs MW energy very strongly, the MW polymerization reaction rate is much enhanced resulting in a reaction time about 50-100 times lowers than by conventional heating. Also, due to the rapid, volumetric and selective MW energy transfer, the molecular weight dispersion of the polymeric material is very low.
2) Development of more efficacious methods for Pn application to potable water (PW) and waste water (WW) treatment. The Pan obtained by EB and EB+MW induced polymerization give the best results for TSS (total suspended solid) and T (turbidity) indicators in the PW case while Pn types obtained by MW induced polymerization give always the best results for OM (organic matters) and TOC (total organic carbon) indicators in the WW case. Also, each quality indicator is associated with a certain amount and a certain type of Pn, which exhibits the maximum ability to its reduction. For a given Pn type there is a different amount for each quality indicator, which gives the best result. These aspects have suggested to mix several Pn types (the best for

each quality indicator) and to use their mixture (Mn) for water treatment. The use of mixture (Mn) of several Pn types demonstrated the ability in the simultaneous reduction of several quality indicators for PW as well as for WW.

3) Preparation of biodegradable polyelectrolytes by radiation induced polymerization of aqueous solutions containing appropriate mixtures of AMD, AA and corn starch.

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A PROMPT GAMMA-RAY SYSTEM USING Pu/Be ISOTOPIC NEUTRON SOURCE FOR ELEMENTAL ANALYSIS OF BULK MATERIAL SAMPLES

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A prompt gamma-ray system is designed and constructed using 2.5 Ci Pu/Be isotopic neutron source. A hyper pure germanium detection system attached with 8192 multichannel analyzer and special computer software programs are used. The system is calibrated up to 11 MeV for energy and efficiency. A sample of NaCl solution of different concentration values are used for testing and calibration. Also, a sample of tap water used in Inshass laboratories is elementally investigated. For sake of comparison this sample is analyzed by ICP and X-ray fluorescence (XRF) techniques. The suggested system is ready for elemental analysis of tiny liquid and solid bulk material samples.

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SEQUENTIAL ANALYSIS OF GAMMA SPECTRA

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This work shows how easy one can deal with a huge number of gamma spectra. The method can be used for radiation monitoring. It is based on the macro feature of the windows XP connected to QBASIC software. The routine was used usefully in generating accurate results free from human errors. One hundred measured gamma spectra were fully analyzed in 10 minutes using our fast and automated method controlling the Genie 2000 gamma acquisition analysis software.

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^{238}U AND ^{232}Th CONCENTRATION IN ROCK SAMPLES USING ALPHA AUTORADIOGRAPHY AND GAMMA SPECTROSCOPY TECHNIQUES

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The activity concentrations of uranium and thorium were measured for some rock samples selected from Dahab region in the south tip of Sinai. In order to detect any harmful radiation that would affect on the tourists and is becoming economic resource because Dahab have open fields of tourism in Egypt. The activity concentration of uranium and thorium in rocks samples was measured using two techniques. The first is α-autoradiography technique with LR-115 and CR-39 detectors and the second is gamma spectroscopic technique with NaI(Tl) detector. It was found that the average activity concentrations of uranium and thorium using α-autoradiography technique ranged from 6.41-49.31 Bqkg^{-1}, 4.86- 40.87 Bqkg^{-1} respectively and by gamma detector are ranged from 6.70- 49.50 Bqkg^{-1}, 4.47- 42.33 Bqkg^{-1} respectively. From the obtained data we can conclude that there is no radioactive healthy hazard for human and living beings in the area under investigation. It was found that there are no big differences between the calculated thorium to uranium ratios in both techniques.

Keywords: NaI(Tl), Natural radioactivity, α-autoradiography technique.

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METHODOLOLOGY FOR QUANTITATIVE ANALYSIS OF LARGE LIQUID SAMPLES WITH PROMPT GAMMA NEUTRON ACTIVATION ANALYSIS USING Am-Be SOURCE

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An optimized set-up for prompt gamma neutron activation analysis (PGNAA) with Am-Be source is described and used for large liquid samples analysis. A methodology for quantitative analysis is proposed: it consists on normalizing the prompt gamma count rates with thermal neutron flux measurements carried out with Hé-3 detector and gamma attenuation factors calculated using MCNP-5. The relative and absolute methods are considered. This methodology is then applied to the determination of cadmium in industrial phosphoric acid. The same sample is then analyzed by inductively coupled plasma (ICP) method. Our results are in good agreement with those obtained with ICP method.

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CHARACTERIZATION OF URANIUM-BEARING MATERIAL BY PASSIVE NON-DESTRUCTIVE GAMMA SPECTROMETRY

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High-enriched, low-enriched, natural, and depleted uranium-bearing materials were analysed. Isotopic composition, amount of U-isotopes, and total U-content were determined. The peak ratio method using intrinsic calibration for U isotopic abundance measurements and a relative method for mass determination of nuclear materials in form of pellets or powder are reported, based on a standard U calibration set, using attenuation correction. A method was also developed for determining the production date of the material.

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ULTRA HIGH ENERGY COSMIC RAYS AND ATMOSPHERIC MONITORING OF AIR-FLUORESCENCE AND AIR-CHERENKOV TELESCOPES VIA HIGH SPECTRAL RESOLUTION LIDAR

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In this work, we give first a review of Ultra High Energy Cosmic Rays (UHECR), with consideration to their origins, composition, acceleration mechanism and an introduction to present and future experiments for such studies. We describe the role of troposphere as a medium responsible for the production of Extensive Air Showers focusing in the characteristics of 3 components: electromagnetic, hadronic and muonic and we explain the production of air-fluorescence and Cherenkov radiation, as well as corresponding simulation codes. We discuss the origins of the needed correction of the overall UHECR signal recorded by EAS telescopes due to scattering of air-Cherenkov and air-fluorescence radiation by molecular and aerosol particulates of the atmosphere. Therefore we explain the necessity of using advanced and at the same time reasonable cost LIDARS for quantification of aerosol to molecular scattering ratio.

On the experimental side, we present a prototype of High Spectral Resolution Lidar (HSRL) in bistatic mode with laser emitter at 532 nm and telescope receiver hosting two Fabry-Perot etalons, needed for the molecular and aerosol channels, respectively. We present experimental results on the characterization of each of the two channels and an algorithm for extraction of the aerosol to molecular scattering ratio. Finally, we give some preliminary report on our plans on using, as alternative to Fabry-Perot etalons, Atomic and Molecular Absorption Filters. In this way, the atomic vapor version of the HSRL replaces the temperature and mechanically sensitive Fabryperot with a robust and stable atomic or molecular absorption filter.

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A DUAL-HEMISHERE (SPHERICAL) IRRADIATION FACILITY FOR Am-Be NEUTRON FIELD OPTIMIZATION

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The design and construction of a dual-hemispheres (spherical) irradiation facility for isotopic neutron field optimization is outlined. Neutron field characteristics is studied using a 5 Ci Am-Be neutron source and both gold and indium bare and cadmium covered foils. Dependence of thermal and epithermal fluxes on foil-source distance is measured for air and water as surrounding media.

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APPLICATION OF THE BERTLMANN-MARTIN INEQUALITY TO SYSTEMS WITH SPIN

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Bertlmann and Martin have established an inequality from the Thomas-Reiche-kuhn sum rule[1]; this bound (BMI) links the mean square radius to the lowest dipole transition energy. Generalizations as well as further studies were derived and tested in various papers [2-7].

In preceding works, the spin degrees of freedom were not included; the purpose of the present study is to discuss some general aspects of the BMI in the case of systems for which the spin degrees of freedom are incorporated.

In previous works, we have checked that, in the case of the harmonic oscillator without spin, the BMI is saturated, i.e., is strict equality [2, 3]. So, it is natural to ask the question of validity of saturation in the case of the harmonic oscillator when spin is included. We, also, try to check the importance of the antisymmetrization of the total wave function on the character of the BM bound. For the sake of simplicity, we present the derivation of the BM bound in the one dimensional space.

The general rule seems to indicate that the BM inequality is saturated.

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RADIATIVE TRANSFER EQUATION FOR ANISOTROPIC SPHERICAL MEDIUM WITH SPECULAR REFLECTIVE INDEX

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Radiative transfer problem for anisotropic scattering in a spherical homogeneous, turbid medium with diffuse and angular dependent (specular) reflecting boundaries is solved using the Pomraning-Eddington approximation method. The angular dependent specular reflectivity of the boundary is considered as Fresnel's reflection probability function. The partial heat flux is calculated with anisotropic scattering through a homogeneous solid sphere. The calculations are carried out for spherical media of radii 0.1, 1.0, and 10 mfp and for different scattering albedo. Two different weight functions are used to verify the boundary conditions. Our results are compared with the available data and give an excellent agreement for thick and highly scattering media.

