8th Conference on Nuclear and Particle Physics

NUPPAC' 11

Book of Abstracts

20-24 November 2011
Hurghada, Egypt

NUPPAC' 11

Affiliation Listing of Submitted Abstracts

No.	Country	Abstracts		No.	Country	Abstracts
1	Egypt	**46**		**16**	Kenya	**1**
2	Algeria	**12**		**17**	Morocco	**3**
3	Armenia	**1**		**18**	Nigeria	**1**
4	Austria	**2**		**19**	Poland	**1**
5	Brazil	**1**		**20**	Romania	**1**
6	Canada	**1**		**21**	Russia	**6**
7	France	**1**		**22**	Saudi Arabia	**2**
8	Georgia, R. of	**1**		**23**	Serbia	**4**
9	Ghana	**1**		**24**	Sudan	**1**
10	Germany	**1**		**25**	Ukraine	**2**
11	Hungary	**1**		**26**	U.K.	**1**
12	India	**4**		**27**	Uzbekistan	**1**
13	Indonesia	**1**				
14	Iran	**14**				
15	Iraq	**3**				
			Total			**114**

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Conference Sessions

Monday, 21 Nov. 2011

9:00 - 9:10	Conference Opening
9:15 - 10:30	Session NSS
11:00 - 12:30	Session IKN1
14:00 - 15:30	Session NSR
14:00 - 15:30	Session RQP
15:30 - 17:00	Session PS1

Tuesday, 22 Nov. 2011

9:00 - 10:40	Session NRP
9:00 - 10:30	Session MCS1
11:00 - 12:30	Session IKN2
14:00 - 15:30	Session DI
14:00 - 15:30	Session ST1
15:30 - 17:00	Session PS1

Thursday, 24 Nov. 2011

9:00 - 10:40	Session NAT
9:00 - 10:30	Session ST2
11:00 - 12:30	Session RMD
11:00 - 12:30	Session MCS2
14:00 - 15:30	Session CS

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Conference Timetable

Sun., 20 Nov.	Time	Mon., 21 Nov.	Tue., 22 Nov.	Wed., 23 Nov.	Thu., 24 Nov.
Cairo Departure	9:00-10:30	**OS NSS**	**NRP/ MCS1**	Full Day Luxor	**NAT/ ST2**
(Bus to	10:30-11:00	Tea/Coffee	Tea/Coffee		Tea/Coffee
Hurghada)	11:00-12:30	**IKN1**	**IKN2**	Or	**RMD/ MCS2**
Midway Rest	12:30-14:00	Break	Break		Conf. Lunch
Arrival Hurghada	14:00-15:30	**NSR/ RQP**	**DI/ ST1**	Hurghada &	**CS** Departure
Registration	15:30-17:00	**PS1**	**PS2**	Red Sea	(Bus to Cairo)
Dinner	19:00-22:00	Cult Evening	Cult Evening		Arrival

Programme abbreviations

OS	Opening Session	**NAT**	Nuclear Analytical Techniques
IKN	Invited/Keynote Talk	**RMD**	Radiation Measurement & Dosimetry
NSR	Nuclear Scattering & Reactions	**DI**	Detectors & Instrumentation
NSS	Nuclear Structure & Spectroscopy	**ST**	Selected Topics
NRP	Neutron & Reactor Physics	**PS**	Poster Session
RQP	Relativistic & Quantum Physics		
MCS	Modelling, Codes & Simulation	**CS**	Concluding Session

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Conference Abstracts Arranged by Receiving Date

1-

PERFORMANCE AND TYPE TESTING OF SELECTED DOSIMETER USED FOR INDIVIDUAL MONITORING

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This study describes calibration and performance testing carried out for a set of 14 electronic personal dosimeters (EPDs) and thermoluminescence dosimeters (TLDs) at the Secondary Standard Dosimetry Laboratory of Sudan. Also the conversion coefficients from air kerma have been determined. Dosimeters tested are belonging to three manufactures representing most commonly used types in Sudan. Calibrations were carried out at three X- ray qualities: 80, 120 and 150 kV, ISO ' narrow' spectra and for 137Cs, 60 Co gamma rays.

The experiments were carried out using ICRU Slab phantom with dimension 30x30x15 cm. Secondary standard ionization chamber was used to measure the personal dose equivalent, Hp(10) as standard dosimetric quantity of interest. Parameters tested include: The variation of response with radiation energy and angle of incident in addition to dose rate dependence. The angular dependence factors have been experimentally determined for the same qualities and for different angles (0, ą20, ą40, ą60o). + were performed in accordance to the relevant international standards. Excellent energy, angular and dose rate response was demonstrated for 662 ^{137}Cs, 1250 ^{60}Co beam and (118, 100, 65 keV) X-ray beam qualities, exception the EPD at PM1203M are slightly larger but still with the acceptable range.

The responses of electronic dosimeters were found to in limits of acceptable performance. For the mean response of all energies is range of EPDs type RADOS 60, Greatz ED 150, Polimaster PM1203M, TLD were (0.75 ± 0.08 - 1.13 ± 0.13), (0.83 ± 0.29 - 1.06 ± 0.07), (1.08 ± 0.14 - 1.27 ± 0.09), (0.99 ± 0.05 - 1.14 ± 0.13), respectively. The majority of the dosimeters tested showed good energy and angular response.

2-

ON THE USE OF MAGNESIUM OXIDE SINGLE-CRYSTAL AS A NEUTRON FILTER

M. Adib[a], N. Habib[a], I. Bashter[b], M. Fathallah[c] and A. Saleh[b]

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A formula is given which, for neutron energies in the range $10^{-4} < E < 10$ eV, permits calculation of the nuclear capture, thermal diffuse and Bragg scattering cross-sections as a function of magnesium oxide temperature and crystalline structure. Computer program have been developed which allow calculations for the MgO BCC structure in its single-crystalline form. An overall agreement is indicated between the formula fits for neutron transmission values of MgO-single crystals, at room and liquid nitrogen temperatures and recently published experimental data.

A feasibility study for use of MgO- single crystal as a thermal neutron filter is detailed in terms of its optimum thickness, mosaic spread, temperature and cutting plane for efficient transmission of thermal-reactor neutrons, and for rejection of the accompanying fast neutrons and gamma rays.

Key words: Neutron transmission, MgO, Neutron filters.

3-

INTERACTION OF K{+}MESON WITH C{12} AND CA{40} NUCLEI AT INTERMEDIATE ENERGIES

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On the basis of One-Boson-Exchange-Potential (OBEP) previously derived by authors, it is studied the scattering of the Kaon (plus) meson with the two light nuclei C (12) and Ca (40)at intermediate energies. The differential and total cross sections were calculated. The results obtained were in good agreement with experimental data.

RADIOLOGICAL PERFORMANCE OF HOT WATER LAYER SYSTEM IN OPEN POOL TYPE REACTOR

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The paper presents the calculated dose rate carried out by using MicroShield code to analyse the importance of hot water layer system (HWL) in 20 MW open pool type reactor from the radiation protection safety point of view. The paper presents the dose rate profiles over the pool surface in normal and abnormal operations of HWL system. The maximum radiation dose rate at 1 meter over the pool surface is 2.6 μSv/h considered below the permissible dose rate limit in normal operation of HWL system. The maximum radiation dose rate at 1 meter over the pool surface is 3.450 mSv/h considered beyond the permissible dose rate limit in case of loss of HWL system.

5-

ON THE DEUTERON RELATIVISTIC WAVE FUNCTION

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Light front form of the relativization of the deuteron wave function is considered. Parameters of the wave function are extracted comparing theoretical results with experimental data. Experimental data are obtained on the two-metre propane bubble chamber of JINR (Dubna) bombarded by the deuteron beam with momentum of 4.2 GeV/c/nucleon.

PACS numbers: 13.75.Cs; 13.85.-t; 21.30.-x; 24.85.+t; 25.70.-z.
Keywords: nucleus, light front, relativistic wave function, distributions.

6-

DESIGN OF DOUBLE PG CRYSTAL NEUTRON DIFFRACTOMETER

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The design of a diffractometer containing two pyrolytic graphite (PG) crystals to select monochromatic neutrons in the range of wavelengths longer than 0.26 nm is given. The first crystal is high oriented pyrolytic graphite (HOPG) set at glancing angle to reflect monochromatic neutrons with a selected wavelength. The second is a low quality PG crystal filter, set at take-off-angle such that, it transmits the selected monochromatic neutrons and rejects the higher order contaminations accompanying the first order reflection. It was shown that, 2mm thick of PG crystal having 0.3^0 FWHM on mosaic spread are the optimum parameters of monochromator PG crystal. While the optimum thickness and mosaic spread of the PG crystal filter were selected to have low contamination factor of higher order reflections. The optimum parameters of the PG filter crystal were calculated using the computer package GRAPHITE recently developed in our laboratory.

Calculation shows that, 3cm thick PG filter (2^0 on mosaic spread) is sufficient to almost eliminate the higher order contaminations accompanying the main monochromatic neutrons.

Key words: Neutron diffractometer, pyrolytic graphite crystals

7-

EFFECT OF THE MEASURING PARAMETERS ON THE RECONSTRUCTED IMAGES BY COMPUTERIZED TOMOGRAPHY

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The potential of computerized tomography by neutrons and gamma rays as a main technique for non-destructive assay of materials and components of prime importance in nuclear and general industries are given and discussed. Both Fast Fourier Transform (FFT) and Algebraic Reconstruction Technique (ART) techniques are introduced and discussed. Shepp and Logan human head phantom is used for theoretical testing and studying the effect of translation value for both techniques. Moreover, the effect of the projection number discussed. Different filter function will be used for FFT technique. The enhancement of the reconstructed images due

to use smaller value of the relaxation parameter will be proven. Comparison between the two techniques has been carried out for the examined object.

8-

DYNAMICS OF CASCADE PROCESSES OF EXCITED STATES OF MESIC HYDROGEN ISOTOPE ATOMS BY MULTI GROUP METHOD

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When the heavy negative particle stops in matter, it usually forms exotic atoms in highly excited states. The exotic atom formation is followed by an atomic cascade consisting of multistep transitions to lower atomic states. Studies on cascade of muonic atoms can reveal important information about the properties of exotic atoms. It is also very important in muon catalyzed fusion (ÁCF). we do not consider the kinetic energy of muonic atoms constant. We have used multi group method. The energy dependence of the rates of collisional cascade processes can take in to account by this method. In addition the energy spectra of muonic atoms in the ground state are calculated. For this purpose we divided the energy spectrum to 10 group, then use the rate of external Auger effect, Coulomb de-excitation, muon transfer and elastic scattering to solve the dynamics of cascade processes in each group. These equations are coupled linear differential equations. To solve them we use the Runge-kutta method in forth order. Finally it was concluded that this energy spectrum is not Maxwellian distribution and our results were compared with the results of the Mont-Carlo simulation.

9-

STATUS OF NEUTRON BEAM FILTERS

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The purpose of filters is to transmit neutrons with selected energy, while remove unwanted ones from the incident neutron beam. This reduces the background, and the number of spurious. The types of commonly used now-a-day neutron filters and their properties are discussed in the present work.

There are three major types of neutron filters. The first type is filter of selective thermal neutron. It transmits the main reflected neutrons from a

crystal monochrometer, while reject the higher order contaminations accompanying the main one.

Beams coming from the moderator always contain unwanted radiation like fast neutrons and gamma-rays which contribute to experimental background and to the biological hazard potential. Such filter type is called filter of whole thermal neutron spectrum.

The third filter type, is it transmits neutrons with energies in the resonance energy range ($E_n \geq 1$ KeV). The main idea of such neutron filter technique is the use of large quantities of a certain material which have the deep interference minima in its total neutron cross-section. By transmitting reactor neutrons through bulk layer of such material, one can obtain the quasi-monochromatic neutron lines instead of white reactor spectrum.

10-

ANALYSIS OF ROTATIONAL ENERGY FORMULA IN HEAVY NUCLEI

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The rotational energy calculations of even-even nuclei show that a nucleus doesn't behave as a pure rotator. In fact, the vibrations of nucleus influence rotational energies. But the calculated energies of nuclei in the mass ranges of 120 230 from Rotation-vibration model present that relation depends on deformation parameter and spin so that it can be used for nuclei with and also it can only predict until 10+ energies. While the Sood's formula can be applied for all nuclei in the mass ranges of 120 230 and it doesn't have deformation parameter and spin limitation.

11-

CHARACTERISTICS OF PYROLYTIC GRAPHITE AS A NEUTRON MONOCHROMATOR

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The integrated reflectivity of the selected monochromatic neutrons from PG crystals cut along its c-axis is high within a wide wavelength band from 0.1nm up to .65 nm. The monochromatic features of PG crystal is discussed in terms of the optimum mosaic spread, crystal thickness and

reactor moderating temperature for high integrated reflectivity within the wavelength band. A computer program Mono-PG has been developed to carry out the required calculations for the PG hexagonal close-packed structure.

Calculation shows that, 2mm thick of PG crystal having 0.3^0 FWHM on mosaic spread are the optimum parameters of monochromator PG crystal. However, the integrated neutron intensity of the reflected 2nd and 3rd orders from PG crystal, when the moderating temperature of the incident reactor beam has room temperature (thermal neutrons), is even higher than that of 1st order one at wavelengths longer than 0.3 nm. While**,** when incident neutrons are cold (moderating temperature at liquid Hydrogen), the integrated neutron intensity of 2nd and 3rd orders is less than the 1st order reflection one.

12.

STUDY OF SOME BIOMEDICAL PROBLEMS BY USE OF NUCLEAR TECHNOLOGY

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Instrumental neutron activation analysis (INNA) was used to study the trace elements contents in children hair that are registered as clinical patients from iron deficiency anemia (IDA). The object of the study were four groups of hair samples of children who were diagnosed due to IDA: 1 - cured from IDA, 2 - mild form of IDA, 3 - medium level of IDA, 4 - severe degree due to IDA. The table 1 shows the results of tests of samples. The contents of micronutrients in all groups of patients have presented as average values of concentrations - C_{av}

Table 1. The results of the analysis

Chemical elements	C_{av}, μg/g
Na	2460±890
Cl	9380±432
K	2720±1020
Ca	510±130
Sc	0,0091±0,001

We found several interesting factors. The first is the range of distribution of the contents of all elements regardless of the extent of IDA and the age of patients is very wide. The difference between the maximum and minimum values for the concentrations of certain elements is 2-6 times.

	7
Cr	0,57±0,11
Mn	1,0±0,2
Fe	43,8±9,3
Co	0,033±0,013
Cu	7,2±2,5
Zn	89,4±46,5
As	0,016±0,005
Se	0,36±0,06
Br	5,6±2,3
Rb	1,61±0,51
Ag	0,22±0,12
Cd	<0,1
Sb	0,074±0,031
I	<0,1
La	0,028±0,007
Au	0,0,9±0,015
Hg	0,032±0,011
U	0,098±0,048

The study of the distribution of chemical elements in the degree of morbidity IDA shows there are certain regularities in the changes in concentrations of individual chemical elements. We have observed the contents of Fe, Mn, Sc, Co, K, Ca, Se, Rb,, Sb La, and Au, in hair of children with higher degrees of IDA, at the time, as the content of Cu, Zn, As and U decrease and the other elements remain unchanged. . Similar distributions are observed for some of the above mentioned items.

We considered the possibility of changing the content of elements in the three age groups of children: Group 1 - children aged 1-3 years, Group 2 - children aged 3-7 years and Group 3 - children under the age of 7 years. We have observed the decrease of Co, Sb, Cl, Na, K, Ag, Rb, Au, Br, and Hg with children age. These data can be used in early detection and correction of the IDA. We developed a method for fast neutron activation analysis (FNAA) for the determination of phosphorus and nitrogen in grains. The nuclear reactions excited by 14 MeV fast neutrons from the neutron generator NG-150 have used. Samples and standards coupled with the fast neutron flow monitor (Al-foils) were irradiated separately. Neutrons flow of energy 14.1 MeV (DT - reaction) was ~ $5.10^9 s^{-1}$. Table 2 presents some results of the analysis of some varieties of cereals, leguminous plants.

Table 2. Some results of analysis of grain

Name of sample	C_P, %	C_N, %
Millet	0,39 ± 0,02	1,52 ± 0,03
Beans	0,53 ± 0,04	3,15 ± 0,06
Buckwheat	0,61± 0,06	2,03 ± 0,13

13-

ALPHA DECAY OF SUPER HEAVY ELEMENTS

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The alpha decay probability, the half live times, and Q value of 143 even-even super heavy elements in the range 102≤Z≤120 has been determined within the Coulomb and Proximity Potential Model (CPPM). From a graph between Q values and log(T) as plotted against neutron number of parent nuclei we found that neutron shell closures in the super heavy region occur at N=162 and N=184. The calculated alpha decay half live times for the considered superheavy nuclei were compared with experimental data and are found to be in good agreement with each other. A semi-empirical formula for alpha decay half lives has been used for calculating half lives of isotopes of nuclei in the 102≤Z≤120. These results showed good agreement with the experimental half life time values and the values calculated using the generalized Liquid Drop Model (GLDM) and Viola-Seaborg systematics.

14-

POTENTIAL ENERGY SURFACES OF SUPERHEAVY NUCLEI

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The structure of the potential energy surfaces of the superheavy nuclei in the range of atomic number from z=110 to z=120 has been investigated in the framework of Macroscopic-Microscopic approach utilizing the Two-Center-Shell-Model and the Strutinsky renormalization procedure. We find systematic changes in the potential energy surfaces of heavy nuclei in the considered region. For most of the superheavy nuclei considered the fission barrier showed a small value.

15-

EFFECT OF GAMMA RAY ENERGIES AND ADDITION OF IRON SLAG BY WEIGHT TO PORTLAND CEMENTS ON MASS ATTENUATION COEFFICIENT

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This paper presents values for density, linear attenuation coefficient and mass attenuation coefficient experimentally in addition to theoretically by using X-Com program (Version3.1), of Portland cement without and with different percentages of iron slag by weight (5%, 15%, 25%, 35%, and 45%).Measurements were carried out using a collimated beam of gamma ray from point sources (Co-60 , Cs-137 , and Na-22) , and sodium iodide (1.5\\x1.5\\) crystal with cassy – gamma ray spectrometer .

From the experimental results, it was found that the mass attenuation coefficients have been increased with increasing the addition of iron slag, in addition the theoretical calculation of mass attenuation coefficient. It is also found that there are deviation between experimental values and theoretical calculation for all cement samples this is due to the experimental errors.

16-

ON SCALAR ENERGY: MATHEMATICAL FORMULATION

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A new kind of electromagnetic waves (EMW) , which exists only in vacuum of the empty space , will be discussed and mathematically formulated in this paper.

The mathematical existence of this energy was first proposed in a series of groundbreaking equations by Scottish Mathematician, James Clerk Maxwell, in the mid of 1800s. This energy is called scalar energy. It is characterized by both particle and wave like. The waves of this energy are called longitudinal EMW to distinguish them from “transverse” EM, the

kind we are familiar with in our daily life. Tesla's name of this energy is scalar energy or zero point energy. It is aimed at this paper to explain more details and to verify the scalar EM concept in vacuum.

17-

PARTICLE ACCOMPANIED FISSION OF 252CF

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Light charged particle accompanied fission and/or ternary fission is a competing mode to binary fission. Energetically, ternary fission with a large dispersion of masses is favorable. However, 90% of light charged particle accompanying in ternary fission is alpha particle. Californium nuclei offer interesting possibilities for both the theoretical and experimental investigation of various spontaneous decay modes. In particular, the spontaneous ternary fission of ^{252}Cf has been studied quite extensively with isotopes of H, He, Li, Be and C nuclei as ternary fission particles [1, 2]. But only, ^{4}He, ^{10}Be and ^{14}C were alone accepted and confirmed as light charged particle accompanying the spontaneous ternary fission. From the theoretical cluster decay studies, it was predicted by one of us [3] that ^{249,252}Cf nuclei present themselves as novel cases of emitting a doubly magic cluster ^{48}Ca or the neighboring nuclei ^{48}Ar and ^{50}Ca. Since these clusters are having considerable probability to perform inside the parent nucleus, perhaps these clusters are first preformed as binary products and then penetrate the three-body barrier. Hence, it would of interest to see such possibilities of observing heavy third fragments in ternary fission also.

Recently, a model has been proposed by us [4], the so called "Three cluster model" to explain the ternary fission of radioactive nuclei. In this model it is possible to minimize the ternary fragmentation potential energy with respect to all possible mass and charge asymmetries. To study the large number of ternary fragmentation of a given nucleus for different third particles, in TCM we impose a condition that A1 A2 A3 in the selection of fragmentation to avoid repetition. Here the subscript 1 and 2 stand for the main fission fragments and the third fragment is denoted by 3. With the implementation of this condition, ternary fragmentation of 252Cf for third fragment mass numbers from A3=1 to 84 are studied in two different configurations, namely, equatorial configuration in which the emitted third fragment is assumed to come out in a direction perpendicular to the main

fission fragments direction, and collinear geometry, in which all the three fragments are considered to be collinearly aligned along the fission axis. The ternary potential energy surfaces minimized with respect to mass and charge asymmetry and yields in both the configurations are studied for all possible third fragments [5,6]. The results of equatorial configuration reveals that for all possible third fragments at least one (or two) among three fragments associates itself with the neutron (or proton) closed shell. The potential energy surface corresponding to collinear configuration exhibits a strong valley arount 48Ca and its neighboring nuclei ^{50}Ca, ^{54}Ti and ^{60}Cr, which was not present in the equatorial configuration. As a consequence of this valley a strong yield is seen for these third fragments. The results obtained indicates that both the equatorial and collinear configurations may be a preferred configuration for emission of light charged third particles and collinear configuration is preferred for emission of heavy charged third fragment in ternary fission of ^{252}Cf.

In this presentation, the results obtained for all possible third fragments in both equatorial and collinear configuration of ^{252}Cf nucleus will be discussed.

References:

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18-

PRE-EXISTENCE PROBABILITY FOR BINARY FRAGMENTATION OF LIGHT AND HEAVY NUCLEI

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The emission of heavy ions and/or cluster of nucleons from a radioactive nucleus is now a well established phenomenon [1-2]. Theoretically, cluster emission is treated either as a case of asymmetric fission or as a process of preformation of cluster and then decay from the

parent nucleus. The theoretical models so far put forth are derived from the Gamow's idea by taking or not taking the concept of preformation. In Gamow's model the probability of pre-existence of the alpha particle is assumed to be unity. However, as the size of the emitted cluster increases, the probability of pre-existence can not be taken as unity. In cluster models, the preformation and/or pre-existence probability is calculated explicitly solving the equations of motion in mass asymmetry coordinate or using the associated wave functions. In fission type of models, it is interpreted that the barrier from parent nucleus radius to the touching configuration mimics the pre-existence probability [3]. Though these two approaches differ in the concept, they produce similar results of the observables such as branching ratio or decay constant. The experimental observations on cluster emission are limited only in trans-actinide region, wherein the emitted clusters are associated always with Pb or its neighboring nuclei as daughter. The attempts to measure such emission associated with 'Sn' daughter is not successful yet. However, such emissions from excited parent nuclei are of much sought after study recently [4]. The structure information associated with the pre-existence probability over entire binary fragmentation is of importance to know the transfer mechanism associated with this process.

Taking the idea of barrier penetration in the overlapping region within WKB approximation as the pre-existence probability, we present in this contribution the pre-existence probability values of entire binary fragmentation of 226Ra and 256Fm in the trans actinide region and the results of 56Ni which is a negative Q-value system. The calculations were carried out for the use of reduced mass as well as for the use of classical hydrodynamical transfer mass. Our calculated results will be compared with the other theoretical calculations made using the preformed cluster model [5].

References:

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19-

RELATIVISTIC ENERGY OF NEUTRON IN NUCLEAR FISSION: A CRITICAL ANALYSIS

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In the fission reactions neutrons produced are known as fast neutrons having energy 2 MeV (1. 954×10^7 m/s or ~ 7% speed of light or ~ 7% speed of light). With help of moderator the velocity of neutrons is reduced to classical limits i.e. 0.025 eV (2185 m/s). The velocity of fast neutron is in relativistic region hence relativistic variation of mass must be taken in account. Thus the mass of fast neutrons must be 1.01080879u (%age increase of 0.2125%) i.e. more than rest mass 1.0086649156u. But in the determination of Q-value, relativistic mass of neutron is taken just equal to rest mass i.e. Relativistic mass (1.954×10^7m/s) = Rest mass, which is not justified. If the relativistic variation of mass is taken in account then magnitude of energy theoretically predicted is 5.99MeV (2.295×10^{-13} J) less. The exact measurement of relativistic mass in various reactions may lead to significant results.

20-

THE ROLE OF ACCELERATOR-DRIVEN SUBCRITICAL REACTOR SYSTEMS IN ADVANCED NUCLEAR FUEL CYCLES: REVIEW AND ASSESSMENT

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(Abstract not available)

21-

ANALYSIS AND INTERPRETATION OF HEAVY METALS ATMOSPHERE CONCENTRATION OBTAINED BY NUCLEAR TECHNIQUES IN ALGIERS URBAN SITE

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The low part of the atmosphere, troposphere, is characterized by a strong human activity accompanied by a serious deterioration of the quality of air in this layer due to the rejection of pollutants.
Among these pollutants one finds heavy metals (Fe, Mg, Pb, Zn, Sc…) contained in the suspended matters. The nuclear techniques such as, the XRF (X-rays fluorescence) and the NAA (Neutron Analysis Activation) constitute effective tools to identify and quantify heavy metals in air. X-ray fluorescence (XRF) analysis is a fast, non-destructive and environmentally friendly analysis method with very high accuracy and reproducibility. All elements of the periodic table from beryllium to californium can be measured qualitatively and quantitatively by study of X rays response emitted by samples after irradiation.
In the NAA process, a nucleus absorbs a neutron. The nucleus becomes excited, and immediately releases a gamma ray and decays to a lower energy level, although it still is in an excited state. Then after a period of time (dependent on the nucleus) the excited nucleus emits and a gamma ray. Analysis of the spectrum of gamma rays emitted allows determination of the elemental composition of the air samples collected in high KASBAH. Analysis of matrix correlation put in an obvious existing relation between different elements, and meteorological parameters.
Keywords: Heavy metals, X-rays fluorescence, Neutron activation, correlation.

22-

SYSTEMATIC STUDIES OF REACTION CROSS SECTIONS WITH THE OPTICAL MODEL, APPLICATIONS TO THE (n, ALPHA) EXCITATION FUNCTION REACTIONS

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By using the optical model, systematic studies of reaction cross sections were carried out and analytical expressions have been deduced for calculating the neutron, proton and alpha reaction cross sections. The new semi empirical formulae obtained, allow a faster calculation of reaction cross sections in an energy range from threshold to 20 MeV and for target nuclei of mass number 50.

23-

ROLE OF LAWS AND REGULATIONS FOR NUCLEAR ENERGY INSTALLATION IN DEVELOPING SAFETY MEASURES AGAINST ACCIDENT

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The energy industry has been considered as an economic development driver. The fundamental safety policy for nuclear facilities is to protect health and safety of the public and the site personnel against undue risks associated with radiation and radioactive materials resulting from normal operation and abnormal conditions. This policy is implemented, based on the as low as reasonably achievable (ALARA) principle for normal operation and the defense-in-depth principle (prevention of the occurrence of anomalies, prevention of the escalation of anomalies into accidents, and prevention of excessive release of radioactive materials into the environment), through establishment of safety guides and standards. More over the consideration of suitable site selection and safety design, verification by safety evaluation, quality assurance for manufacturing, construction and operation, periodic testing and inspection, confirmation by regulatory bodies, and reflection of experienced troubles to safety countermeasures. Are of these paramount importance concepts are applied variety of nuclear facilities, that is, nuclear reactors, uranium enrichment plants, fuel conversion/fabrication plants, reprocessing plants, radioactive waste management facilities, and so on, considering unique features of each facility.