Keywords: Radiative Transfer / Anisotropic Scattering / Spherical / Ponzraniizg- Eddington Fresnel's Reflection.

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STUDY OF THE SPECTRUM OF PHOTONS IN PLANAR QED AT FINITE TEMPERATURE AND DENSITY. EXACT GREEN FUNCTION

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In (2+1)-dimensional QED, the structure of the exact Green function of photons at finite temperature and density is derived. It can be written as a sum of ten tensor structures with corresponding factors. Five tensors are transversal; five are not. Particularly, the structure of the exact Green function in (3+1)-dimensional QED/QCD is derived. The imaginary time formalism are used.

The spectrum of longwavelength photons is derived from the pole positions of this Green function for the case of form factors computed in one-loop order. The high density asymptotics for the form factors, the Debye mass, the magnetic mass and the spectra of different photon states in this limit are calculated. A comparison with the results in the framework of SU(2) gluodynamics is done [1].

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SEARCH FOR O(6) BEHAVIOR: APPROXIMATE FORMULA OF THE ENERGY SPECTRA IN O(6) LIMIT WITH THREE-BODY POTENTIAL

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The purpose of this note is to study the O(6) symmetry limit by counting of particle (p) and hole (h) boson by partition of the major shell space of Z=50-82, N = 82-126 into four quadrants (Q) viz. quadrant I and III here p-p and h-h bosons, respectively and II, IV are p-h bosons. We also compare the two–body potential of O(6) energy spectra with three-body potential. We have calculated the energy levels and B(E2; 2-0) values for a number of nuclei that satisfy the condition of O(6) symmetry in all the four quadrants. The variation of B(E2; 2-0) values with the number of valence proton and number of valence neutron number is also illustrated.

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TWO-LEVEL ATOM IN AN ELECTROMAGNETIC WAVE OF CIRCULAR POLARIZATION: EXACT SOLUTION VIA PATH INTEGRAL

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The movement of two-level atom in interaction with an electromagnetic wave of circular polarization is studied using the formalism of path integral. The propagator, is first of all, written in the standard form, then using the phase space and some rotations in the space of coherent states have enabled greatly simplify the calculations. The corresponding wave functions were found exactly.

Keywords: Path integral, Two-level atomi, Propagator.

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TIME DOMAIN NONLINEAR ANALYSIS OF A TWO-PHASE NATURAL CIRCULATION LOOP

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One approach of instability analysis for two phase flow is solution of nonlinear differential equations derived from conservation equations. In two phase flow systems the steady state characteristics are obtained from a set of nonlinear algebraic equations. In this paper, we apply an algorithm based on Newton-Raphson method by using a relaxation parameter which decreases the convergence rate while increases the convergence probability significantly. We solve the set of nonlinear equations by convergence criteria of. The other unknown variables of equations are derived by using the entrance velocity obtained from the steady-state solution. The applied method in transient mode is the forth-order Runge-Kutta algorithm including precision order. The employed increment time is. In transient mode, the oscillations of entrance velocity in the low power region and the high power region involves the type-I instability and the type-II instability, respectively.

At the end, the stability map of the loop has been drawn. The stable region in this low-pressure system is extended up to about that is greater than the stability map of the double-channel two-phase natural circulation loop obtained by the other considered references.

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SOLITARY WAVES IN SPACE DUSTY PLASMA WITH DUST OF OPPOSITE POLARITY

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The nonlinear propagation of small but finite amplitude dust-acoustic solitary waves (DAWs) in an unmagnetized, collisionless dusty plasma has been investigated. The fluid model is a generalize to the model of Mamun and Shukla to a more realistic space dusty plasma in different regions of space viz.., cometary tails, mesosphere, Jupiter's magnetosphere, etc., by considering a four component dusty plasma consists of charged dusty plasma of opposite polarity, isothermal electrons and vortex like ion distributions

in the ambient plasma. A reductive perturbation method were employed to obtain a modified Korteweg-de Vries (mKdV) equation for the first-order potential and a stationary solution is obtained. The effect of the presence of positively charged dust fluid, the specific charge ratio μ, temperature of the positively charged dust fluid, the ratio of constant temperature of free hot ions and the constant temperature of trapped ions and ion temperature are also discussed.

Keywords: dusty plasma; opposite polarity; dust-acoustic waves; mKdV equation; solitary solution.

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RAPIDITY AND IMPACT PARAMETER CORRELATION IN PION-XENON INTERACTIONS AT GeV ENERGIES

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A knowledge of the degree of centrality of high energy hadron/nucleus-nucleus interactions, quantitatively represented by an impact parameter (IP) is needed for space localization of intranuclear collisions and for the elaboration of appropriate models of such interactions. Nevertheless, the IP is not an observable quantity whereas experimentally measured are only energies, momentum and multiplicities of specified secondary particles. Next, using these observables constructed are such variables as (pseudo)rapidity, four-velocity and various scaling parameters which allow to present experimental data in a more or less compact and universal form suitable for theoretical analysis. At the same time from simple model considerations one can conclude that, for example, the higher is the value of rapidity the large is the IP, and the larger is the multiplicity of emitted/produced particles the more central collisions have been engaged, i.e. the closer to zero is the IP etc.

In our previous works we have studied the correlation between the average longitudinal rapidity and IP for πXe interactions of 2.34 to 30 GeV energy [1] using JAM code [2] and established their statistical dependence increasing with interaction energy. But the most interesting is to know, at the certain level of probability, within what interval of IP a concrete observed event of interaction occurs. To this end we investigate in our work the statistical correlation between the longitudinal rapidity (LR) and IP for several most interesting channels of πXe interactions, such as, for example, peripheral channels $\pi^+ + Xe \rightarrow \pi^0 + A$ and $\pi^- + Xe \rightarrow \pi^0 + A$ at different energies. As an example Fig.1 shows the scatter plot of LR vs. IP for $\pi^{+/-} + Xe \rightarrow \pi^0 + A$ at 2.34 GeV/c and 3.5 GeV/c, respectively, calculated by using the JAM code.

One can notice that the LR vs. IP correlation remarkably increases with increasing energy of interaction.

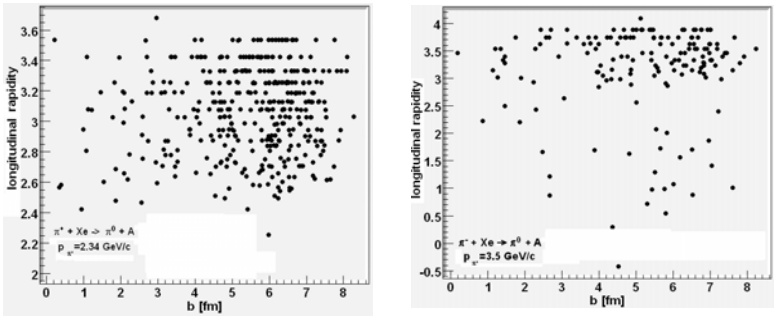

Fig.1. Scatter plots of longitudinal rapidity vs. impact parameter of neutral pions from the reaction π^++Xe→π^0+A at 2.34 GeV/c (left) and π^-+Xe→π^0+A at 3.5 GeV/c (right) calculated using JAM code [2].

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ON THE POSSIBILITY OF A NEW LIGHT NEUTRAL BOSON IN HEAVY ION COLLISIONS

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We have performed an experimental study reporting the measurements of e^+e^- pairs in nucleus - nucleus interactions, using ^{32}S (200A GeV) beam from CERN and [^{12}C and ^{22}Ne (3.7A GeV)] beams from Dubna. From the interactions of such beams with nuclear emulsion, 134 electron pairs have been observed. Challenging observations are found to be remarkably similar to 57 years old emulsion data, from Bristol, obtained by exposure to cosmic ray. The results show that, both data are consistent in a way that, they scaled well in a single curve which provided a unified description of mesonic decay. The results suggest that the pairs originate from light neutral bosons emitted during the collisions, The origin of such neutral bosons could be due to de-excitation of the produced fragments ^{4}He, ^{8}Be and ^{12}C resulting in the fragmentation of ^{32}S, ^{22}Ne and ^{12}C beams. The masses of the neutral bosons were estimated from conservation laws of kinematics and found to be equal to 1.55±0.14 MeV/c^2. '[he corresponding lifetimes are of order of 10^{-16} s. The results could solve the puzzles which were going on during the last 5 decades around the anomalous mean free path of α-particle produced during high energy particle collisions of secondary helium fragments as compared to those of primary ^{4}He at similar energy. This result demonstrates the possibility of neutral boson formation.

Keywords: Electron Pair Production, Neutral Boson Decay Heavy Jon Collisions.