24-

VALIDATION OF THE DETERMINISTIC DIFFUSION METHOD FOR THE NEUTRONIC CALCULATIONS OF THERMAL RESEARCH REACTORS OF TRIGA TYPE USING THE WIMS-IAEA-69 NUCLEAR DATA LIBRARY AT FIVE AND SEVEN ENERGY GROUPS CONDENSED ENERGY SPECTRUMS

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The objective of this paper is to assess the accuracy and the suitability of the deterministic diffusion method in the neutronic calculations of the TRIGA type research reactors in purposed condensed energy spectrums of five and seven energy groups with one and three thermal groups respectively using the calculational line; WIMS-IAEA-69 nuclear data library/ WIMSD-5B lattice cell code/ CITVAP multigroup diffusion depletion code. Firstly, The assessment goes through analyzing the integral parameters - k_{eff}, ρ^{28}, δ^{25}, δ^{28}, and C^* - for the TRX and BAPL standard benchmark lattices for thermal reactors and comparison with experimental, previous WIMS and Monte Carlo MCNP results using other evaluated nuclear data libraries at the full energy spectrums. Secondly, the assessment goes through evaluation of the three dimensional nuclear characteristics of three different models for the TRR-1/M1 TRIGA Mark-III reactor using the multigroup diffusion depletion code CITVAP3.1 and macroscopic cross section libraries generated using the WIMSD-5B code with the integrated cell parameters evaluated at the purposed five and seven energy groups spectrums separately. The results include the fresh cores excess reactivities and the worth of control rods which are compared with the previous Monte Carlo results and the experimental values. The results also include the neutron flux distributions and power peaking factors which are settled for future comparisons with experimental or other calculational techniques. The results of the integral parameters of the TRX and BAPL benchmark lattices show good agreement with the references, albeit better accuracy of predicting the integral parameters is shown with the seven energy groups condensation spectrum. For the core calculations, the evaluated reactivities and the worth of control rods show good agreement with the experimental and Monte Carlo results at the two condensation spectrums, albeit better accuracies are shown with the five energy groups condensation spectrum. The study reflects adequacy of the neutronic calculations of the TRIGA type research reactors using the referred modeling procedure and the deterministic diffusion method with the WIMS-IAEA-69/WIMSD-5B/CITVAP3.1 calculational line at condensed energy spectrums of five and seven energy groups.

25-

INCOMPRESSIBILITY OF HOT ASYMMETRIC NUCLEAR MATTER

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A momentum dependent M3y effective interaction (MDM3Y) is extracted by using the normal density dependent effective interaction (DDM3Y) within a mean field model in order to calculate the thermal properties of nucleonic matter. The parameters of this new effective interaction are determined by comparing to the results of DDM3Y interaction at zero temperature. By constructing the effective Hamiltonian of system by MDM3Y interaction, the equation of state (EOS) of symmetric and asymmetric nuclear matter at finite temperature is obtained.

By performing required variations of total free energy, we have obtained expressions for various thermodynamical quantities such as pressure, entropy and etc. The critical behaviors of system are investigated by calculating the liquid-gas phase diagram. The nuclear isothermal incompressibility &K_{/infinity}$ for the symmetric nuclear matter and the isospin dependent part of K_{asy} of isobaric incompressibility as well as the density slop L are also determined at finite temperature. Finally we have compared our results with other theoretical predictions.

26-

SIMULATION AN ACCELERATOR DRIVEN SUBCRITICAL REACTOR WITH THORIUM FUEL

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During recent years, A new generation nuclear reactors known as “Accelerator Driven Subcritical Reactor” have been developed. An ADS is a subcritical core coupled with an accelerator. One of the new application aspects for ADS, more than transmutation HLW and burned Minor Actinids, is the capability to use Thorium as a nuclear fuel. In this work, a subcritical core in experimental scale is designed and simulated with MCNPX code. In this core, there are two type fuel assemblies include (85% ThO_2+ 15% UO_2)for Thorium fuel assemblies and (80%U+ 20%Pu) other type fuel

assemblies. Consequence, Thorium fuelled ADS neutronic parameters are calculated. Also, some parameters related to accelerator coupled with core are calculated. The purpose of this simulation is to study the behavior of ADS core with Thorium fuel assemblies.
Keywords: Accelerator Driven Subcritical Reactor- Thorium fuel cycle- MCNPX code

27-

APPLICATION OF THE BERTLMANN-MARTIN INEQUALITIES TO SUPER SYMMETRIC PARTNERS

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The purpose of the present study is to discuss some general aspects of the Bertlmann and Martin inequalities (BMI) in the case of the super symmetric partners.

The (BMI) have been established by minoring the multipole sum rules according to a method initiated by Bertlmann and Martin [1]. One of these bounds links the mean square radius to the lowest dipole transition energy. Application to different potentials and generalizations were derived and tested in various papers [2-5].

We start by presenting new concepts of super symmetry in quantum mechanics (SUSYQM) when applied to exactly solvable potentials [6]; we define corresponding super symmetric partners. Hence, we show how to deduce the properties of energy spectra and eigenfunctions of new super symmetric partner from the previous one [7].

Finally, we apply the (BMI) to some potential examples. For the sake of simplicity, we present the derivation of the BM bounds in the one dimensional space.

The general rule seems to indicate that the BM inequalities are saturated (i.e. are quasi equalities) within few percents.

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28-

DOSIMETRIC COMPARISON OF SIMULATED HUMAN EYE AND WATER PHANTOM IN INVESTIGATION OF IODINE SOURCE EFFECTS ON TUMOUR AND HEALTHY TISSUES

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For better clinical analysis in ophthalmic brachytherapy dosimetry, there is a need for the dose determination in different parts of the eye, so simulating the eye and defining the material of any parts of that, is helpful for better investigating dosimetry in human eye. However in brachytherapy dosimetry, it is common to consider the water phantom as human eye globe. In this work, a full human eye is simulated with MCNP-4C code by considering all parts of the eye like; lens, cornea, retina, choroid, sclera, anterior chamber, optic nerve, bulk of the eye comprising vitreous body and tumour. The average dose in different parts of this full model of human eye is determined and the results are compared with the dose calculated in water phantom. The central axes depth dose and the dose in whole of the tumour for these two simulated eye model are calculated too, and the results are compared. At long last, as the aim of this work is comparing the result of investigating dosimetry between two water phantom as human eye and simulated eye globe, the ratios of the absorbed dose by the healthy tissues to the absorbed dose by the tumour are calculated in these simulations and the comparison between results is done eventually.

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RADIOACTIVE DISPERSION MODELING OF TEHRAN RESEARCH REACTOR

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The released radioactive material from reactors stack producing the dose equivalent may be external or internal to the body. The assessment of the total effective doses equivalent (TEDE) received to public around the reactors site is urgent for nuclear reactors safety. The TEDE assessment onto environment for radioactive materials from the 5MW Tehran research reactor using HOTSPOT 2.07 health physics code was simulated in this paper. The HOTSPOT 2.07 code uses a Gaussian plume model to calculate the air concentration and dose from radioactivity releases to the atmosphere.

Material and Methods: The radioactive materials released from Tehran research reactor stacks in the form of gas and particulate. A radius of 10 km around the Tehran research reactor site covers more than %80 of the whole Tehran city. The atmospheric stability classes (A芳) were assumed for dispersion calculation. The A stability class (very unstable) observed frequently at the Amirabad district (30%) and was supposed this simulated. Also other atmospheric stability classes (B芳) were considered in study.

Results: HOTSPOT code can be calculated the dose in various atmospheric conditions with different wind speeds at different height receptor. Results of simulation for Tehran research reactor showed that the radiological impacts of released radioactivity from TRR were lower than the permissible effective dose for the public. Conclusion: TEDE calculation depends on some factors such as released (reactor stack) and receptor heights and wind rose, atmospheric condition that all of them are considered this paper. The results approve TEDE calculated for personal and public around the TRR are lower than the permissible effective dose.

Keywords: Absorbed dose assessment, HOTSPOT code, Radiological impacts, Tehran research reactor.

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T=1 AND T=0 NEUTRON-PROTON PAIRING EFFECTS ON THE ENERGY OF EVEN-EVEN SYSTEMS USING A BCS APPROACH

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Due to fast progress in Radioactive Ion Bean programs, the study of neutron-proton pairing effects has known a renewal of interest during the last decade (cf. e.g. [1-4]). Indeed, these effects that were negligible in ordinary¡ nuclei must be taken into account in nuclei such as N=Z of which the experimental study is now possible. Neutron-proton (np) pairing effects may exist in two varieties: the isovector (T=1) and the isoscalar (T=0) pairing. The latter one has been less studied than the first one, in particular in realistic cases. Among others, the choice of the pairing-strengths is one of the difficulties encountered in the study of the isoscalar pairing.

The goal of the present contribution is to study numerically T=1 and T=0 neutron-proton pairing effects on the system energy as a function of the isovector and isoscalar pairing- strengths. With this aim, we used a BCS approach and considered even-even systems within the schematic one-level model.

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HADRONS SPECTROSCOPY IN A NON- RELATIVISTIC QUARK MODEL

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Many of researches and works are interested in the experimental and theoretical studies of mesons. The reason of that is that the mesons are the simplest system governed by the strong interaction.

The non-relativistic quark model has been built along quark-antiquark potentials. The choice of a good potential is a crucial condition to get reasonable description of the data.

For many years, researchers tried more and more to have a potential that give theoretical data near to the experimental. In this study a potential in the

form (Coulomb + linear + hyperfine + spin dependent) was used it in the potential energy part of the Schrödinger Equation (V) The kinetic part was the usual non-relativistic kinetic energy (K) The matrix method in an iterative approach was used to solve Schrödinger Equation by means of a FORTRAN program and to calculate mesons masses that were found near to the experimental values.

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STUDY OF NEUTRON-NEUTRON INTERACTION IN *nd* BREAKUP REACTION

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The study of *nd* breakup reaction is a powerful tool of studying *nn* interaction. In view of absence of a free neutron target the use of deuterium target and neutron beam is, as a matter of fact, unique effective way of studying *nn* interaction. Rather small number of nucleons in system allows the accurate strict solution of the three-body problem. Despite the simplicity of final *pnn* system the experiments can be performed in different kinematical arrangements of the outgoing three nucleons and their results be compared with rigorous theoretical predictions.

Important argument for continuation both experimental and theoretical works in this area are the clear discrepancies between the theory and existing data. The strongest discrepancies occur in the *nn* quasifree scattering (QFS) and in the *nd* STAR (three nucleons are flying in the c.m. system with momenta of equal magnitude) geometries. The final state interaction (FSI) geometry is widely used for determination of singlet *nn*-scattering length characterizing the *nn* scattering at zero energy. Data for a_{nn} together with analogous data for *pp* scattering length a_{pp} (difference $a_{nn} - a_{pp}$) define a quantitative measure of the charge symmetry breaking (CSB) of nuclear forces.

The goal of our study is the determining characteristic parameters of neutron-neutron interaction, as well as obtaining new accurate estimation of CSB effect. To study the *nd* breakup reaction the experimental setup allowing registration of all secondary particles was installed at neutron channel of Moscow Meson Factory of the Institute for Nuclear Research. Experiment is performed in broad energy region of neutrons (20-100 MeV) incident on deuterium (CD_2) target. The setup allows obtaining data in different kinematical arrangements. We present the first preliminary data on

a_{nn} obtained in the FSI geometry at our setup. The test measurements in the *np* QFS arrangement showed the possibility of our setup to obtain data on neutron-neutron QFS in broad region of neutron energy.

33-

NATURAL RADIOACTIVITY MEASUREMENTS FOR SOME ALGERIAN BUILDING MATERIALS

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The objective of this work was to assess the radiation hazards associated gamma rays from building materials. The radon exhalation and uranium contents are also presented. Natural gamma rays activities of natural radionuclide represented mainly by three natural radioactive series ^{238}U, ^{235}U, and ^{232}Th, and the primordial ^{40}K in the samples of building materials consisting of soil, bricks, sand, ceramics, marble and gypsum from different areas of eastern Algeria have been measured using gamma ray spectrometry. The values of the activities of these radionuclides do not clearly reflect the radiation hazard associated with these materials.

The radium equivalent (Ra_{eq}) concentration is, therefore, defined which takes into account the effectiveness of these isotopes in creating the radiation hazard. Radium equivalent activities, external and internal hazard indices (H_{ex} and H_{in}) have been calculated from of the activities of ^{226}Ra, ^{232}Th and ^{40}K for suitability of the materials.

34-

CHEMOMETRIC NUCLEAR SPECTROANALYSIS OF ENVIRONMENTAL AND GEOTHERMIC MATRICES

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Although nuclear spectrometric techniques have high analytical accuracy, speed and versatility for a wide variety of matrices, their utility to environmental and geothermic studies is limited by the complexity of the sample matrices and of data analysis and interpretation. With respect to two popular nuclear analytical techniques (NAT) namely X-ray fluorescence (XRF) analysis and gamma-ray spectrometry (using especially low resolution detector) the analytical challenges in complex matrices (extreme matrix effects, spectral overlap, poor signal-to-noise ratio (SNR) for trace analytes, 'dark matrix' problem (for XRF), undefined geometry, difficult digestion) are daunting. Difficulty in data analysis and interpretation arises from the fact that environmental processes are complex (e.g., separation of anthropogenic influences from natural geochemical background) and dynamic, thus their study requires equally complex methods. Since the range and complexity of problems that can be solved by analytical spectroscopy is increased by chemometrics, we report selected results from our research that demonstrate how we apply chemometrics methods to reduce the complexity and increase the information gained in nuclear spectroanalysis. Chemometrics has ability to extract important features (e.g. underlying phenomena) from complex multivariate data and once developed for a specific application to perform rapid and stable analyses. One of its benefits is the representation of multivariate data in a graphical interface. We show how the combination of chemometrics with XRF analysis afforded a novel method for characterization and identification of heavy trace metals in ambient aerosol particulate matter (PM) in a typical urban (anthropogenic) environment, i.e. Nairobi, Kenya. The developed methodology showed good results for characterization, identification and source apportionment of size-resolved aerosols. We also successfully applied chemometrics-assisted XRF and geostatistical analysis of trace element characteristics to map the unique 'marker' elements of the Kerio Valley (Kenya) geothermal field, and to conclude that the geothermal field is composed of acid-sulphate aquifers which, by inference, have elevated temperatures. In another study we successfully combined chemometrics with NaI(TI)–based gamma-ray spectrometry to determine the levels of naturally occurring radioactive materials (NORM) and technologically-enhanced (THE)-NORM in shore sediments at Port Victoria, where a major catchment river, the Nzoia, enters Lake Victoria, their associated dose rates, effective dose rates, as well as to elucidate their sources (source apportionment) and multivariate relationships that help interpret the river catchment basin.

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EFFECT OF A PRESSURE PREPULSE ON THE IMPLOSION OF A SPHERICAL SHELL

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A simple model for the implosion of a single-layer spherical shell driven by a two-step pressure pulse is developed. The model gives the magnitudes that characterize that state of the shell when the implosion stagnates. The effect of the prepulse on the process of central hot-spot formation is studied, and the optimum shaping of the shell entropy is found.

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HEAVY MESONS SPECTRA IN THE NON-RELATIVISTIC QUARK MODEL

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Schrödinger Equation in the framework of the non-relativistic quark model is solved by using three groups of potentials to get the spectra of heavy mesons. New experimental published data of heavy mesons are fitted. The third group gives the best fitting results which are in a good agreement with the experimental data.

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COMPUTATIONAL APPROACHES FOR EVALUATION OF GAS PRODUCTION USING MONTE CARLO METHOD

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Radiation particles may be damaged materials by different factors. The gas production as one of radiation damage has unfavorable consequence on the material. Therefore the calculations of total gas production such as hydrogen and helium can be affected in selection of materials and their shielding. The Monte Carlo method is one of the suitable techniques to

implementation of gas production calculations. The MCNPX is a general-purpose Monte Carlo code, which is widely used in these calculations. In this research, several different procedures have been compared for achievement of these calculations using this code. Results show that the outputs have not depicted great different between procedures. Maximum relative difference was almost lower than one order magnitude.

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EVALUATION OF THE BETA DECAY HALF-LIVES WITH INCLUSION OF THE NEUTRON-PROTON PAIRING AND PARTICLE-NUMBER CONSERVATION

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The study of the beta transitions (in both forms) is a good probe for the study of nuclear structure. Although the mechanism of the latter is - in principle- well known, their study is still limited due to the various interactions which may occur. Moreover, it is expected that the neutron-proton (np) pairing plays a significant role in this kind of transitions [1]. However, np pairing is often treated within the BCS approach of which the non-conservation of the particle-number is the main drawback [2]. The goal of the present work is thus to study the particle-number fluctuations, which are inherent to the BCS theory, in the isovector case, on the beta decay half-lives. With this aim, we have first established the expressions of the transition probabilities, of Fermi as well as Gamow-Teller types, which strictly conserve the particle-number. They have been numerically calculated for some transitions of isobars such as N=Z. The obtained results are compared, on the one hand, to values obtained before the projection, and on the other hand by considering only the pairing between like-particles. We have then studied the effect of the deformation (and specially the elongation) of the mother-nucleus on this physical observable.

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RADIATION RESISTANCE OF ZNO FILMS AND NANOSTRUCTURES

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Zinc oxide (ZnO) is a prominent semiconductor for a number of important applications. The economic and ecological benefits of ZnO are low cost of Zn (1.1 $/kg), available technology for films and nanoobjects growth, nontoxicity and biocompability with human organism. Nowadays it is the most published semiconductor in the world what results in hundreds of publications per year what overcomes the number of papers on GaN, SiC, CNT. ZnO attracted great interest as the material for ultraviolet (UV) and blue-light-emitting devices because of its wide band gap of 3.37 eV, possibility for band-gap engineering and large exciton binding energy of 60 meV. ZnO can be used for fabrication of UV emitters, blue and green LEDs, detectors of UV radiation, cathodoluminophors, transparent electrodes, transparent thin film transistors, acoustoelectric and acoustooptic devices, gas sensors etc.

For space applications, nuclear researches, extraction uranium ores and their treatment, semiconducting devices have to operate in harsh radiation conditions involving high energy particles. An important point for such applications is the high radiation resistivity of the semiconducting material, providing reliable operation of devices during extended periods of time. Presently, the main wide-band-gap materials for space applications include the III-V nitrides, SiC, and diamond. Whereas the effect of high-energy electron irradiation has been reported for ZnO[1], GaN[2], and SiC, no data are yet available regarding the irradiation of ZnO by heavy particles such as protons and α-particles, as was reported for GaN. In particular, to our knowledge, data pertaining to radiation-induced defects in ZnO are unknown.

The applications of devices based on ZnO depend essentially on type and concentration of point defects (firstly zinc and oxygen vacancies zinc interstitial). This problem is closely related to the interaction of ZnO with high energy particles (α-particles, protons, neutrons, etc). It leads to a generation of radiation defects in ZnO crystal lattice similar to native

defects at thermodynamic equilibrium and at growing thin films by different methods.
The types of defects generated by radiation, the processes of their annealing and methods for their characterization are considered. The impact of radiation on properties of ZnO and other wide band gap semiconductors (GaN, SiC) are compared.
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EFFECT OF N^+ AND O^+ IMPLANTATION ON PROPERTIES OF ZNO FILMS

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Ion implantation is the important method for modification and control of semiconductor properties. In this paper we report about the influence of nitrogen and oxygen implantation on the attributes of ZnO and $Zn_{1.0-x}Cd_xO$ (x=0.5-0.6) films.

This activity is motivated by the high importance of this semiconducting material. ZnO and its alloys with CdO and MgO are promising ones for ultraviolet, blue and green light emitting diodes and other various devices [1]. Nitrogen and oxygen are important species. Nitrogen is an acceptor impurity in ZnO, which is promising for obtaining p-type material. Vacancies of oxygen are responsible for green emission of ZnO.

Nevertheless the problem of ion implantation was studied up to date incompletely. Few papers were published on nitrogen and oxygen ion implantation into ZnO, but in some details they are contradictory to one another.

ZnO and ZnCdO films were deposited on c-sapphire and p-Si substrates

by magnetron sputtering implanted by 150 keV N^+ and O^+ ions with fluence 10^{16} cm-2 and then annealed at 600-800°C under air ambience. Magnetron sputtering allows obtaining high quality textured films oriented along c-axis in comparison with other growth techniques, what was confirmed by X-ray diffraction measurements. Raman scattering, photoluminescence (PL) and cathodoluminescence measurements were carried out on all stages of experiment.

Ion implantation reduces ultraviolet and visible PL both due to introduced defects of crystal lattice. Annealing improves the optical quality of films, enhances the ultraviolet PL and changes the structure of visible PL due to defects. The latter contain important information about the nature of the luminescence bands of different defects which form the total shape of visible PL band.

The fulfilled investigations allowed to make conclusions about the role of nitrogen as acceptor centres, interaction of implanted O+ ions with oxygen vacancies, effect of small additions of Cd isoelectric impurity on properties of implanted films, input of implanted ions to the structure of visible PL.

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STUDY OF NEUTRON-RICH NUCLEI IN THE LANTHANIDE REGION, NEAR A ~ 150, PRODUCED BY (n,fission): QUASIPARTICLE ISOMERS AND BANDS STRUCTURE

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Nuclei with A~150, and neutron number N~90, lie in an interesting part of the nuclear chart for experimental and theoretical investigations. This is because the h11/2-, d5/2 and i13/2-, f7/2 couplings lie close to the Fermi surface, which can form octupole modes. The sudden increase in quadrupole deformation beyond N=90 is thought to reduce the strength of octupole interactions. Investigations into E1 transition rates can give information on the size of the dipole moments and strength of octupole modes present here. The presence of one, or two, unpaired nucleon(s) outside the even-even core can lead to a change in the nature of deformation because of the core polarization effect [1, 2]. If this effect is sufficiently strong, the symmetry of the average nuclear field can be broken and a dipole moment induced. However, further, polarization of the nuclear core may be configurationally dependent, and two shapes with different symmetries may coexist in a given nucleus [3], depending on the properties of the valence orbitals.

To investigate the origin of the dipole moment here, the neutron-rich N = 93 isotones ^{155}Sm and ^{153}Nd have been studied by delayed γ-ray and conversion-electron spectroscopy at the Lohengrin mass spectrometer. A half-life of 2.9(5) s has been measured for the $5/2^+$ [642] state at 16.5 keV in ^{155}Sm. The decay of a 1.17(7)- s isomer in ^{153}Nd, at 191.7 keV, has been measured and its spin has been reassigned as $(5/2^+)$. This state contains a strong component of the $5/2^+$ [642] Nilsson orbital. In addition, a new 1.00(8)- s isomeric state at 538.6 keV, with a probable 11/2 [505] Nilsson configuration, has been observed in ^{155}Sm. Triple γ-ray coincidence data from the spontaneous fission of a ^{252}Cf source placed inside the Gammasphere array were used to extend the collective band on top of the $(5/2^+)$ isomeric state of ^{153}Nd, and a new band with the same bandhead spin has been observed in ^{151}Ce. The observation of this new band and an additional new transition in the ground-state band has led us to change the ground-state spin of ^{151}Ce to (3/2). Calculations using the quasiparticle-rotor model successfully reproduce the majority of the features of the β- decays of these nuclei, including branching ratios and isomeric half-lives. Because this

model uses a reflection-symmetric core, we conclude that the polarizing effect of the odd particle is responsible for the dipole moment present in the $5/2^+$[642] states of the three nuclei studied and the 11/2 [505] level of ^{155}Sm.

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GROSS ALPHA AND BETA ACTIVITY MEASUREMENTS IN DRINKING WATER USING LIQUID SCINTILLATION ANALYSIS

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Gross alpha and beta activities are ready and highly informative parameters for the radiometric screening of drinking waters. Ultra-low level liquid scintillation counting (LSC) coupled to alpha-beta discrimination allows rapid and simple discrimination of gross alpha and beta activities that are simultaneously measured through alpha-beta discrimination technique. Liquid scintillation counting was performed by a Quantulus 1220 (Perikn Elmer). For gross alpha and gross beta measurement, the scintillation counter must be calibrated to determine the alpha particle detection efficiency in the alpha region of interest (ROI), the alpha particle detection efficiency in the beta ROI, the beta particle detection efficiency in the beta ROI and the beta particle detection efficiency in the alpha ROI. The alpha and beta detection efficiencies, spillover factors, minimum detectable activity (MDA) and gross alpha and gross beta activity of the samples with corresponding uncertainties were determinate. The use of a pulse shape analysis device to discriminate alpha and beta events introduces a correlation between input quantities, and it has to be considered.

The drinking water samples were collected in cities and villages from public water supply system from wells, artesian bore holes and springs in Serbia. Water samples were prepared for measurements according to the ASTM D 7283-06 Standard Method. Of 28 measured drinking water

samples, only in one the gross alpha activity that exceeds the legally defined threshold of 0.1 Bq ∙ l-1 was detected.

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EFFICIENCY CALIBRATIONS OF HPGe DETECTORS USING SRM4350B

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Efficiency calibration of gamma-detectors is very important for the environmental samples analysis. There are a lot of methods for determining the total efficiency of volume source, Monte Carlo simulation technique and experimental methods. In this paper, experimental method of efficiency calibration of four HPGe detectors has been described using standard referent material, SRM4350B. Also, efficiency calibration for different matrices has been determined using semi-empirical program Angle. This introduces a fast method of efficiency determination for different composition of source matrices.

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THE RADON FACTOR: REAL OR IMAGINARY

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Worldwide data clearly indicate that radon contributes a major proportion to background radiation. Interest in radon gas and its short-lived decay daughters is real because of the possible link between sustained exposure to radon gas and the development of lung cancer. In Ghana, research data on radon concentration in various parts of the country have been obtained for more than a decade. Our recent research includes indoor radon level measurements in the district of Dome in the Dome-Kwabenya constituency. In this District, radon concentrations varying from 278Bq/m3 to 749Bq/m^3 have been measured. These values translate to annual effective dose range of 8.42 to 22.41mSv per year. Our calculations, using the BEIR III model, lead to the prediction of a lung cancer risk of 2.03 x 10^{-5} to 4.06 x 10^{-5} for various age groups. In this Paper, we compare our recent data with previous data from our laboratory, as well as results from other workers. We

conclude that the radon factor in calculations of background radiation in Ghana is real. Therefore, serious effort must be made to bring all results together for the establishment of a national data base and reference record.

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PERCENTAGE BURN-UP SEMI-EMPIRICAL FORMULAE GENERATED FOR A RESEARCH REACTOR

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Percentage burnup (%B.U.) through out the entire core is of a great attention to reactor operators to perform the burn-up calculations and to be able to perform correct and economic fuel management.

It is much easier for the operator in the control room to deal with a percentage consumption of uranium (B.U.%) rather than MWD/Ton, reporting the different fuel average burn-up in order to decide which fuel element exceeded the maximum burn-up level, so this paper presents a semi-empirical formula for percentage burn-up which is obtained for a convenient and easy operation. This paper shows the procedures of calculations on an example of a MTR research reactor containing three kinds of fuel with different uranium concentration.

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TOTAL REACTION CROSS FOR *p*-^{12}*C* REACTION FROM LOW TO HIGH ENERGIES

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The total cross section of antiproton reaction with ^{12}C is calculated in the energy range from 21 MeV to 280 GeV. Calculations is done within the framework of Glauber multiple scattering model and include implication of Gaussian matter density distribution for the target nucleus as well as two

relativistic mean field nuclear matter density distributions. The dynamical short-range, Pauli, and center-of-mass effects are included in the calculations. Semi-empirical formulae for the variation of the total *NN* cross section, the ratio of the real to the imaginary part of the forward *NN* scattering amplitude, and the slope parameter are proposed. An implication of the phase variation of *NN* amplitude through nuclear phase shift function is examined and the results express the explicit connection between phase variation parameter and the ratio of real-to-imaginary pa11s of the forward *NN* scattering amplitude.

Keywords: Antiproton-induced reactions, Many-body theory in nuclear reaction models. Glauber multiple scattering

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HIGH RADIOACTIVE MATERIALS IN BUILDING INDUSTRY

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All building materials contain various amounts of natural radioactive nuclides. The purpose of setting controls on the radioactivity of building materials is to limit the radiation exposure due to materials with enhanced or elevated levels of natural radionuclides. The doses to the members of the public should be kept as low as reasonably achievable. However, since small exposures from building materials are ubiquitous, controls should be based on exposure levels which are above typical levels of exposures and their normal variations. Fifty high active samples of building material used in Serbian building industry were surveyed for natural radioactivity by gamma-ray spectrometry. From the measured gamma ray spectra, activity concentrations are determined for 232Th, 226Ra and 40K. The total effective dose and the activity concentration index are calculated applying the dose criteria recommended by the European Union for building materials.

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CHARACTERIZATION AND CLASSIFICATION OF THE FIRST METEORITE FALL IN VARRE-SAI TOWN, SOUTHEAST BRAZIL, USING X-RAY MICROFLUORESCENCE TECHNIQUE

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On the night of June 19th, 2010, a meteorite fell nearby the town of Varre-Sai, Rio de Janeiro state, southeast Brazil. A small part of it was found and taken for analysis. A meteorite analysis can give researchers a better understanding of the origins of the Universe. However, some of the most traditionalist methods of characterization and classification of meteorites are destructive. In this paper we present the results of a chemical analysis and classification of this particular meteorite using X-ray microfluorescence (琪RF), a non-destructive technique that allows for a quick and easy elemental analysis within the range of micrometers. Both sides of the meteorite were measured, 35 points in total, using Artax, a state of the art 琪RF system developed by Bruker, at 50kV tension and 700涣 current. Quantitative analysis using Direct Comparison of Counting Rates (DCCR) method showed concentrations of iron and nickel together of roughly 7,86%. We found that it is possible to distinguish this meteorite from most of the categories as an ordinary L-type chondrite but a more thorough analysis might be necessary so as to obtain a more detailed classification.