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THE ROLE OF S11(1535) RESONANCE ON INCOHERENT ETA ELECTRO-PRODUCTION OFF THE DEUTRON

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As an extension for the study of the s11(1232) nucleon resonance, the role of this resonance on the exclusive response functions of the incoherent eta electroproduction off the deuteron at different values for the four-momentum transfers squared and the virtual photon lab energy is studied. The study is carried out in the impulse approximation (IA) i.e. the final state interaction is neglected. The elementary amplitude for eta electroproduction is taken from the MAID-2003 model.

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HADRON MULTIPLICITIES FROM THE TOP AND W BOSON

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The average multiplicity of charged hadrons from the top quark is calculated in perturbative QCD for the first time. The hadron

multiplicities in e+e- events induced by primary top-antitop pairs are estimated at the ILC energy (500 GeV). The average multiplicity of charged hadrons from the W boson is also calculated. The agreement of theoretical prediction with the LEP data on e+e- events with the W boson production says in favor of universality of the QCD evolution in hard processes.

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HORIZONTAL SYMMETRY OF LEPTONS FROM THE BOTTOM UP

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Connection between horizontal symmetry of leptons and the neutrino mixing data is discussed. If the tri-bimaximal form of neutrino mixing is assumed, then the minimal horizontal symmetry is S_4. Symmetry groups A_4, S_3 and their relation with the neutrino mixing data are also discussed.

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STRANGE QUARKS IN NUCLEON AND PARITY-VIOLATING EFFECTS IN ELASTIC ELECTRON-DEUTERON SCATTERING

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Parity-violating asymmetries in polarized electron scattering from nucleons and nuclei result from the interference of photon (γ) and Z-exchange. These processes are therefore considered to be ideal for studying the structure of hadrons and in particular to understand the role of sea quarks in the structure of nucleons. A theoretical and experimental study of strange electric $G_E^s(Q^2)$, magnetic $G_M^s(Q^2)$, and axial $G_A^s(Q^2)$ form factors provides thus information about the role of strange sea quarks in the nucleon. Many experimental programs have been started at various electron accelerators to search for the strangeness content of the nucleon through the observation of parity violating asymmetries in the scattering of polarized electrons from proton, deuteron and ^{4}He targets. These experiments are expected to answer questions about the strange form factors of the nucleon and radiative corrections to the axial vector couplings which may also lead to an understanding of anapole moments. In theory, many calculations have been done for the parity-violating helicity-dependent electron asymmetry in the quasi-elastic scattering of polarized electrons off deuterons and. But there exist very few calculations for the case of elastic electron deuteron scattering. The general expressions for parity violation observables in elastic scattering of polarized and/or unpolarized electrons from unpolarized deuterons are given and are numerically evaluated for the kinematics of new experiments. The dominant contribution from the interference of γ and Z exchange as well as the smaller contributions from strangeness $(s\bar{s})$ components of the nucleon, parity odd admixtures in the deuteron wave function, anapole moments and radiative corrections are included and discussed in the context of parity-violating electron scattering experiments of present interest.

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PRECISION NEUTRON TOTAL CROSS SECTION MEASUREMENTS FOR NATURAL HAFNIUM AT REACTOR NEUTRON FILTERED BEAM

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Hafnium and its alloys are used for control rods in nuclear reactors and nuclear submarines because hafnium is the excellent neutron absorber and it has a very high melting point and is corrosion resistant.

As it has noted in the NEA Nuclear Data High Priority Request List [1] , the interpretations of critical experiments with UOx fuel conducted by CEA in the AZUR zero-power reactors has shown systematic underestimation of the reactivity worth that may by attributed to an overestimated natural hafnium capture cross section. Experimental results reported in the literature obtained either from microscopic or integral

measurements have pointed out that all existing evaluated neutron data libraries show deficiencies concerning description of the nuclear properties of the hafnium isotopes. So, the new high precision measurements for hafnium capture cross section were appeared needed.

The development of filtered neutron beam technique at the Kyiv Research Reactor (KRR) enables to form the fluxes of about 10^6 to 10^7 neutron/cm^2·s at the fixed neutron energies in the range 0 – 160 keV at the reactor horizontal channels. High intensity quasi-mono-energy beam availability and the existing experimental base allow to perform the precise measurements of total neutron cross section with accuracy better than 0.1% and neutron elastic scattering cross section with accuracy better than 3%. At the neutron energies less than 100 keV hafnium capture cross section may be determined as the difference between total and elastic scattering cross sections. So, the attainment of the 4% accuracy of the hafnium capture cross section being measured at the KRR filtered beams is possible.

The measurement of hafnium total neutron cross section, result of which is presented here, was the first step to solve this task.

Total neutron cross section measurements were performed at the 8-th reactor horizontal channel of the KRR at the 54 keV neutron filtered beam using transmission method. To receive the quasi-mono-energy beam with the average energy $53.6 \pm^{0.7}_{2.4}$ keV we used the composite neutron filter consisted of Si (256.3 g/cm^2 thick), S (76.8 g/cm^2), Al (5.39 g/cm^2), Mn (6.26 g/cm^2), ^{10}B (0.5 g/cm^2). The purity of beam was about 99.7%. These experiments utilized several thicknesses of metallic samples of natural hafnium (chemical purity of Hf was 99.26%): 0.00494±0.00004, 0.00804±0.00003, and 0.01297±0.00004 at/b. The recoil hydrogen counter was used as a neutron detector.

The results of measurements are presented together with the analysis of the known previous experimental data from EXFOR/CSISRS and the evaluated nuclear data from libraries ENDF/B-VII, JEFF-3.1, JENDL-3.3 and CENDL-2, averaged over 54 keV filter neutron spectrum.

[1] http://www.nea.fr/html/dbdata/hprl/hprlview.pl?ID=419

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CALCULATIONS OF RADIOLOGICAL SOURCE TERM FOR LIGHT WATER REACTOR FOLLOWING SEVERE ACCIDENTS

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The aim of the present work is to calculate the release of some radionuclides from a hypothetical severe nuclear reactor accident. A reactor accident can lead to severe consequences only if several barriers between the reactor core and the environment are breached. One postulated scenario by which this could occur is the failure of the reactor core heat removal systems. This would release steam and non condensable gases to the reactor containment building as will as leading to release of some radionuclides to the environment. The determination of RST (radiological source term) means the quantification of the possible release of radionuclide from the plant (mostly from the containment) into the environment.

ORIGEN2 code is used to simulate a PWR reactor core of 1000 MWE power rector; the core inventories are calculated after 540 full power days of operation. An accident is hypothetically occurred; radionuclides from the core to the containment and from the containment to the environment are released. The containment failure of the reactor core is simulated under different accident scenarios and conditions. The release from the containment to the environment is also calculated for the assessment of the accidents consequences.

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MCNP COMPUTER SIMULATION TO MYRRHA ACCELERATOR DRIVEN SUB-CRITICAL SYSTEM

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In recent years, there has been an interesting interest in the application of accelerator driven systems (ADS) for the purpose of incinerating long

lived radionuclides in high level waste . The ADS is a non self sustaining , sub-critical reactor driven by an external neutron source that is maintained by a a charged particle accelerators. MYRRHA is a typical ADS that is designed and operated in Belgium. The reactor core is loaded with MOX (U-Pu) fuel, Minor actinides and fission product. The accelerator produces protons with current 5 mA and energy 350 MeV. The thermal Power of MYRRHA is 53.7 Mw. The spallation target is a liquid Pb-Bi, that in turn is coupled to a Pb-Bi cooled subcritical fast reactor.

MCNPX computer code (which is based on Monte Carlo method) is used to simulate the typical geometry and compositions of MYRRHA to perform both neutronic and burnup analysis. The results of the model are compared with the published results of the ADS. The capability of the ADS to reduce the long lived radionuclides and burn both MOX fuel and minor actinides is demonstrated.

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THIRD ORDER NODAL EXPANSION METHOD FOR THE SOLUTION OF THE NEUTRON DIFFUSION EQUATION IN CYLINDRICAL GEOMETRY

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In nodal methods, the reactor core is subdivided into large homogenized regions and each such region constitutes a node. Usually a subassembly is defined as a node. The essential idea of nodal methods is to relate neutron currents across an interface between two nodes to the average flux levels in those two nodes. The formed coefficient matrix relates the node-averaged fluxes and currents on the nodal surfaces to each other. Considerable effort is necessary to utilize third order polynomial expansion within nodal expansion method. The diffuculty this creates is centered around the evaluation of third order expansion coefficients. In polynomial basis of degree greater than 2, it is not possible to express the expansion coefficients solely in terms of the edged averaged fluxes and the cell averaged flux. Hence definitions of quantities which are called flux moments are made. In this method zeroth and first order flux moments are defined. In this work, a third order nodal expansion method has been developed in cylindrical geometry. In this method, the expansion coefficients are determined by applying Fick's law in combination with discrete nodal balance equation and weighted residual procedure. In addition to lowest order nodal expansion method, the weighted residual procedure is necessary to equate the numbered unknowns to the number of equations in third order. In weighted residual procedure neutron balance equation is multiplied with a weight function which is a first order polynomial in this case, and integrated over the node. Then an equation is obtained by demanding the integrate of the weighted residue to vanish.