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AIRBORNE RADIOIODINE IN NORTHEN SERBIA FROM FUKUSHIMA

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After the public presentation of the accident on the Fukushima power plant a devoted environmental radioactivity monitoring system was established. Aerosol, rain, milk and spinach samples have been collected daily. In the aerosol samples the activity concentration of 131I has been measured to be of mBq order of magnitude while in the rain, milk and spinach samples about 1 Bq kg-1 of I-131 has been found.

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NEW LIMIT FOR THE NONCOMMUTATIVITY PARAMETER OF THE NONCOMMUTATIVE STANDARD

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We discuss the limits on the scale of the noncommutative (NC) parameter Λ_{NC} via studying the top quark pair production through electron-positron collision in the framework of the minimal noncommutative standard model (mNCSM) using the Seiberg-Witten (SW) maps to the first order of the noncommutative parameter Θ_{μν}. In this work we assume an ansatz for the NC parameter Θ_{μν} and we find new limit on the NC scale Λ_{NC} which is in the range 0.1-0.2 TeV . We confirm the results obtained in muon pair production.

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MEASUREMENT OF $\gamma\vec{d} \to pp\pi^-$ AT LARGE PROTON MOMENTA

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The experiment was carried out at the VEPP-3 storage ring at an electron energy of 2 GeV using internal polarized deuterium gas target. Two protons from the $\gamma\vec{d} \to pp\pi^-$ reaction were measured in concidence by two hadron hodoscopes located at the vertical plane symmetrically to the electron beam axis. In assumption of zero electron scattering angles, the pion electro- and photoproduction was related.

Proton momentum was encounted in the range of (300-700) MeV/c at the azimuth interval Δφ=60°. Polar angle acceptance for each hadron hodoscpope was 44°-88°. Integrated charge emitted in a beam during the whole experiment time was 440 KC.

Several criteria were applied to separate about 212,000 events corresponding to considered reaction where full set of kinematic parameters was reconstructed further. For photon energy range (300-900) MeV this approach allows issuing T tensor analyzing power component and the differential cross section distributions by angular and energy values.

Attained results had been compared with theoretical predictions of spectator model involving final state interaction effects.

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SEMIRELATIVISTIC 1S-2S EXCITATION OF ATOMIC HYDROGEN BY ELECTRON IMPACT

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In the framework of the first Born approximation, we present a semirelativistic theoretical study of the inelastic excitation (1s1/2 → 2s1/2) of hydrogen atom by electronic impact. The incident and scattered electrons are described by a free Dirac spinor and the hydrogen atom target is described by the Darwin wave function. Relativistic and spin effects are examined in the relativistic regime. A detailed study has been devoted to the nonrelativistic regime as well as the moderate relativistic regime. Some aspects of this dependence as well as the dynamic behavior of the differential cross-section in the relativistic regime have been addressed.

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HANDLING THE SINGULARITIES OF THE PERTURBED KRATZER AND INVERTED KRATZER POTENTIALS

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The r^{-1} and r^{-2} singularities in the Kratzer and inverted Kratzer potentials have been absorbed in the reference Hamiltonian. Through such a step, it was trouble-free to calculate the bound and resonance energies fully for these potentials. Our results were found to be in excellent agreement with the exact analytic expressions. A study to an extension of our method with a perturbation to Kratzer and Inverted Kratzer potentials will be given and compared with the available data.

Keywords: Singular potential, Kratzer potential, Inverted Kratzer potential, Coulomb - Bound states, Singular short-range potential, J-matrix method, resonance energies, Complex rotation.
PACS: 03.65.Ge, 34.20.Cf, 03.65.Nk, 34.20.Gj

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MEASUREMENT OF IONIZING RADIATION EXPOSURE LEVELS IN NASARAWA QUARRY SITE OF NASARAWA STATE, NIGERIA

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The radiation exposure level of a Quarry site in Nasarawa, Nigeria was measured using Inspector Alert Nuclear Radiation Monitor. The results showed that the excavation point has the highest radiation level of 1.96ą0.17 followed by the immediate areas around the excavation point of 1.66ą0.09, the processing point has a radiation level of 1.45ą0.63 and the background radiation level 500m away from the quarry site is 1.19ą0.11. This shows that the workers are exposed to radiation of 0.77ą0.06 which implies that, there is no need for regulatory control and may not cause radiological hazard in the workers working on this quarry if this condition is maintained.
Keywords: Radiation, Exposure, Radionuclide, Ionization, Exposure, levels.

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IMPROVEMENT OF RADIOACTIVE WASTE SOLIDIFICATION PROCESS USING MODIFIED BENTONITE MATERIALS

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The solidifaction matrix is an important barrier for the safety of disposal site. Improvement of this matrix is done by incorporation of Na bentonite and K- bentonite loaded by cobalt and cesium into ordinary Portland cement. To improve the compressive strength for the final solid block, bentonite was coated by acrylic acid and styrene. The compressive strength for the Portland cement containing 25wt. % K- bentonite was increased from 15MPa to 27 and 36MPa when Na- bentonite was incresead

respectively. On the other hand, the compressive strength styrene was increased from 14MPa to 33 MPa when coated by acrylic acid and styrene respectively. Mechanical, chemical and radiation satiability has been carried out under different conditions. The effect of radiation dose to solidified cemented waste form was investigated and the results show that at 1.5 Mrad the compressive strength increased to its maximum value 57 Mrad and 51.2 Mrad for k- bentonite and Na- bentonite, respectively. To assess the safety of radioactive waste –cement composition, the leaching of ^{60}Co and ^{137}Cs from a waste composite into a surrounding fluid has been studied using under ground water as leachant. Leaching tests were carried out in accordance with method recommended by the IAEA.

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SENSITIVITY STUDY OF SOME PARAMETERS THAT AFFECT THE SAFETY OF DISPOSAL SITE

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Disposal pof radioactive materials require identifaction of the permissible radionuclide and its inventory limits. this paper addresses the study of some parameters to specify radioactive waste, which are buried in repository by assessing; 1) the sensitivity of these parameters on the dose received by individual through ingesation path, and 2) approach to evaluate the effect of these specific parameters on the safety of disposal site, travel time and dose conversion factors are the selected parameters for this study. Using simple model, the effect of these parameters on a human dose shows higher sensitivity index. Additionally, safety opf repository in respect to the time and activity of radionuclide's are evaluated

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NATURAL RADIONUCLIDES DISTRIBUTION IN THE BLACK SAND OF RASHEED (ROSETTA) SEASHORE IN NORTH OF EGYPT

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Systematic studies on gamma radiation level and the distribution of natural radionuclides were carried out for the establishment of baseline data

on background radiation level and the distribution of radionuclides in the environment of Rasheed (Rosetta) seashore, in the north of Egypt, where the black sand cover most of the seashore. The external absorbed dose rates prevailing in the region were measured using Calcium Foluride doping with Dysbrzium (CaF2-Dy) with commercial name (TLD-200) which is sensitive to environment radiation. Also personal dosimeter was using to estimate external absorbed dose rates which is Lithium Foluride doping with magnisium and Titiuium (LiF:Mg, Ti) with commercial name (TLD-100) . Sixty black sand samples were collected from different locations covers three kilometers of the seashore. Radioactivity of terrestrial radionuclides (^{238}U, ^{232}Th, ^{226}Ra and ^{40}K) was measured in these samples using gamma ray spectrometry system with an HPGe detector. The activity of ^{238}U was found to vary between 244.6-3660.19 Bq/kg, with a mean value 1509.6 Bq/kg. ^{232}Th varies between 258.02-8294.02Bq/kg, with a mean value 3274.3 Bq/kg. ^{226}Ra varies between 265.05-3906.16 Bq/Kg with a mean value 2085.15 Bq/kg and ^{40}K varies between 233.7-760.2 Bq/kg with a mean value 590.0Bq/kg. The contributions of ^{238}U, ^{232}Th, ^{226}Ra and ^{40}K to the total gamma absorbed dose rate were calculated. The gamma absorbed dose rate estimated using the results of activity concentration of ^{238}U, ^{232}Th, ^{226}Ra and ^{40}K are found to compare well with that of TLD-200 chips. Personal dosimetries (TLD-100) were used to evaluate the dose rate to public (fishers). The results of the study were compared with the literature values reported for other environs of the country as well as the world, and conclusions are drowned.

Key words: TLD, Environment, Natural Radioactivity, Rosetta.

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NEW EXPERIMENTAL RESULTS ON THE LOW-ENERGY ANTIKAON NUCLEON AND NUCLEUS INTERACTION

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The antikaon (K-) interaction on nucleons and nuclei at low energy is neither simple nor well understood. Kaonic hydrogen is a very interesting case where the strong interaction of K- with the proton leads to an energy shift and a broadening of the 1s ground state. These two observables can be precisely studied with x-ray spectroscopy. The behavior at threshold is influenced strongly by the Lambda (1405) resonance. The

DAFNE electron-positron collider at Laboratori Nazionali di Frascati (Italy) provides an unique source of monoenergetic kaons emitted in the Phi meson decay. Recently the experiment SIDDHARTA on kaonic hydrogen and helium isotopes succeeded in getting new values of the low-energy observables.

The European network LEANNIS devoted to the research on the antikaon interactions with nucleons and nuclei is accepted for continuation in the European Framework Program 7. This talk will present an update on LEANNIS with new experimental results and will give an outlook to future perspectives in this research field.

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STUDY OF TRANSFER FACTOR OF 238U AND 232TH FROM SOIL TO MEDICINAL PLANTS USING THE SSNTD

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The levels of ^{238}U and ^{232}Th in different parts of some selected plants used in traditional treatment of hypertension and diabetes in south-eastern Morocco (Errachidia area) has been studied using two different types of solid state nuclear track detectors (SSNTDs) LR-115 type II and CR-39. Plant uptake of radionuclides is one of many vectors for introduction of contaminants into the human food chain. Thus, it is critical to understand soil-plant relationships that control nuclide bioavailability. Soil concentrations of uranium ranged from 6.10 to 11.62 ppm, with a mean of 7.90 ppm. Soil concentrations of thorium ranged from 2.70 to 4.80 ppm, with a mean of 3.41 ppm. Mean uranium specific activities were 8.38 Bq.kg-1 in root tissue, 5 Bq.kg-1 in stem tissue and 6.02 Bq kg-1 in leaf tissue. Mean thorium specific activities were 2.53 Bq.kg-1 in root tissue, 1.64 Bq.kg-1 in stem tissue and 1.96Bq.kg-1 in leaf tissue. The transfer factors of ^{238}U and ^{232}Th from soil to different parts (root, stem, leaf, seed and fruit) of

studied plant samples have been investigated. The transfer factors obtained for root plants were markedly higher than those for leaf, stem, fruit and seed plants. Soil-to-plant transfer factor (TF) is one of the most important parameters to be used in transfer models for predicting the concentration of radionuclides in agricultural crops and for estimating dose impacts to man. This study of uranium and thorium uptake in plants used in traditional medicine is also significant as far as the health hazard effects of uranium and thorium in human being are concerned.

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SEASONAL VARIATION MEASUREMENTS OF RADON LEVELS AND RADON DOSE DETERMINATION IN MOROCCAN DWELLINGS USING PASSIVE TRACK DETECTORS

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Solid-state nuclear track detectors (SSNTDs) are increasingly being used for the measurement of time-integrated radon levels in dwellings under different conditions. Inhalation of radon (222Rn) and its daughter product are a major source of natural radiation exposure. The measurement of radon activity in dwelling is assuming ever increasing importance. It is known from recent surveys in many countries that radon and its progeny contribute significantly to total inhalation dose and it is fairly established that radon when inhaled in large quantity causes lung disorder. Thus, the indoor radon activity level and radon effective dose rate were carried out in the dwellings of Beni-Mellal, Khouribgra and Ben Guerir towns, Morocco, using CR-39 and LR-115 type II plastic track detectors. Assuming an indoor occupancy factor of 0.8 and 0.4 for the equilibrium factor of radon indoors, we found that the 222Rn effective dose rate in the studied dwellings ranges from 0.92 to 760 mSv y-1. The radon activity in the corresponding dwellings was found to vary from 40 to 532 Bqm-3. The radon activity has not only been found to vary with seasonal changes, but also with the age, the construction mode of houses, and the ventilation conditions and with specific.

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DESIGN OF X-BAND MEDICAL LINEAR ACCELERATOR WITH MULTIPLE RF FEEDS

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In this work, design of a 6 MeV X-band 9.3 GHz medical linear accelerator is presented. The design is based on separately exciting clusters of cavities of the accelerating structure, where a coherent excitation is provided to each cluster with different amplitude and/or phase. The use of multiple accelerating sections with multiple RF feeds permits the use of inexpensive RF sources to allow the development of low cost medical linacs. The design parameters of the accelerating sections, RF sources and gun are described. The gun is a two stages 10 keV thermionic gun to control beam current and energy separately. The accelerating structure is composed of multiple standing wave sections operating in the Pi-mode. Each section has been designed and optimized for high shunt impedance by means of 2D SUPERFISH code and 3D CST code. Two dimensional codes, named PTCC, were developed to investigate the beam dynamics through accelerating structure.

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EINSTEIN'S LIGHT ENERGY–MASS INTER-CONVERSION EQUATION AND $\Delta E=\Delta mc^2$

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Einstein's Sep. 1905 paper in which $\Delta L=\Delta mc^2$ (light energy –mass equation) is derived, is not completely studied; and is only valid under special conditions of involved parameters. Sometimes the derivation becomes invalid and $\Delta L=\Delta mc^2$ is not always obtained. The origin of $\Delta E=\Delta mc^2$ from $\Delta L=\Delta mc^2$ is completely speculative in nature without mathematical derivation. $\Delta E=\Delta mc^2$ is obtained from $\Delta L=\Delta mc^2$ by simply replacing L by E. $\Delta L=\Delta mc^2$ was initially derived for light energy –

mass interconversion, then it was generalized for every energy $\Delta E=\Delta mc^2$. It is not justified logically and mathematically. The factor c^2 has been arbitrarily brought in picture by Einstein. As to obtain $L=\Delta mc^2$ Einstein retained term $v^2/2c^2$ (compared to unity) without giving numerical values to v. If the value of v is considered in typical classical region, 1cm/s say ($v^2/2c^2=5.55\times10^{-22}$ is negligible) then result is $M_b=M_a$. Thus conversion factor c^2 is arbitrarily brought in the picture as both the results i.e. $\Delta L=\Delta mc^2$ and $M_b=M_a$ are equally probable. Further, if body emits light energy, but measuring system is at rest (v=0) even then Einstein's derivation is not applicable or valid and no result is obtained. If all values of parameters are taken in account then the same derivation also gives $L \alpha \Delta mc^2$ or $L=A\ \Delta mc^2$, where A is coefficient of proportionality. Thus the value of energy emitted varies with variables, thus result is not always $\Delta L=\Delta mc^2$ .There are numerous values of coefficients of proportionality in the existing physics. The energy emitted can be less or more than emitted by L/c^2. Thus Einstein's derivation of $\Delta L=\Delta mc^2$ and speculation of $\Delta E=\Delta mc^2$ is not mathematically and logically consistent. Hence equation must be re-derived by other methods.