Four equations for each node are obtained. Nodal balance equation constitutes one equation and two equations are derived from Fick's law. The last equation comes from weighted residual procedure. These equations are used to form the coefficient matrix. Then nodal calculations are carried out to determine the effective multiplication factor and assembly powers.

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COMPARISION OF NODAL EXPANSION METHOD WİTH FINITE ELEMENTS METHOD FOR THE SOLUTION OF THE NEUTRON DIFFUSION EQUATION IN CYLINDRICAL GEOMETRY

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In this work, a third order nodal expansion method has been developed for the solution of the neutron diffusion equation in cylindrical geometry. Four equations for each node are obtained. These equations are used to form the coefficient matrix. A computer program called NEMR3 has been developed using this matrix form.. It can carry out criticality-eigenvalue calculations in multi-group diffusion theory. This program has been written in FORTRAN 90 and run in WINDOWS operating system. It is capable of calculating the effective multiplication factor, flux distributions, average fluxes for multi-group and multi-region problems. It can make these calculations using both lowest and third order nodal expansion methods in cylindrical geometry.

In order to validate NEMR3, it was run for problems with known analytical solutions. Results were compared with calculated values and finite element method solutions (linear and quadratic) which were obtained using a FORTRAN program called QFEMR.

Four problems, extend from a simple bare, one group reactor to two-group, seven-region TRIGA reactor, were considered. Effective multiplication factors, flux distributions and average fluxes were compared with analytical solutions.
As a result, it appears that nodal expansion method is a practical method for the problems in which the mesh is very coarse.

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THORIUM-BASED FUELS PRELIMINARY LATTICE CELL STUDIES FOR CANDU REACTORS

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The choice of nuclear power as a major contributor to the future global energy needs must take into account acceptable risks of nuclear weapon proliferation, in addition to economic competitiveness, acceptable safety standards, and acceptable waste disposal options.
CANDU reactors offer a proven technology, safe and reliable reactor technology, with an interesting evolutionary potential for proliferation resistance, their versatility for various fuel cycles creating premises for a better utilization of global fuel resources. CANDU reactors impressive degree of fuel cycle flexibility is a consequence of its channel design, excellent neutron economy, on-power refueling, and simple fuel bundle. These features facilitate the introduction and exploitation of various fuel cycles in CANDU reactors in an evolutionary fashion.
The main reasons for our interest in Thorium-based fuel cycles have been, globally, to extend the energy obtainable from natural Uranium and, locally, to provide a greater degree of energy self-reliance. Applying the once-through Thorium (OTT) cycle in existing and advanced CANDU reactors might be seen as an evolutive concept for the sustainable development both from the economic and waste management points of view.
Two CANDU fuel bundles project will be used for the proposed analysis, namely the CANDU standard fuel bundle with 37 fuel elements and the CANFLEX fuel bundle with 43 fuel elements.
Using the Canadian proposed scheme - loading mixed ThO_2-SEU CANFLEX bundles in CANDU 6 reactors - simulated at lattice cell level led to promising conclusions on operation at higher fuel burnups, reduction of the fissile content to the end of the cycle, minor actinide content reduction in the spent fuel, reduction of the spent fuel radiotoxicity, presence of radionuclides emitting strong gamma radiation for proliferation resistance benefit.
The calculations were performed using the lattice codes WIMS and DRAGON (together with the corresponding nuclear data library based on ENDF/B-VII).
Keywords — Thorium-based fuels, CANDU reactors, fuel burnup, spent fuel radiotoxicity, proliferation resistance, sustainable development.

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ON THE USE OF PLEXIGLASS SUBSTRATES FOR NEUTRON MIRRORS

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The work deals with neutron reflectivity measurements performed for Ni films coated on different types of the commercially available plexiglass substrates. The Ni coatings were NiCr (80% Ni, 20%Cr), ^{58}Ni and natural nickel. The reflectivity behaviors of ^{58}Ni and natural nickel are compared with a present measurement performed for a ^{58}Ni film (150 nm thick) coated on glass substrate. Some of the present mirrors were measured several years before and are included in the presented measurements in order to check the quality of the plexiglass mirrors over years. It has been found, from the presented measurements, that plexiglass, as a substrate, successfully substitutes glass and the quality of the Ni coating can last for several years without deterioration.

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APPLICATION OF EFFECTIVE FIELD THEORY FOR LIGHT NUCLEI FORMATION

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In this paper, we introduce Effective Field Theory (EFT) in nuclear physics and progress in this theory for calculations of the first structures

from Big-Bang Nucleosynthesis as well as the triton and 3He structures. Very low-energy radiative capture and weak capture reactions involving few-nucleon systems have considerable astrophysical relevance for studies of stellar structure and evolution and big-bang nucleosynthesis. In the standard Big-Bang deuterons being to be formed through the process deuteron-proton radiative capture and then the following reactions of primordial nucleosynthesis proceed rapidly: proton-deuteron, neutron-deuteron radiative capture and other chains for building of nucleonic structure of the first universe. These reactions at the energies relevant for BBN, $0.02 < E < 0.2$ MeV, is not well-measured experimentally and there are significant theoretical uncertainties. Some theoretical calculation has been down for these reactions but all of them show very significant theoretical error. In model independent calculation or EFT calculation for neutron radiative capture by proton by Savage and Chen (1999) and show higher order calculation by Rupak (2000) show 1\% theoretical uncertainly for energy 1 MeV[1,2]. In few past years, the search for three-nucleon forces effects in electromagnetically induced process come more and more take into attending. It is also a quantitative question for current choosing of gauge invariant nuclear force models to reveal signatures of three-nucleon forces. Recently, we have calculated the cross section of neutron radiative capture by deuteron. No new three-nucleon forces are needed in order to achieve cutoff independent results of neutron-deuteron radiative capture process up to N2LO [3,4,5]. They also will be fixed by the triton binding energy and Nd scattering length in the triton channel.

In this paper, we study the cross section of triton photo-dissociation 3H using pionless EFT and insertion of the three-body force, up to N2LO [6]. The evaluated cross section has been compared with experimental data and the three-nucleon photodisintegration calculation of the total cross section with modern realistic two- and three-nucleon forces AV18/UrbIX potential models calculations. We demonstrate convergence of the EFT calculation order by order in the low-energy expansion and cutoff dependence is negligible. Close agreement between the available experimental data and the calculated cross section is reached. We demonstrate convergence and cutoff independence order by order in the low energy expansion.

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INFLUENCE OF GRAVITY ON NONCOMMUTATIVE KLEIN-GORDAN EQUATION AND SCALAR PARTICLES CREATION

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In this paper, we investigate the influence of gravity and noncommutativity on Klein-Gordon equation. By adopting the noncommutative canonical space-time and Seiberg-Witten maps of the scalar field, vierbein, gauge field and spin connections, we show that the modified Klein-Gordon equation in general form. As an application, we compute the density number of the created particles of the absence electric field in an anisotropic Bianchi universe, we show that the same results in ordinary case in the presence of electric field.

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NONPERTURBATIVE CALCULATIONS IN QCD, R-RELATED QUANTITIES AND THE OPERATOR PRODUCT EXPANSION

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A nonperturbative method based on the analytic approach to QCD is applied to evaluate the hadronic contributions to various physical quantities. It is shown that this approach allows us to describe well the ratio of hadronic to leptonic tau-decay widths, the Adler function, the smeared R-function, as well as the hadronic contributions to the muon anomalous magnetic moment and to the evolution of the fine structure constant. A common feature of the theoretical description of these quantities and functions is that they are defined through the Drell ratio R(s), the normalized hadronic cross-section, integrated with some other functions. By definition, all these quantities and functions include an infrared region as a

part of the interval of integration and, therefore, they cannot be directly calculated within the standard perturbation theory.
Furthermore, the Borel type sum rules are constructed. The latter allow us to determine the residual condensates. It is shown that within the method suggested the optimal values of these lower dimension condensates are close to zero.

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CALCULATION OF THEORETICAL ISOTROPIC COMPTON PROFILE FOR MANY PARTICLE SYSTEMS

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Theoretical isotropic (spherically symmetric) Compton profile (ICP) have been calculated for many particle systems He, Li, Be and B atoms in their ground state. Our calculation was performed using Roothan-Hartree-Fock (RHF) wave function, HF wave function of Thakkar and re-optimized HF wave function of Clementi-Roetti, taking into account the impulse approximation. The theoretical analysis includes a decomposition of the various intra and inter shells and their contributions in the total ICP. A high momentum region up to 4 a.u. was investigated and a non-negligible tail was observed in all ICP curves, the existence of a high momentum tail is mainly due to the electron-electron interaction. The ICP for the He atom has been compared with the available experimental data. It is found that ICP values agree very well with experimental data. A few low order radial momentum expectation values 〈p^n 〉 and the total energy for these atomic systems have also been calculated and compared with their counterparts wave functions.

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ANALYTICALLY SOLVABLE MODEL FOR FUSION NEAR COULOMB BARRIER

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Using the asymmetric two-center shell model potential in parameterized forms,the ynamical solution for the radial and the mass asymmetry coordinates are obtained analytically for the fusion process near the Coulomb barrier. Our semiclassical quantization results for the radial degree of freedom fixes the maximum excitation energy carried by the compound nucleus and agrees reasonably well with the observed value.The shell effects of the colliding partners play an important role in deciding the incident energy for a reaction to take place. Our results show the nucleus Z=122,A=300 as a doubly magic. Our calculations further emphasize that the doubly magic reaction partners prompt the phenomenon of large mass transfer even at low excitation energy.
Keywords: Shell Model, Compound Nucleus, Non-linear dynamics, Fusion Process, Nuclear reactions.

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REISSNER-NORDSTROM BLACK HOLE IN NONCOMMUTATIVE SPACES

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We investigate the behaviour of a non-commutative radiating Reissner-Nordstrom (Re-No) black hole. We find some interesting results: a) the existence of a minimal non-zero mass to which the black hole can shrink. b) a finite maximum temperature that the black hole can reach before cooling down to absolute zero. c) compared to the neutral black holes the effect of charge is to increase the minimal non-zero mass and lower the maximum temperature. d) the absence of any curvature singularity. We also derive some essential thermodynamic quantities from which we study the stability of the black hole. Finally we find an upper bound for the non-commutativity parameter θ.

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ONE–BOSON–EXCHANGE MICROSCOPIC POTENTIALS IN K(+)-NUCLEON AND NUCLEI INTERACTIONS

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Derived semi–relativistic potentials of the K+ Nucleon (K+N) and nucleus (K+A)interaction are obtained and interpreted, on the basis of the one–boson Exchange (OBE) model where used a set of boson parameters suggested by the Jülich group, to get the radial forms of the interacting potential V(r) for (K+N), (K+2H), (K+6Li), (K+12C) , in the K+ incident energy region Plab< 1GeV. The model is consistent with the belief that the contributions from higher order kernels are minimized by the nature of the (K+N) interaction. In Dirac space the process is based on the exchange of four mesons, one attractive scalar meson and three repulsive vector mesons. The chosen structure for the (K+N) interaction is consistent with the fact that more additional repulsion is required by the data where the shortest range -meson is not prepared to carry such load by blowing up its coupling constant which is restricted to its SU(6) group value. Alternatively, it is proposed to use the additional phenomenological meson of much shorter range and higher mass where its structure is taken as in the - exchange with opposite sign and heavier exchange mass. In addition, the derived forms for the (K+N) and consequently the (K+A) potentials are corrected for the center of mass of the two particles having different masses. This is supported by the suggestion that the interacting particles move under the influence of a harmonic oscillator which, in consequence, enables us to deal with the two – body wave function as known generalized Talmi-Moshinsky-Smirnov (GTMS) brackets for in-equal particles masses. To evaluate the numerical results for the studied potentials we have used three different Yukawa-type meson functions.

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CONTRIBUTION OF 194.1 keV RESONANCE TO $^{17}O(p, \alpha)^{14}N$ REACTION RATE USING R MATRIX CODE

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Knowledge of the $^{17}O(p,\alpha)^{14}N$ reaction rates is required for evaluating elemental abundances in a number of hydrogen – burning stellar sites. This reaction is specifically very important for nucleosynthesis of the rare oxygen isotope ^{17}O. Classical novae are thought to be a major source of ^{17}O in the Galaxy and produce the short–live radioisotope ^{18}F whose β^+ decay is followed by a gamma ray emission which could be observed with satellites such as the INTEGRAL observatory.

As the $^{17}O(p, \alpha)^{14}N$ and $^{17}O(p, \gamma)^{18}F$ reactions govern the destruction of ^{17}O and the formation of ^{18}F, their rates are decisive in determining the final abundances of these isotopes. Stellar temperatures of primary importance for nucleosynthesis are typically in the ranges T = 0.01–0.1 GK for red giant, AGB, and massive stars, and T = 0.01–0.4 GK for classical nova explosions

In recent work, we observed, for the first time, a resonance à 183.3 keV corresponding to level in ^{18}F at Ex = 5789.8 ± 0.3 keV. A new astrophysical parameters of this resonance are found.

In this work we study this reaction using numerical code based on R matrix method including the new values of level energy and parameters of 183.3 keV resonance in order to show his contribution to $^{17}O(p, \alpha)^{14}N$ reaction rates.

We also use old parameters values of this resonance given in Keiser work for comparison. We show that this resonance predominate the reaction rates in all range of stellar temperature for classical nova explosions. This is in good agreement with our work with experimental method.

We also study cross section and differential cross section $^{17}O(p, \alpha)^{14}N$ reaction with R matrix method.

Keywords : *Nuclear reaction, Nucleosynthesis, R matrix.*

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ELASTIC SCATTERING AT HIGH ENERGIES VS LHC AGENDA FOR MEASUREMENTS

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Theoretical and experimental studies on Elastic and Diffractive scattering have been carried out for the last half a century. We now know better about the size and behaviour of nuclei at ultra high energies. However, a lot needs be learnt further which constitutes the agenda for the TOTEM collaboration at LHC. In our talk, we give an extended view of what we know and what is possibly in store for us.

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STUDY OF LIGHT CHARGED PARTICLE PRODUCTION DOUBLE-DIFFERENTIAL CROSS SECTIONS AT INTERMEDIATE ENERGY

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We measured light charged particle (LCP) production double-differential cross-sections (DDXs) for 360- and 500-MeV proton induced reactions on 232Th for nuclear data of ADS. Emitted LCP energies were measured with stacked scintillator spectrometers by the AE-E technique. The experimental results were compared with the intranuclear cascade (INC) model and the quantum molecular dynamics (QMD) model. In order to incorporate cluster production process into INC, we investigated the cluster knockout and coalescence process. In addition, effect of the nuclear potential was discussed within the framework of the INC model. Predictive ability of the present INC model was improved.

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ANALYSIS OF ^{6}Li SCATTERING AT 600 MeV

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Double folding optical model potentials have been formulated based upon the SlY effective nucleon-nucleon (NN) Interaction and *tpp* approximation In order to analyze the elastic and Inelastic ^{6}L1 scattering on ^{12}C, ^{58}Ni, ^{90}Zr and ^{308}Pb targets at 600 MeV. Single channel and coupled channel (CC) calculations are performed to investigate the breakup effect and its feedback to the elastic scattering for ^{6}Li ions. Successful reproduction of the data is obtained. In-medium NN cross section and second order (double-scattering) correction to the *tpp* potential are considered, Reaction cross sections are calculated using exact and approximation solutions.

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SUPER SYMMETRY IN STRONG AND WEAK INTERACTIONS

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For strong interaction two new fermion mass units 105.32 MeV and 11450 MeV are assumed. Existence of “Integral charge Quark bosons” , “Integral charge effective Quark fermions”, “Integral charge (effective) Quark fermi_gluons” and “Integral charge Quark boso_gluons ” are assumed and their masses are estimated. It is noticed that, characteristic nuclear charged fermion is Xs*105.32=938.8 MeV and corresponding charged boson is Xs(105.32/x) = 415.0 where Xs = 8.914 is the inverse of the strong coupling constant and x=2.26234 is a new number using which ‘super symmetry’ can be seen in ‘strong and weak’ interactions. 11450 MeV fermion and its boson of mass = 11450/x= 5060 MeV plays a crucial role in ‘sub quark physics’ and ‘weak interaction'. 938.8 MeV strong fermion seems to be the Proton. 415 MeV strong boson seems to be the mother of the presently believed 493,496 and 547 MeV etc strange mesons. With 11450 MeV fermion ‘effective quark_fermi_gluons’ and with 5060 MeV boson ‘quark boso_gluon masses’ are estimated. “Effective quark fermi_gluons” plays a crucial role in ground state charged baryons mass generation. Light quark bosons couples with these charged baryons to from doublets and triplets. “Quark boso_gluons” plays a crucial role in ground state neutral and charged mesons mass generation. Fine and super-fine rotational levels can be given by [I Or (I/2)]power(1/4) and [I Or (I/2)] power(1/12) respectively. Here, I = n(n+1) and n = 1,2,3,..