62 b-

BINDING ENERGY AND MASS DEFECT OF DEUTERON: REVISITED

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There are two inherent observations; firstly masses of nucleons are fundamental constants (masses are same inside and outside the nuclei) in all cases and secondly nuclei possess BE ($\Delta E=\Delta mc^2$) due to mass defect. Currently the experimental observations of deuteron (BE= 2.2244 MeV) are explained on the basis of $\Delta E=\Delta mc^2$, and difference in masses of nucleons must be 2.388×10^{-3} u. It is not justified as masses of nucleons are fundamental physical constants i.e. should be same inside and outside the nucleus. But the generalized equation $\Delta E = Ac^2\ \Delta m$ is capable of explaining both the observations simultaneously i.e. equality of masses of nucleons and binding energy of nucleus. The reason is that according to $\Delta E = Ac^2\Delta m$ (if A is regarded as 10^{10}) even infinitesimally small mass defect (2.388×10^{-13} u, of nucleons both inside and outside nucleus must be the same. Hence say) predicts binding energy 2.2244MeV. If mass defect is 2.388×10^{-13} u then

masses $\Delta E = Ac^2\Delta m$ explains both observations simultaneously which $\Delta E=\Delta mc^2$ cannot explain. This generalization has no effect in those cases where $\Delta E=\Delta mc^2$ is established.

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ON THE SOURCE OF ENERGY OF ASTRONOMICAL BODIES

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It is considered that the universe has existed for more than 5 billion years in its current form. It is of the same age as the Sun. The fact that the number of neutrinos coming out of the Sun is too little dispels doubts that fusion reaction is the energy source of the Sun. Besides, in order to have thermonuclear reaction in stars, temperature of 20 million degrees is needed, whereas, for example, solar underground temperature is 6 million degrees. It is also known that, for example, the energy emitted from Mars and Saturn approximately equals to the Sun's energy. And there is no fusion reaction inside them. In this paper energy of the magnetic field of bodies is considered as source of energy of the bodies (including stars). As it is known, in each 1 cm3 there is one atom of hydrogen in average. The Sun, for example, attracts these particles belonging to its magnetic field and conveys them kinetic energy which was then converted into heat, when the particles fall on it. This is the endless source of energy that stars have. After using corresponding mathematical apparatus, estimates show that the energy acquired by the Sun equals to E=5.1x10^32 erg/s. As we know, the Sun emits Q=3.8x10^33 erg/s temperature to environment. Taking into account the influence of various factors, we can see that the correspondence is simply astounding. Depending on their weights, some stars become astronomical bodies, but the most important conclusion is that each body provides energy for its existence. Gaining energy, atoms act the same way. Eradiating energy by portions is explained by the fact that acquired energy is eradiated ("leaves the atom") only when it reaches certain critical value. If the atom radiates energy then it loses energy. If it does not gain extra energy, then ceases to exist. In other words, Bor's stationary orbits also do not save stars.

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STUDY OF SOME ENVIRONMENTAL EFFECTS ON FRICKE DOSIMETER AND THE RELATION BETWEEN DOSE DISTRIBUTION AND DENSITY

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The most important quantity in material irradiation is absorbed dose by samples. In order to acquire exact and reliable results, the control procedure and their condition must be satisfied. To achieve the best results using suitable calibration and dosimetry based on standard is required. In this work using standard method ASTM and applying the Fricke reference standard dosimeter system, absorbed dose rate, back ground dose, the rate of uniformity and distribution of dose in irradiated chamber model Gamma Cell Issleodovatel PX-30 is evaluated. Also dose distributions for different densities were considered. Finally the influence of some environmental factors such as changes in light and temperature of solution storage before and after irradiation, chemical equilibrium of dosimeter solution by changing the storage time before and after irradiation and the related results were studied.

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THE MEASUREMENT OF NUCLEAR LEVEL DENSITY BY PATH INTEGRAL METHOD

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Since the nucleus is a many body system, so for describing it we need statistical concepts. Nuclear level density (NLD) is the key of paying to these statistical concepts. Because by calculating this quantity, we can calculate for example entropy, heat capacity and also transition probability. NLD is very important both from theoretical and experimental reasons. The most studies about this have been done by Bethe and the others have improved it. During the last years many efforts have been done for calculating NLD exactly. Between them we can refer to FGM, ESM, BCS and finally path integral method (PIM). But one of the most successful

methods is PIM which we deal with it in this work. In this research we considered the reality of interactions in the nucleus and have assumed the quadrupole-quadrupole interaction has an important role in NLD calculation. In this work we obtained the Hamiltonian of the system and based on statistical discussions. We have calculated partition function and at last we calculated NLD for 104Pd.

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THE MEASUREMENT OF NEUTRON DOSE AROUND THE ZERO POWER REACTORS OF ISFAHAN WITH MCNP4B CODE AND COMPARISON WITH EXPERIMENTAL DATA

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A reactor is a source of neutrons, so it is necessary that its neutron dose rate to be under control for the health of not only persons but also environment. In this work we have studied and measured the neutron dose rate of zero power reactor of Isfahan so that to have confidence in the health of the persons who work there.

65 b-

MEASURING THE LEVELS OF SOME TRACE ELEMENTS IN THE BLOOD OF PATIENTS SUFFERING FROM MULTIPLE SCLEROSIS USING NEUTRON ACTIVATION

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Multiple Sclerosis (MS) is a neurological autoimmune disease in which the immune system attacks the central nervous system for unknown reasons and causes several damages to human body by demyelinating the nerve cells. One of the possible causes of this disease is the abnormality levels of some trace elements such as Br, Fe, Rb, Sb, As, and Zn in human body. Neutron activation analysis is one of the most precise methods for determining trace elements in blood. This study attempts to measure the levels of four trace elements of Br, Fe, Rb, and Zn in the patients' blood samples and compare them with control samples from healthy individuals.

According to the obtained results, the differences between the levels of Br, Fe, and Rb in patients' blood samples and control was not significant (P 0.05). However, the average level of Zn between samples and controls showed a significant difference.

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PTFE-G-PS PROTON EXCHANGE MEMBRANES BASED ON THE RADIATION-GRAFTING TECHNIQUE

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Styrene was grafted onto commercial Poly Tetrafluoroethylene (PTFE). The grafted films were sulfonated by chlorosulfonic acid (PTFE-g-PSSA) for use as proton exchange membranes (PEM)s. The ion conductivity increased with degree of grafting. The grafted membranes showed comparable ion conductivity and methanol permeability to Nafion membrane. The positron annihilation lifetime (PAL) technique has been used as a powerful probe for the characterization of the free volume in polymers, where gas permeation is governed by the free volume. Good property values approved the applicability of the mem-brane from the cost benefit point of view.

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RADIATION-INDUCED GRAFTING OF STYRENE ONTO POLY (VINYLIDENE FLUORIDE) FOR ELECTROLYTE FUEL CELL APPLICATION

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Gamma irradiation was used effectively for grafting of styrene onto Poly vinylidene fluoride (PVDF). Membranes were characterized by thermal gravimetric analysis (TGA).The properties of the obtained membranes were evaluated in terms of proton conductivity, methanol permeability and positron annihilation lifetime (PALS) parameters. The high probability of Positronium formation enables the application of PALS to the study of free volume. The change in the free volume size and fractional free volume as a function of irradiation dose is a result of new bonds formation during the grafting process. Owing to its low cost and the

results of the current study, PVDF-g- PS is suggested as a viable proton exchange membrane for direct methanol fuel cell applications.

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SIMULATION STUDIES OF THE EXTRACTION REGION FOR GLOW DISCHARGE ION SOURCES

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This work deals with the simulation process for the extraction region of the glow discharge ion sources, using SIMION computer program, with and without space charge. Ion beam trajectories with and without space charge have been determined and, from the results, optimum extraction conditions have been deduced. Simulation of singly charged ion trajectories for a concave meniscus with 3.5 mm curvature radius was studied with and without space charge has been done using a singly charge argon ion trajectories. Firstly, for a concave meniscus with 3.5 mm curvature radius, the influence of the current density on the ion beam shape is investigated. Furthermore, influence of the extraction voltage applied to the extraction electrode on the ion beam envelope is carefully studied. Finally, the influence of the extraction gap width on the ion beam envelope was also studied.

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STUDY OF TECHNETIUM TRANSMUTATION IN THE BR2 HIGH FLUX REACTOR

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In this study the effectiveness of transmutation for the long lived fission product technetium-99 in the BR2 high flux reactor is evaluated. The calculation of Ruthenium concentration evolution under irradiation was performed using Chain Solver 2.34 code. The approximation used for the transmutation calculation is the assumption that the influence of change in irradiated materials structures on the reactor operator mode characteristics is insignificant.

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A SELF-CONSISTENT STUDY OF THE EVOLUTION OF NEUTRON HALO IN BERYLLIUM ISOTOPES

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A self-consistent study of the evolution of neutron halo phenomenon in beryllium isotopes has been performed using the Skyrme-Hartree-Fock model, covering mass numbers A = 7-11. The SkM* parameter set has been used to calculate the charge density distributions. The calculations show a systematic decrease in rms charge radius from A = 7 to 10 and an increase from A = 10 to 11, in agreement with recent experimental data and the assumption of a one-neutron halo structure in 11Be.

Keywords: neutron halo, beryllium isotopes, self-consistent calculation, Skyrme-Hartree-Fock model.

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CALCULATION OF AVERAGE ANNUAL EFFECTIVE DOSE FOR EVERY PERSON LIVING IN TEHRAN CITY DUE NATURAL RADIONUCLIDE IN SOIL USING RESRAD CODE

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Calculation of average annual effective dose due natural radionuclide for everyone that living in one zone is very important to determine cancer risk index and value of allowable absorb dose that get from other ways for example: medical imaging, nuclear medicine, radiotherapy, etc… In this research had been simulated environment and natural radionuclide (232Th, 238U, 40K) in soil of Tehran city using RESRAD code by environmental and living parameters for everyone that living in Tehran city. According to the results average annual effective dose in first year for every person that living in Tehran city due external radiation, inhalation, ingestion and summation of those (external radiation+ inhalation+ ingestion) has calculated 105µSv/y, 2.8µSv/y, 202.2µSv/y and 310µSv/y respectively.

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175Yb-EDTMP AS A NOVEL AGENT FOR PALLIATIVE TREATMENT OF BONE METASTASES

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Bone metastasis is one of the most frequent causes of pain in cancer patient. Different radiopharmaceuticals are recommended for bone pain palliation. 175Yb-EDTMP is proposed as a proper alternatives to other radiopharmaceuticals as the relatively long half-life (T1/2=4.18 days), maximum energy beta particle Eβ-=470keV (86.5%), low abundance gamma emission 396.3 keV (6.4%), 282.5 keV (3.01%), 113.8 keV (1.88%), low cost and easy production are considered advantageous in the wider use of this product.

The optimization of 175Yb-EDTMP production and quality control was targeted in this work. Yb-175 chloride was obtained by thermal neutron bombardment of a natural Yb2O3 sample; Radiolabeling was completed in one hour by the addition of EDTMP at the room temperature, radiochemical purity was higher than 98%. Biodistribution studies in normal wild-type rats were carried out.

The result shows favorable biodistribution features of 175Yb-EDTMP, indicating significant accumulation in bone tissues. This research presents 175Yb-EDTMP as a suitable therapeutic radiopharmaceutical for bone pain palliation and substitute of other radiopharmaceuticals.

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ANALYSIS OF AP2600 PWR CORE USING NEUTRONIC COMPUTATIONAL TOOLS AND TECHNIQUES

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The present work deals with the design and development of calculational techniques and evaluation of key neutronic parameters of AP2600 PWR core using a total reactor power of 3000 MWt. AP 2600 PWR core consists of 158 fuel assemblies containing a total of ~72 tons of uranium arranged vertically in a concentric square array within the core shroud. Each fuel assembly contains 264 UO2 fuel pins with various enrichments, 24 control rods of Gd2O3 and one central water channel and all are arranged in a 17×17 array of matrix. Different computer codes including WIMS, CITATION and MCNP have been employed to develop a versatile and accurate reactor physics model of the PWR core. The computer and methods, tools and techniques, customization of cross section libraries, various models for cells and super cells and a lot of associated utilities have been standardized and established/validated for the overall core analysis. The analysis was performed in 3 steps: firstly for fuel pincells, then for the fuel assemblies and finally for the whole core. The WIMS and MCNP calculated infinite multiplication factors for fuel pincells having 2.1% enriched 235U were found to be 1.23395 and 1.23654 for 2.6% enrichment 1.28087, and finally for 3.1% enrichment 1.32481 and 1.32812, respectively. The peak thermal neutron flux in the core calculated by MCNP has found to be 5.09298×1014 neutrons/cm2s and the average core power density was 17.1 kW/cm3. It is shown that the calculated results from different codes were found to be very good agreement for different moderator conditions. The choice of computer codes like WMSD, CITATION and MCNP which are being used in nuclear industry for many years were selected to identify and develop new capabilities needed to support PWR analysis.

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FINAL RESULTS OF THE TWIST EXPERIMENT AT TRIUMF. PRECISION MEASUREMENTS OF THE MUON DECAY $\mu^+ \to e^+ \nu_e \bar{\nu}_\mu$

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Why is the muon decay so interesting?

- Only the weak interaction is present in the final state, to a good approximation.

- The muon, positron and neutrinos are leptons, they don't feel the strong interaction (the stronginteraction can be present in higher orders, but it is negligible).
- The electromagnetic interaction manifests itself via radiative corrections, which can be calculated from theory.
- The neutrinos have very small masses. They have a negligible effect in TWIST.