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MICRO-SR-XRF STUDIES FOR ARCHAEOLOGICAL GOLD IDENTIFICATION – THE CASE OF CARPATHIAN GOLD AND OF DACIAN BRACELETS

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The goal of the study is to verify if Transylvanian gold was used to manufacture Romanian archaeological objects using information related to trace elements: Sb, Te, Pb – recognized fingerprints for Carpathian Mountains mines and Sn characteristic for the panned river-bed (alluvional) gold. To solve these issues, samples (grains, nuggets,fine gold "sand") from various Transylvanian mines and rivers and some very small (few milligrams) fragments of archaeological objects are measured. During the experiment, point spectra for 22 natural gold samples from Transylvania and 18 "micronic" samples from archaeological objects were acquired at 34 keV excitation SR energy, using a spatially resolved SR-XRF set-up mounted for analyses at the hard X-ray beam line – BAMline at BESSY, Berlin. A summary for the characterization of Transylvanian native gold is the following: high (8 - 30%) Ag amounts and low (0.2 - 1%) Cu amounts; placer deposits (Valea Oltului, Stanija, Valea Pianului) contain as fingerprint Sn (150-300 ppm) – most probably from river bed cassiterite; primary deposits present as fingerprints Te (200-2000 ppm), Sb (150-300 ppm) - however, the samples are very inhomogeneous; primary deposit Sacaramb contains Te = 0,25%, Sb (500 ppm), but also Sn (200 ppm); primary deposit Fizesti presents a big amount of Pb = 1%, Sb (350 ppm), traces of Te and also Sn. As concerning the "koson" dacian coins, the type "with monogram" is made from refined (more than 97%) gold with no Sb, Te or Sn traces (remelted gold) and the type "without monogram" is clearly made from alluvial gold, partially combined with primary Transylvanian gold (Sn and Sb traces detected). A spectacular application of the micro-SR-XRF studies on native gold was the one of authentication of some recovered heritage artifacts: five Dacian gold bracelets exhibited at the National Museum of Romania's History, Bucharest. The Dacian multi-spiraled bracelets were made of gold; they belong to the classical period of the Dacian civilization (2^{nd} century B.C. - 1^{st} century A.D.). To confirm the authenticity of the bracelets, in early spring 2007 the compositional analysis of the bracelets was performed by X-Ray Fluorescence at "Horia Hulubei" National Institute of Nuclear Physics and Engineering, Bucharest, by using ^{241}Am (30 mCi) and ^{238}Pu (10 mCi) radioactive sources, and a HPGe detector. The compositional results are the following (average of three measuring points):

- Bracelet No 1: Au 89.85%, Cu 0.65%, Ag 9.50% ; Sn 200 ppm
- Bracelet No 2: Au 78.20%, Cu 1.50%, Ag 20.30%; Sn 60 ppm
- Bracelet No 3: Au 82.40%, Cu 1.40%, Ag 16.20%; Sn 360 ppm
- Bracelet No 4: Au 91.50%, Cu 0.40%, Ag 8.10%; Sn 125 ppm
- Bracelet No 5: Au 92.80%, Cu 0.30%, Ag 6.90%; Sn 50 ppm
- Bracelet No 6: Au 92.00%, Cu 0.90%, Ag 7.10% ; Sn 230 ppm
- Bracelet No 7: Au 92.60%, Cu 0.75%, Ag 6.35%; Sn 50 ppm
- Bracelet No 8: Au 85.00%, Cu 2.10%, Ag 12.80%; Sn 1000 ppm
- Bracelet No 9: Au 87.10%, Cu 0.65%, Ag 12.25%; Sn 120 ppm
- Bracelet No 10: Au 87.10%, Cu 0.75%, Ag 11.80%; Sn 425 ppm
- Bracelet No 11: Au 86.15%, Cu 0.75%, Ag 12.60%; Sn 400 ppm
- Traces of tin – from cassiterite – fingerprint for placer/panned gold;
- Traces of antimony – from jamesonite ($Pb_4FeSb_6S_{14}$), stephanite (Ag_5SbS_4);
- Ca-rich soil traces in cracks - proving the bracelets were buried for a long period of time ;

.Comparing the XRF results on bracelets with the micro SR-XRF results on Transylvanian gold samples, the conclusion was that the bracelets were made from native Carpathian (Transylvanian) gold (panned mixed with primary) and realized using a primitive metallurgy (no intention to refine the native gold). In this way, our results strongly support the stylistic arguments regarding the authenticity of the bracelets.

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SUPPERLATTICE AND INTERSUBBAND COMPARISON OF QUANTUM CASCADED LASERS

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Our goal in this paper is to compare quantum cascaded lasers (QCLs) fabricated from chirped superlattice with intersubband one. In order to, evaluate which performance is better. Improving the lasing properties of the interminiband QCLs through block diagram as well as mathematical models is the main scope in this paper. The mathematical model is derived to express

explicitly the performance of the device, while a block diagram programming model is implemented by VisSim environment which implicitly describe the same device. In order to enhance the performance of the underlined device, mathematical model parameters are used in a reliable manner in such a way that the optimum behavior was achieved. These parameters play the central role in specifying the optical characteristics of the considered laser source. Additionally, proposed relation that linked emitted power with QCLs parameters is deduced. In order to confirm our models and their validity on the practical applications, we make a comparison between the results obtained by our models and that experimentally published and a very good agreement is observed.

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SOME APPLICATIONS OF X-RAY BASED ELEMENTAL ANALYSIS METHODS FOR ROMANIAN GOLD MINERALS STUDIES

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The elemental composition of gold, gold minerals and gold associated minerals releases important informations both from scientific (geologic) and economic point of view. In the present work, we focused on samples from Rosia Montana and Musariu ore deposits, from so called "Transylvanian gold" of the golden "quadrilateral", Metaliferi Mountains. Our investigation started using optical microscopy. On the sample from Roşia Montană a native gold band could be macroscopically seen. Gold occurs also like native gold in carbonate minerals, or associated with galena, sphalerite, chalcopyrite and quartz. The sample from Musariu shows native gold distributed at the border of sphalerite, native gold enclosed and along the margins of sphalerite and native gold between quartz grains. Three X-ray (the emission of characteristic lines spectra for each element present in the sample) based elemental analysis methods were also used: X-Ray Fluorescence (XRF), micro Synchrotron Radiation induced X-Ray Fluorescence (micro-SR-XRF) and micro Proton Induced X-Ray Emission (micro-PIXE). Our XRF methods are based on X-ray tube spectrometers: a portable one - X-MET 3000TX and a stationary one - SPECTRO MIDEX. The two Rosia Montana and Musariu gold samples were studied using the micro-PIXE technique at the AN2000 accelerator of Laboratori Nazionali di Legnaro (LNL), INFN, Italy – maps and point spectra. The experiment was carried out with a 2 MeV proton microbeam (9 μm2 beam area), maximum beam current ~400 pA. The characteristic X-rays were measured with a Canberra HPGe detector (with 180 eV FWHM at 5.9 keV). Complementary experiments on the samples due the improved condition offered by the high energy X-rays, namely –Sb, Sn, Te detection, were performed at BESSY Synchrotron Radiation Facility, Berlin – point spectra. During the experiment, point spectra were acquired at 35 keV, excitation energy, using a spatially resolved synchrotron-radiation XRF set-up detected to analyses. The XRF spectrometers were used for a preliminary investigation, providing only a first sample characterization due to the measurement spot size (6 mm x 5 mm). For Rosia Montana, the Au/Ag/Cu ratio is strongly variable from 14.2/4/2.9 to 1.7/2.1/0.8 and as associated minerals we found sphalerite, pyrite, chalcopyrite, galena and alabandine. For Musariu the Au/Ag/Cu ratio is strongly variable from 57.8/16.7/nd to 33.00/23.00/2.40. As associated minerals we found sphalerite, for pyrite and chalcopyrite. Using micro-PIXE at LNL Legnaro, for Rosia Montana sample the Au/Ag ratio is very different from a point to another: 53.58/16.30, 34.60/10.78, 13.83/3.75, 34.60/10.53. On the maps a weak presence of copper in the gold region in comparison with silver may be observed. Gold and silver are strongly mixed. On the outlying gold grains there are Sb, Te, Zn and also Ag-rich areas. For Musariu sample the Au/Ag/Cu ratio is strongly variable from 3.24/0.42/0.0027, 6.05/1.32/0.0217 to 19.13/4.19/0.0078. In the case of the Musariu ore deposit gold, silver and copper are evidently mixed; a strong presence of copper is observed. A significant amount of Si (quartz) was observed surrounding the gold grains. On the distribution map, Zn-rich areas are observed, beside Au, Sb, and less Ag. There are some metallic Cu-points, Fe-points (pyrite), Pb-points (galena), Mn-points (alabandine) and native As-rich points. As characteristic trace elements, we found from BESSY micro-SR-XRF point spectra measurements local relatively large (up to 1500 ppm) amounts of Te and moderate (100-150 ppm) of Sb in Rosia Montana and also local relatively important (350-500 ppm) quantities of Sb in Musariu.

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LASER PROTON ACCELERATION FOR RADIOTHERAPY

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Laser acceleration of protons to relativistic energies requires an intensity I_p (W/cm^2) = 4.67 x $10^{24}/\lambda^2$ (μm) corresponding to the dimensionless laser amplitude $a \equiv eE_0/m_0c\omega = M/m$, where E_0, c and ω are the electric field, speed light and frequency of the electromagnetic wave and the e, m_0 and M_0 are the charge, rest electron mass and rest proton mass. This paper, presents the laser proton acceleration methods to obtain the main parameters of a medical proton beam - intensity of 10^{10} proton/s and a maximum proton energy of 250 – 300 MeV - for to be used in proton radiotherapy.

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ELECTRON BEAM PROCESSING OF RUBBER MIXTURES WITH POLYFUNCTIONAL MONOMERS

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The major obstacle in radiation crosslinking of rubbers is the requirement of high irradiation doses. Appropriate polyfunctional monomers (PFMs) in polymer matrix can be used to obtain desired crosslinking density at lower irradiation doses [1]. This paper presents the concentration effect of the polyfunctional monomers TMPT (trimethylopropane trimethacrylate) on the physical properties for the natural rubber (NR) and EPDM (Ethylene-propylene–terpolymer) rubber, crosslinked by EB processing. Also, the concentration effect of the polyfunctional monomer TAC (triallylcyanurate) on the physical properties for EVA (ethylene vinyl acetate) rubber and CPE (polyethylene chlorinated) rubber, obtained by EB vulcanization, is reported. The obtained results show the improvement of rubber several properties as compared to classical procedure using benzoyl peroxide. The rubber samples were obtained from raw rubber mixtures, as compressed sheets of 2 mm in the polyethylene foils to minimize oxidation. The EB rubber processing is performed with the electron accelerator ILU-6M of 1.8 MeV and 10.8 kW built in Russia, Institute of Nuclear Physics-Novosibirsk. The ILU-6M is a resonator-type accelerator, operating at 115±5 MHz. This accelerator generates electron beam pulses of 0.375 ms duration, up to 0.32 A current peak intensity and up to 6 mA mean current intensity. The cross-sectional size of the scanned EB at the vacuum window exit is 1100 mm x 65 mm. The single pass dose with conveyor under the ILU-6M scanner is adjustable from 12.5 kGy to 50 kGy. For EB processing the sheets were cut in rectangular shape of 0.15 x 0.15 m^2. The EB treatment was performed with layers of three sandwiched sheets. The rubber physical properties were evaluated by measuring 100% modulus (100%M), tensile strength (TenS), tearing strength (TeaS), elongation at break (EBR), residual elongation (REL), hardness (Har) and other. The relation between rubber physical properties and PFM concentration, rubber nature and EB dose is discussed. The control samples or samples represented at zero EB dose are obtained by classical procedure using benzoyl peroxide. The analysis of the results led to the following observations and conclusions: 1) The optimum value of the rubber parameters depends strongly on rubber nature, PFM type, PFM concentration and EB absorbed dose level; 2) Without added PFMs, the rubber parameters improve slowly versus EB dose increasing. Significant higher vulcanization degrees are only obtained for higher EB doses; 3) With added PFMs, the rubber parameters exhibit a significant improvement; 4) For a given rubber type, different parameters exhibit an optimum value at different EB doses and PFM concentrations as followes: for NR, the parameters 100%M, TenS, and TeaS exhibit optimum values at 200 kGy / 9 phr TMPT, 150 kGy / 6 phr TMPT and 200 kGy / 9 phr TMPT, respectively; for EVA, the parameters 100%M, EBR and REL exhibit optimum values at 200 kGy / 6 phr TAC, 150 kGy / 9 phr TAC and 200 kGy / 9 phr TAC, respectively; for EPDM, the parameters EBR and REL exhibit optimum values at 150 kGy / 9 phr TMTP and 150 kGy / 12 phr TMTP, respectively; for CPE, the parameters 100%M, EBR and REL exhibit optimum values at 100 kGy / 9 phr TAC, 150 kGy / 9 phr TAC and 150 kGy / 9 phr TAC, respectively.

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polyfunctional monomers on physical properties of acrylonitrile-butadiene rubber under-electron beam irradiation", *Rad. Phys. and Chem*., 2005, *73 (3)*, 155-158.

AR3-7 92b

DISTRIBUTION AND PARAMETER'S CALCULATIONS OF TELEVISION CAMERAS INSIDE A NUCLEAR FACILITY

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In this work, a distribution of television cameras and parameter's calculation inside and outside a nuclear facility is presented. Each of exterior and interior camera systems will be described and explained. The work shows the overall closed circuit television system. Fixed and moving cameras with various lens format and different angles of view are used. The calculations of width of images sensitive area and Lens focal length for the cameras will be introduced. The work shows the camera locations and distributions inside and outside the nuclear facility. The technical specifications and parameters for cameras selection are tabulated.

Session RAR2

RAR2-1 63

INVENTORY OF USED, DISUSED, WASTE & DISPOSED SOURCES IN KENYA

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Kenya is committed to the peaceful applications of sealed and unsealed radioactive sources in medicine, industry, agriculture and training and research in order to achieve socioeconomic development. There are 4 nuclear medicine centers, 3 industrial radiotherapy facilities, 2 gamma irradiator facilities, one linear accelerator, 2 high dose radiation (HDR) Brachytherapy units, 5 industrial radiography units and many training and research facilities in the country that posses radioactive sources. The Kenya Radiation Protection Board is a Regulatory body established under Cap 243 of the Laws of Kenya cited as the Radiation Protection Act which provides for the protection of the public and radiation workers from dangers arising from materials capable of producing ionizing radiation. The mission of the Board is to accelerate, regulate and expand the contribution of nuclear and irradiation technology to the Kenyan economy through promotion of nuclear and radiation safety culture. The use of radioactive material requires an adequate established inventory. The objective of this project is to establish and maintain a national inventory of sealed and unsealed radioactive sources in Kenya. A national inventory was done by sending a questionnaire and personal communication as well thorough countrywide inspection surveys by Radiation Protection Officers from the regulatory body where lead pot containers were carried in case of disposal of a disused source or spent source. Advanced survey meters and automes radiation meters were used for radiation safety work, alarm meters were used to detect the threshold and source identifiers were used to identify unknown sources and their activities. A total of 130 radioactive sources (34 used, 20 disused, 39 waste and 37 disposed) including their JPEG images were identified and a national inventory established. Co-60 recorded the highest activity of 11,000 Ci followed by Cs-137 with 400 Ci and Ir-192 with 40 Ci. An updated inventory for the next 5 years is recommended.

RAR2-2 68

ANALYSIS OF THE AIR BY SPR TECHNICS

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An experimental procedure has been devised to study the diffusion of impurities throughout thin films using the surface plasmon resonance technique. When such a film is in contact with two dielectrics having different indices the surface plasmons, at two interfaces of a metallic film can be optically excited simultaneously, by attenuated total reflection (ATR). The plasmons are totally decoupled.. Experimental results of the diffusion of gold through thin silver films are presented using the experimental procedure outlined above.

This study shows that the surface plasmons can be excited separately at two interfaces of a thin metallic film. The resonance curves are completely decoupled due to the judicious experimental set up. This constitutes a powerful and non-destructive probe that may be used to study the diffusion process of impurities through thin films.

RAR2-3 104

EVALUATION OF MERCURY AS A PASSIVE SHIELDING FOR THE LOW-LEVEL GAMMA-RAY SPECTROMETERS

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Gamma-ray spectroscopic measurements of low level environmental samples require the reduction of the background as far as possible. In the present work, we investigate the advantages of adding Hg passive shielding inside a low-background Pb-shield with a thickness of 10 cm to further reduce the background from the surrounding materials and cosmic rays. Four different arrangements for the Hg-shield were investigated. The count rate achieved by the Pb-shield alone over the energy interval from 25 to 2700 keV, amounts to 8.4□10$\bar{4}$ counts/s/keV which is ~1.5% of the normal background. The introduction of Hg adds another 7—11% reduction depending on the design of the Hg-shield. On the average, the Pb-shield suppresses the net peak area of X- and gamma-rays to ~3 and 1% of the normal background, respectively. On the other hand, the reduction of the count rate due of these peaks due to the addition of Hg-shield varies according to the design of the Hg-shield and/or the energy. The measurements showed no evidence of the presence of cosmogenically produced ^{194}Hg in the measured spectra.