The physics

The Standard Model of weak interactions has been very succesful until now but there is no reason to believe that it is the final theory in particle physics. There are two possibilities to search for possible violations of the Standard Model:

- Going to higher energies: for example, CERN,
- or
- Going to high-precision low-energy experiments: for example, TWIST.

The experiment

A collaboration of: Kurchatov Institute (Russia), Texas A&M and Valparaiso University (USA), and the Canadian partners: TRIUMF, University of Alberta, University of British Columbia, University of Montreal, University of Regina.

The results are in agreement with the Standard Model, with an improved accuracy.

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SAFE AND EFFICIENT THERMAL REACTOR OF ADS TYPE LOADED WITH THORIUM FUEL

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Nowadays it is commonly accepted that nuclear power (NP) meets the condition of sustainable development and economic competitiveness. Moreover, it does not consumes oxygen and not creates greenhouse gases disturbing the ecosystem balance of our planet. Nevertheless, NP deals with the energy concentration of eight orders of magnitude greater than the energy generation based on organic fuel and thus it always exists the problem of operation safety and security conditions. Other all-important concern of NP is to have long-term fuel resources to be a global scale energy producer and a minimum amount of ultimate waste that must be precisely

controlled and isolated/passivated to not cause any possible impact on human health and the environment, i.e. to fulfill ALARA principle.

The above mentioned problems have been investigating for about the last half century and particularly intensively are scrutinizing in the current years. For this purpose various experimental arrangements were constructed and modeling codes composed. Some of these setups are of the type of an accelerator driving system (ADS) [1] permitting to study simultaneously a variety of important tasks. One of such a facility is the YALINA-Thermal Benchmark (YTB) [2] designed at the IAEA to investigate the ADS physics both experimentally and by using different modeling approaches. The YTB is a relatively simple and flexible version of subcritical assembly consisting of UO_2 fuel rods arranged horizontally and polyethylene moderator surrounded by a graphite reflector in the radial direction. This facility operating with the neutron multiplication factor k_{eff}<0.98 may be driven by external neutron sources.

In the work we modeled the time evolution of the neutron multiplication factor (NMF) k_{eff}, ^{233}U generation intensity and source strength at various geometric configurations of YTB core irradiated with neutrons from ^{252}Cf as an external source and fuel composition consisting of different number of uranium and ^{232}Th rods. Location of thorium rods in the sub-critical reactor core in terms of impact on NMF is also analyzed. The modeling has been performed by using MCNPX code [3]. As a main result of our investigation the conclusion is made that the efficient and safe thermal thorium loaded breeder reactor is to be constructed.

Key words: thorium fuel, burnup, ADS, subcritical reactor, MCNPX code

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EFFECT OF APPROXIMATIONS IN REACTOR GEOMETRY ON BURN-UP CALCULATIONS FOR MTR TYPE REACTORS

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In the present paper, three-dimensional burn-up calculations were performed using different patterns of control rods , in order to examine their effect on power density and neutron flux distributions through out the entire core and hence on the local burn-up distribution. These different cores burn-up calculations are carried out for an operating cycle equivalent to 15 Full Power Days (FPDs), with a power rating of 22 MW.

Calculations were performed using an example of a typical research reactor of MTR-type using the internationally known computer codes' package "**MTR_PC system**", using the cell calculation transport code **WIMS-D4** with 12 energy groups and the core calculation diffusion code **CITVAP** with 5 energy groups. A depletion study was done and the effects on the research reactor fuel (U-235) were performed. The burn-up percentage (B.U. %) curves for every fuel element type were drawn versus irradiation (MWD/TE). Then an empirical formula was generated for every fuel element type, to correlate irradiation to burn-up percentage.

Charts of power density and neutron flux distribution for each core were plotted at different sections of each fuel element of the reactor core. Then a complete discussion and analysis of these curves are performed with comparison between the different core configurations, illustrating the effect of insertion or extraction of either of the four control rods directly on the neutron flux and consequently on the power distribution and burn-up.

A detailed study of fuel burn-up gives detailed insight on the different B.U. % calculations options which gives great help to reactor operators and reactor utilization.

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MAIN PARAMETERS AFFECTING THE EXCITATION FUNCTIONS OF FUSION

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The main conditions of fusion channels, namely the separating distance of the two colliding nuclei and the barrier of fusion channel are the more interest points guiding to fit the excitation functions of fusion for various interacting pairs Interpretations and differentiations are made on the different forms used to deduce all concerned variables. Definitions of these variables due to different theories are explained in the text. Different interacting pairs are studied to deduce most of these parameters aiming to approach the best fit of their excitation functions, measured upon fusion regions. Present calculations support the significance of specifying the potential barrier radial position Rfus as well as its height VB, concerning Woods-Saxon, unified and other forms defining the nuclear part of that barrier. The effect of maximum angular momentum l max, on smooth cutoff approximation has been cleared .Finally , comparisons with measured and calculated barrier parameters and excitation functions for the undertaken, light to heavy pairs, at different excitation energies are given. *Keywords:* fusion, radius, barrier, excitation, WKB approximate; PACS : 25.60.Pj ; 25.70.Gh ; 25.70.Jj.

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X-RAY FLUORESCENCE, ENERGY DISPERSIVE X-RAY AND NEUTRON ACTIVATION ANALYSIS INVESTIGATION OF RECENT EGYPTIAN ONE POUND COIN

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The present work is to identify and study the Egyptian one pound coin which appeared at the years 2005, 2007 and 2008 by using three different analytical techniques namely, Energy Dispersive X-Ray Fluorescence (EDXRF), Energy Dispersive x-ray (EDX) and Neutron Activation Analysis (NAA). The elemental composition for the one pound Egyptian coins is demonstrated. The analysis shows that the one pound which is mint in 2005 is differ from the other two coins at 2007 and 2008. A comparison of the analysis shows that the results obtained by these three techniques are in agreement with each other.

Key Words: X-ray Fluorescence / Non Destructive Analysis/ Egyptian Pound Coin.

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NUMBER PROJECTED NUCLEAR CHARGE RADII OF EVEN-EVEN PROTON-RICH NUCLEI IN THE ISOVECTOR PAIRING CASE

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The study of the structure and properties of proton-rich nuclei is one of the active fields in nuclear physics. However, in proton-riche nuclei, the neutron-proton (np) pairing correlations are no more negligible and must be taken into account. They are generally studied within the BCS approach, but it is well known that the main shortcoming of this approach is the particle-number fluctuation.

The aim of the present contribution is to study both the np pairing effect, in the isovector case, and the particle-number fluctuation effects on the nuclear charge radii of even-even proton-rich nuclei.

As a first step, an expression of the quadratic charge radius is established using a particle-number projection method [1-3]. It is shown that it generalizes that obtained when only the pairing between like-particles is considered [4]. As a second step, this observable is calculated for some even-even nuclei such as N close to Z using the single-particle energies of a Woods-Saxon mean-field. The obtained results are compared to those obtained when one considers only the pairing between like-particles.

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SIMULATION OF DIFFERENT PARTICLES DEPOSITION IN THE HUMAN RESPIRATORY TRACT

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Deposition of ultrafine, fibrous and biological aerosol particles was simulated by stochastic lung model using Monte Carlo methods under different breathing conditions. Computed deposition patterns for ultrafine particles under sitting breathing conditions, normalized to the number of particles entering the trachea, show that with increasing particle diameter from 1 to 100 nm the preferential deposition of ultrafine particles shifts from large bronchial airways to peripheral bronchiolar and alveolar airways with decreasing total deposition. The penetration probability of inhaled man-made mineral fibrous particles with different dimensions demonstrates that the carinal ridges of the central airway bifurcations can be reached even by large particles. The calculations of total and lobar deposition of fungal particles under light exercises activity show that the deposition of the detected fungal species has the highest value in the right lower (RL) and left lower (LL) lobes while the lowest deposition was found in the right middle (RM) lobe. These predictions show two distinct deposition maxima at the bronchial and the acinar regions with the highest deposition being in the acinar region. In all cases, the deposition reaches its maximum at generation 12 in the bronchial region and at generation 22 in the acinar region. Our results come to important evidence that there is a positive relationship between the deposition of the inhaled aerosol particles in the lung and some respiratory tract.

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THORIUM BASED FUELS – AN ATRACTIVE POSSIBILITY FOR PROLIFERATION-RESISTANT FUELS

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Actual trends in nuclear power plants design, construction and operation put more and more pressure upon nuclear fuel resources, leading to an active and continuous increasing interest in advanced fuel cycles development. Main goals are to extend the nuclear fuel resources utilization, to reduce the amount of radioactive waste produced by nuclear reactors operation and moreover to enhance the proliferation resistance. Nowadays, the world faces huge challenges related to the energy production and the corresponding security issues. One of the most interesting alternatives existing today to replace standard Uranium fuel cycle in nuclear power reactors, offering a variety of significant strategic and economic advantages, is Thorium. A set of Thorium-based fuels and one Uranium-based fuel (as reference case) were considered, according to existing references in the domain; considered fuels have been loaded into the elements of SEU43 fuel bundle developed in INR Pitesti. Fuels characteristics related on the proliferation resistance issue have been investigated.

Keywords: Nuclear energy, advanced fuel cycles, nuclear fuel resources security, Proliferation resistance, Thorium

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OPTIMUM FUSION ORIENTATIONS AND CANCELLATION OF DIFFERENT DEFORMATION COMPONENTS

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We investigate the correlation between the orientation variation of the deformed nucleus radius and the orientation Coulomb barrier distribution in presence of the higher order deformation components, 6 and 8, in addition to the lower order ones. Also, we try to understand how a cancellation of the different nuclear deformations could arise. We found that the simple expression which describes the deformed target nucleus can be used to predict with good accuracy the behavior of the fusion Coulomb barrier with both orientation and deformation as well as the optimum (cold or hot) fusion configurations, even if there are higher deformations. It can predict the orientations of compact and elongated configurations of the interaction and whether they are equatorial or polar or none of them. The value and sign of the deformation parameters ratios with respect to one of them have been used to classify these configurations. We applied the same correlation to predict successfully the mutual cancellation effects between the different deformation components up to 8.

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THE BOUND STATE ENERGIES OF THE MANNING-ROSEN POTENTIAL USING THE *J*-MATRIX METHOD

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Bound states energies of the Manning-Rosen (MR) potential are calculated using the J-matrix method. The calculations are carried out for states with arbitrary quantum numbers n and. Comparisons are made with the available literature data and excellent agreement is observed. In all the cases, the present method yields considerably improved results over the other existing calculations. Some new states are reported for guiding future studies.

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USING NEW SHIELDING MATERIALS IN SHIELDING CALCULATIONS FOR ILSF (IRANIAN LIGHT SOURCE FACILITY) BEAM STOPS BY THE FLUKA MONTE CARLO CODE

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Iranian Light Source Facility (ILSF) is a 3rd generation synchrotron light source under planning .To control beam in synchrotron accelerator, an important role is played by beam Stops. It is assumed the worst case in the radiation shielding considerations, because all electrons are lost in one point.

In the present study attempts have been made to see the shielding capability of a new high density magnetite concrete and a new material based on colemanite and epoxy resin in shielding calculations for ILSF linear accelerator and booster beam stops .The fluence and transmission factor for neutron and photon have been calculated according to FLUKA simulations results .FLUKA is a multi particle Monte Carlo transport code. Then, these values have been compared to ordinary and barite concrete. The results show that high density magnetite concrete with density of 4.1 g/cm3 is an effective shield for neutrons and gamma beams.

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SPALLATION NEUTRON SOURCES FOR SCIENCE AND TECHNOLOGY

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Increasing interest has been noticed in spallation neutron sources (SNS) during the past 20 years. The system includes high current proton accelerator in the GeV region and spallation heavy metal target in the Hg-Bi region. Among high flux currently operating SNSs are: ISIS in UK (1985), SINQ in Switzerland (1996), JSNS in Japan (2008), and SNS in USA (2010). Under construction is the European spallation source (ESS) in Sweden (to be operational in 2020). The intense neutron beams provided by SNSs have the advantage of being of non-reactor origin, are of continuous (SINQ) or pulsed nature. Combined with state-of-the-art neutron instrumentation, they have a diverse potential for both scientific research and industrial applications. Areas include material science, magnetism and superconductivity, crystalline and disordered materials, polymers and soft matter, complex fluids, structural biology, among others.

The article aims at giving insight on the physics of spallation reaction process, operating and planned SNS facilities, selected applications in science and technology are outlined.

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RADON DOSIMETRY IN ERBIL CITY HOSPITALS

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The aim of this study was to compare radon concentrations and effective dose equivalent in state hospitals inside the Erbil city having different periods of building. Effective doses were estimated in different floors of the five selected hospitals by using the (CR-39) Solid State Nuclear Track Detectors with the guide of ICRP Publication 66. The hanged dosimeters were left for about 60 days and after etching the radon concentration, annual effective dose and effective dose equivalents were calculated. Annual effective doses were estimated as

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ALPHA DECAY OF EVEN-EVEN SUPERHEAVY NUCLEI

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The alpha decay is one of the most important properties of the atomic nuclei. In recent years it became a powerful tool particularly for the study of nuclei far from the valley of stability, the nuclei with shell closure and the heavy and superheavy nuclei. For the latter, the alpha decay plays a major role since it makes possible to determine the limit of their existence and to identify new elements.

The purpose of the present work is to study the alpha decay of some even-even superheavy nuclei. In a first step, Hartree-Fock-Bogoliubov calculations based on the Skyrme interaction are carried out to determine the ground state properties such as binding enegies, radii, deformations and alpha decay energies. In order to correctly treat the pairing correlations in the vicinity of shell closure, a particle-number projection of the wave function was carried out by the Lipkin-Nogami method [1]. The obtained decay energies are then used for the calculation of the decay half-lives using a formula similar to that of Viola-Seaborg [2]. The parameters of the formula were obtained through a least square fit to even-even heavy nuclei taken from the tables of Audi-Wapstra [3] and some more recent references. The results are compared with the available experimental data and with those obtained by using Q values extracted from the Moller-Nix-Kratz mass tables [4].