RAR2-4 105

RADIOLOGICAL STUDIES IN THE HOT SPRING REGION OF OYOUN MOSSA AND HAMMAM FARAUN THERMAL SPRING AREAS IN WESTERN SINAI

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Radioactivity in and around the two hot springs, Oyoun Mossa and Hammam Faraun, Western Sinai has been determined. The ground water, sediment and sand samples were measured by gamma-ray spectrometer for ^{232}Th, ^{226}Ra and ^{40}K isotopes. The enrichment of ^{226}Ra in Hammam Faraun hot spring was the most prominent feature. The concentration of ^{226}Ra in Oyoun Mossa and Hammam Faraun hot springs are 68 and 2377 Bq/kg for sediments, 3.5 and 54.7 Bq/kg for wild plants, and 205 and 1945 mBq/l for the ground water, respectively. In addition, the concentration of sand samples are ~14 times larger in the area of Hammam Faraun compared with that of Oyoun Mossa. On the other hand, the concentration of ^{232}Th in different samples are comparable in the two areas while ^{137}Cs concentrations are relatively higher in Oyoun Mossa. For the purpose of comparison, sand samples were collected from two locations 5-12 km away from each spring. The activity concentrations of the four locations are comparable and in agreement with those from the area of the two springs except in one case. The major difference was the activity concentration of ^{226}Ra in the area of Hammam Faraun, which is much higher. The concentrations of all detected isotopes in water samples from these two springs are much higher than that detected in 27 natural wells in north Sinai. The results of the present study indicate that water only in Hammam Faraun hot spring is contaminated with ^{238}U-isotopes and the surrounding area is affected by this contamination. The calculated annual effective dose equivalents in the surroundings of Hammam Faraun (81.8 μSv) is superior to the maximum contaminant levels recommended.

RAR2-5 113

ASSESSMENT OF THE RADIOLOGICAL IMPACT OF Fe-Mn ALLOY PRODUCTION PLANT IN ABU ZENIMA, SOUTHWEST SINAI

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Uranium and thorium are always present in association with a variety of elements in the geological formations of natural occurring radioactive Materials (NORM). The extraction of non-radioactive minerals from the mineral matrices may lead to the build up of NORM wastes with different concentrations of uranium and thorium daughters, depending on the extraction procedures, the initial concentrations and chemical forms of the naturally radioactive materials in the mineral matrices. Gamma-ray spectrometry was used for the quantitative assessment of radioactive isotopes and the associated radiation hazards at the Fe-Mn alloy production plant in Abu Zenima (West Sinai, Egypt). The low grad Mn from Um Bogma is mixed with Norwegian Mn to improve its quality. While the Egyptian Mn is richer in ^{238}U, the Norwegian Mn is richer in ^{40}K. The mixing process leads to increasing concentrations of ^{226}Ra (330.3 Bq/kg). The radioactivity concentrations of ^{226}Ra, ^{232}Th and ^{40}K in different row materials used in the alloy formation process as well as the Fe-Mn alloy and the waste are also determined. The estimated range of the total activities of wastes produced annually by the extraction process are 8.7−17.3, 0.7−1.3 and 6.7−13.4 GBq for ^{226}Ra, ^{232}Th and ^{40}K, respectively. The calculated absorbed dose rate and the annual effective dose equivalent in waste dumps with these increased fractions of NORM are 225 nGy/h and 276 μSv, respectively. This investigation does not recommend the use of the waste in housing construction or as filling materials in the area where houses may be built on or near the tailing piles.

RAR2-6 120

RADIOLOGICAL STUDY INVESTIGATION OF THE BLACK SAND REGION OF THE NORTH-EAST OF THE NILE DELTA

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Within a comprehensive radiological investigation of the Mediterranean cost of Egypt an environmental radiation survey of the black sand region of the North-East of Nile Delta was carried out. The activity concentration of the natural ^{226}Ra , ^{238}U, ^{232}Th and ^{40}K for 18 soil samples, 25 shore sediment samples and 6 bottom sediment samples were determined using gamma spectrometers based on HpGe detector and were found to reach 193 Bq/kg for ^{226}Ra and 267 Bq/kg of ^{232}Th for some shore sediment samples. Ten sea water samples were analyzed using laser fluorimetry technique after applying a radiochemical separation procedure and the determined total uranium concentration in these samples was found to be in the range (5.2-21.8) mBq/lt.

RAR2-7 128

ALARA PRINCIPLE APPLICATION FOR LOADING SPENT NUCLEAR FUEL ASSEMBLIES FROM NUCLEAR RESEARCH REACTOR VVR-S MAGURELE-BUCHAREST ROMANIA INTO TRANSPORTATION CASKS

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Safety implementation of Spent Nuclear Fuels Assemblies (SNFA) handling procedures at the VVR-S reactor site is ensured by technical perfection and reliability of equipment, monitoring of its condition, qualification and discipline of personnel as well as organization and execution of work complied with requirements of regulatory documents, process procedures, guidance and manuals. The personnel training for execution loading of SNF FAs is other important aspect for radiation protection and safely activities.

Estimations carried out using MicroShield software show that maximal dose rate upon working site when loading four FAs into basket of cask will not exceed 1.7 μSv/h, excluding natural radiation. Radiation Safety Analyses estimates for loading 70 SNFA in 18 transportation casks are:

maximal individual dose: 4274.7 μSv, maximal expected collective dose persons: 17 031.2 manμSv. By application ALARA principle with technical and administrative measures the loading process developed in the following conditions: maximal individual dose: 68 μSv, the collective dose persons: 732 man μSv. The work will presented the technical measures and procedures applied in loading process.

RAR2-8 140

HALIDE FILM DOSIMETER SYSTEM RESPONSE INFLUENCED BY CHEMICAL PROCESSING

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Halide film dosimetry is a quantitative method of measurement of the radiation doses. The fog density and chemical processing of the dosimeter film affect the radiation dose measurement accuracy. This work presents the effect of the developer solution concentration on the response of the dosimetric film which different fog densities. Thus, three batches of film, dosimeters with following fog densites: 0.312 ± 1.31 %, 0.71 ± 0.59% and 0.77 ± 0.81 %, were irradiated to ^{137}Cs standard source to dose value of 1mSv. The halide films have been chemical processed at different concentrations of the developer solution: 20 %; 14.29 %; 11.11%; all other physics-chemical conditions in baths of development have been kept constants. Concentration of 20% is considered to be chemical processed standard conditions of the films. In case of the films exposed to 1 mSv dose, optical density recorded on the low fog films processed at 20% developer solution is rather closed of high fog film optical densities processed at 11.11% developer solution concentration. Also, the chemical processing effect on the image contrast was taken into consideration.

Keywords: radiation dose, dosimetre, fog density, optical density (OD).

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Conference Timetable

Time	Wed., 11 Nov.	Thu., 12 Nov.	Fri., 13 Nov.	Sat., 14 Nov.	Sun., 15 Nov.
9:00-10:30	Cairo	OS IKN1		HEP1/NRP1/ ARU	HEP2/NRP2/ RQP3
10:30-11:00	Registration	Tea/Coffee	Full	Tea/Coffee	Tea/Coffee
11:00-13:00	Departure	IKN2	Day	IKN3	NSR3/AR3/ RAR2
13:00-14:00	(Bus	Break	Sharm	Break	Conf. Lunch
14:00-15:30	to	NSR1/MCS/ RQP1	and	NSR2/NSS/ RAR1	CS Departure
15:30-17:00	Sharm)	AR1/NAT1/ DI	Sinai	AR2/NAT2/ RQP2	(Bus to Cairo)
19:00-22:00	Arrival	Cult Evening		Cult Evening	Arrival

Programme abbreviations:

OS	Opening Session	**RQP**	Relativistic & Quantum Physics
IKN	Invited/Keynote Talk	**MCS**	Modelling, Codes & Simulation
HEP	High Energy & Particles	**NAT**	Nuclear Analytical Techniques
NSR	Nuclear Scattering & Reactions	**DI**	Detectors & Instrumentation
NSS	Nuclear Structure & Spectroscopy	**RAR**	Radiation and Radioactivity
NRP	Neutron & Reactor Physics	**AR**	Activity Review
ARU	Accelerator & Reactor Utilization	**CS**	Concluding Session

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11-15 نوفمبر 2009

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