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Pu DETERMINATION IN Pu-Be NEUTRON SOURCES BY NDA METHODS IN HUNGARY

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The presence of Pu-Be neutron sources in Hungary and some other countries is an issue both for safeguards and security of nuclear materials. About 200 sealed Pu-Be sources were imported to Hungary in the period 1960–1985. Being left from industrial applications, most of them are out of use recently. The Pu content of these sources was not declared upon delivery, and it remained basically unknown (and this is the case in several other countries as well). Neutron output was only provided by the supplier. The missing information is relevant for safeguards, nuclear safety, physical protection, illicit trafficking, and material management purposes. The State and facility inventories were, and still partly are, based on rough estimated values. The neutron output of the sources ranges from 104 to 107 neutron/s. Bookkeeping was based on a calculation of the domestic authority relying on the neutron output, using a specific yield value 6.17•104 n/s g Pu, assuming pure 239Pu content. Estimated on this basis, Pu quantities in individual sources amounted to 0.1 – 178 g (nominal values). However, the neutron output depends very much on the actual isotopic composition. Since the sources contain also other Pu (and Am) isotopes with much higher specific activities, these data can be considered as an upper limit only.

Plutonium content of the sources was determined by applying NDA methods. Gamma spectrometry and neutron gross and coincidence counting were used either as combined or independent methods as well. Calorimetry served for calibration. The total Pu amount of 120 sources investigated so far proved to be a rough 16% of the sum of nominal values. Pu inventory of the rest is planned to be taken as well. Our method is offered for routine use also to other countries facing similar problems.

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SILICON PHOTOMULTIPLIER FOR SUBATOMIC PHYSICS EXPERIMENTS

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Most of the radiation detector systems used at very low light intensities is based on photomultiplier tubes (PMTs). Only recently, new types of detectors, based on silicon diodes working in the avalanche regime, have been developed and proved to be extremely interesting candidates to replace the existing PMTs [1, 2]. This is the Silicon PhotoMultipliers (SiPMs). SiPMs are semiconductor devices consisting of many photon microcounters positioned on a common silicon substrate. Each single microcounter (avalanche photo diode, APD) is working in the Geiger-mode. Like PMTs, they are capable of measuring extremely low light levels. However, compared to PMTs, SiPMs offer the ' solid-state' advantages of lower operating voltages, ruggedness, smaller physical size and lighter weight [3]. SiPM has key advantage over the PMT: The insensitivity to magnetic fields.

SiPMs represent a promising solution for the light detection providing the potential to replace classical PMTs in many applications, such as scintillating fiber readout and imaging Cherenkov applications [4]. The growing variety of available SiPM devices requires the necessity to test and to characterize them in order to select and find the optimum operating conditions for given applications. Measurements of dark current, dark count rate and cross-talk of this device have been presented elsewhere [5]. One of the most important features of SiPMs is the capability of ultrafast timing (picoseconds range). In these report we are presenting our latest results of the SiPMs timing performance studies. Furthermore, three examples of applications in subatomic physics experiments will be presented.

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THE INELASTIC THERMAL SPIKE MODEL DESCRIPTION OF TRACK FORMATION INDUCED BY SWIFT HEAVY IONS IN INSULATORS

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The Inelastic Thermal Spike Model is used in order to explain the appearance of the latent tracks formation in amorphisable insulators [1-3] due to high electronic deposition during swift heavy ion irradiation. In this model, the energy is first deposited on the electrons and subsequently transferred to the atomic subsystems via electron-phonon coupling. The heat diffusion in the electron and the lattice subsystems is described by two coupled differential equation governing the energy diffusion on the electron and atomic subsystems and their exchange via the electron-phonon coupling. The track size, resulting from the quench of a molten phase, is determined by the energy density deposited on the atoms around the ion path. The same model will be extended to semiconductors.

Keywords: Swift heavy ion, irradiation, track formation, insulators, inelastic thermal spike model.

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SECONDARY NEUTRON PRODUCTION FROM PATIENTS DURING THERAPY WITH HADRONS AND THEIR CORRESPONDING RADIATIONS DOSES: ARE THERE POTENTIAL RISKS? NUCLEAR PHYSICS CONTRIBUTION TO HADRON THERAPY

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Purpose:

To estimate the fluence and energy distribution of secondary neutrons produced in patients during therapy with hadrons, and further assess their radiation contributions to various organs. There is no reliable data on this important subject.

Materials and Methods:

In the absence of any reliable experimental or theoretical data on the production of neutrons from patients/tissues we chose to make use of the existing experimental neutron out put measurements from thick-targets of different elements, in order to compute the fluence and the energy distribution of the secondary neutrons from human tissue under bombarded with hadrons. Then, using the existing tabulations, we calculated the doses to different body organs due to these secondary neutrons. We preferred this approach to the direct measurements of the radiation doses due to these neutrons, with dose meters placed outside the body, requiring special calibration and thus prone to unreliable results.

Results:

Our results indicate that at least 4.2 neutrons, with energies greater than 5 MeV, are produced for every carbon ion of 400 MeV / u energy incident on tissue. This number reduces to 3, 1.4 and 0.3 respectively at carbon energies of 300, 200 and 100 MeV /u.. In the case of neon ions these figures are slightly higher. For irradiation with alpha particles the number of these secondary neutrons reduces to about 1 neutron per alpha particle with incident energy of 200 MeV / u. In the case of protons the numbers of secondary neutrons from tissue are estimated to be 0.05, 0.2 and 0.4 per proton of energies 100, 200 and 300 MeV respectively. There would, no doubt, be even more neutrons with energies lesser than 5 MeV which could not be estimated due to the lack of experimental data.

For a physical treatment C-ion dose of 20 Gy in the Bragg Peak, the total number of secondary neutrons produced in patients are 1.6 x 10 9 / cm 2, 7.3 x 10 8 / cm 2, 2.5 x 10 8 / cm 2 and 4,1 x 10 7 / cm 2 respectively at carbon-ions energies of 400,. 300, 200 and 100 MeV / u. These figures for a physical proton dose of 20 Gy in the Bragg Peak are 2 x 10 9/cm 2, 4.17 x 10 8 / cm 2 and 4.17 x 10 7 / cm 2 neutrons respectively at proton energies of 20, 160 and 70 MeV. The corresponding doses to various organs, lying close to the treatment sites, could be as high as around 200 mGy for C-ions of 400 MeV/u and protons of 200 MeV/u..

Conclusions:

In our opinion the large number of secondary neutrons produced from patients during therapy with hadrons, and their corresponding doses to various organs, indicate they could have real potential to cause new primary cancers and cause other harmful side-effects in patients. Furthermore. It is also to see as to what is the "real" RBE of C-ions; is the observed RBE due to C-ions alone or in combination with these secondary neutrons?

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PGNAA IN LARGE SAMPLE USING 241AM-BE NEUTRON SOURCE: SIMULATION WITH MONTE CARLO CODE

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A simulation method based on Monte Carlo code (MCNP4C) was used for elemental estimation in large sample of water. The simulation consists on PGNAA setup composed principally by an 241Am-Be source, large sample of pure water and a shielded GeHP gamma- rays detector. Thermal neutron flux and detection efficiency curves were obtained by using MCNP calculations. For validation, the concentration of cadmium in water was found similar to known amount dissolved in water and irradiated by the 241Am-Be source. The simulation with MCNP code will be used to estimate the concentrations of pollutants without resorting to costly experimental trials in travel time on site and equipment.

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THEORETICAL STUDY OF ^{6}He+^{12}C ELASTIC SCATTERING AND BREAKUP REACTIONS USING A MICROSCOPIC OPTICAL POTENTIAL

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Theoretical analysis is made of the 6He+12C elastic scattering data at three different beam energies [1]. The breakup effect of the 6He at higher energies is also studied. Calculations were performed using microscopic optical potentials obtained by a double-folding procedure and also those inherent in the high-energy Glauber-Sitenko approximation. The problem of ambiguity of the adjusted depths of these potentials is resolved requiring the respective volume integrals to obey their determined dependence on the collision energy. Estimations of the Pauli blocking effect on optical potentials and cross sections are given. The role of breakup processes in formation of the imaginary potential in elastic channel is also discussed [2].

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NUCLEAR CHARGE RADII AND ELECTROMAGNETIC MOMENTS OF SCANDIUM ISOTOPES AND ISOMERS

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Collinear laser spectroscopy experiments on the ScII transition 3d4s 3D2 → 3d4p 3F3 at $\lambda \approx 363.1$ nm were performed on the 42-46Sc isotopic chain using an ion guide isotope separator with a cooler-buncher. The hyperfine structures and isotope shifts of five scandium isotopes ($Z = 21$) in the mass region $42 \leq A \leq 46$, with isomeric states in 44,45Sc, have been measured [1, 2]. Radioactive isotopes were produced in a fusion ion guide by irradiating a 45Sc target in reactions of the type (d,p), (p,pxn), (p,p′) using 15 MeV deuterons and 25 - 48 MeV protons at 5-10 μA. Laser light was provided by a frequency-doubled Spectra-Physics 380D dye laser locked to a chosen molecular iodine absorption line.

Extensive multi-configurational Dirac–Fock calculations were performed in order to evaluate the specific mass–shift, MSMS, and field–shift, F, parameters which allowed evaluation of the charge radii trend of the Sc isotopic sequence. The charge radii obtained show systematics more like the Ti radii, which increase towards the neutron shell closure N = 20, than the symmetric parabolic curve for Ca. The changes in mean square charge radii of the isomeric states relative to the ground states for 44Sc and 45Sc were also extracted.

For the studied isotopes of the odd-Z element scandium the magnetic dipole and electric quadrupole hyperfine coefficients A and B of both lower, 3d4s 3D2, and upper, 3d4p 3F3, states are obtained from the hyperfine structures using a $\chi 2$ minimization fitting procedure. The results obtained from these data for the magnetic dipole and electric quadrupole moments of 43,44,44m,46Sc isotopes are in good agreement with those summarised by Stone [3], but has better accuracy. The nuclear moments μ(45mSc) and Qs(45mSc) are deduced for the first time. The unusually large quadrupole moment of the isomeric state of 45Sc is the most striking feature of the present data.

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SOLITARY SOLUTION FOR THE KADOMSTEV-PETVIASHVILI EQUATION AT CRITICAL DENSITY

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The nonlinear properties of small amplitude electron-acoustic solitary waves (EAWs) in a homogeneous system of unmagnetized collisionless plasma consisted of a cold electron áuid and isothermal ions with two di§erent temperatures obeying Boltzmann type distributions have been investigated. A reductive perturbation method was employed to obtain the Kadomstev-Petviashvili (KP) equation. At the critical, the KP equation is not appropriate for describing the system. Hence, a new set of stretched coordinates is considered to derive the modiÖed KP equation. The present investigation can be of relevance to the electrostatic solitary structures observed in various space plasma environments.

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CURRENT RADIATION PROTECTION PRACTICES IN EGYPT

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The aim of the present study is to report in going activities in Egypt during 2010-2011. Such activities are controlled by Egyptian Law no 59 (1960). Where activities controlled by Ministry of Health are x-rays machines, accelerators and sealed sources. While activities controlled by Atomic Energy Authority are unsealed sources and reactors. Radiation protection practices include radiation monitoring at sites, external and internal personnel dosimetry of radiation workers.

It covers sites such as Hospitals, companies, research reactors and research institutes and others. Detailed summary of the radiation protection practices shall be covered in the present study. Attention shall be paid to the new Ionizing Radiation Law, which was issued in 2011. The new law shall be implemented as soon as its executive regulation is issued. Upon its implementation

The duties of the controlling authorities shall be redistributed between Ministry of Health and a new controlling authority. The new authority shall control nuclear and radiological activities.

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RADIATION SURVEY OF THE SUGGESTED EGYPTIAN NPP SITES

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The pre-operational environment radiation; and micrometeorological study of and around any suggested nuclear power plant site are of great importance. The aim of the environmental radiological study within 30-50 km, of the NPP site is to predict the radiation exposure to be received by the members of public around the plant due to its operation and to demonstrate that the total dose due to the existing preoperational natural and man-made radionuclides and due to NPP operation are below the limits allowed by national regulatory body.

To establish the base line radioactivity levels of the NPP site environment, hundreds of environmental samples have to be collected and analyzed. The sampling must cover all environment components. Special attention has to be paid to soil and sediment sampling. Also sufficient number of air, surface (sea) water, fresh (ground) water, vegetation, plant, fish and aquatic organisms has to be collected and analyzed. The analyses by different techniques are to be carried out to determine the specific radioactivity of Ra-226 (of U-238), Th-232, K-40, Cs-137, Sr-90; and also Gross α and Gross β.

The pre-operational survey must also include collection of data related to features and characteristics of atmospheric, aquatic and terrestrial environment; and data related to the population distribution and human activities around the site, both present and planned. These data have to be studied to understand and predict the dilution and dispersion characteristics of the atmosphere. This study is also important to predict and identify the

most probable pathways of radio-nuclides migration and radiation exposure. Based on that, the locations and frequency of sample collection during future NPP operation may be well predicted.

It is also important to establish database of the external radiation levels, within the area around the site, due to natural radioactivity by repeating measurements of the dose rate using highly sensitive survey meters and the annual BG radiation doses using TLD`s.

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MEASUREMENTS OF NATURAL RADIOACTIVITY IN SOIL SAMPLES FROM BEKHME, KURDISTAN REGION, IRAQ

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In order to initiate a radiological assessment program and to establish a baseline map of radioactivity background levels in the Kurdistan region environment, this study have been adopted to identify the radionuclide contents in the soil of Bekhma dam region. The activity concentration of natural radionuclide in 10 soil samples, collected from municipal area of Bekhme region, have been studied and evaluated. Gamma ray radioactive standard sources Cesium-137 (^{137}Cs), Potassium Chloride (KCL) and Radium-226 (^{226}Ra) were used to calibrate the gamma-ray spectrometer involving the NaI(TI) scintillation detector. The activity concentration of the natural radioisotopes; ^{40}K, ^{226}Ra and ^{232}Th have been estimated to being within the standard acceptable values.

Radium equivalent activity, air absorbed dose rate, annual effective dose rate, and the external hazard index were evaluated and found to be within the permissible internationally approved values.

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DETERMINATION MULTIPOLE MIXING RATIOS AND TRANSITION STRENGTHS OF GAMMA RAYS FROM LEVEL STUDIES OF ^{93}Mo VIA (p, nγ) REACTION

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In the present Study, The angular distributions reported previously have been used to calculate the multipole mixing ratios by three methods a2-ratio, Constant statistical tensor(CST) and Least square fitting(LSF) from

levels of 93Mo(p, n γ) reaction. The results are found to be in general in good agreement with the previous results. The branching ratios of such γ- transitions are calculated using the corresponding relative intensities reported previously. The transition strengths have been calculated for γ-transitions from excited states whose life times have been reported previously.

100-

CALCULATION OF REFLECTANCE AND TRANSMITTANCE OF COATING WITH OPTICALLY ROUGH SURFACES

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A two-flux model for a source-free anisotropic scattering rough surface is derived using Pommraning-Eddington approximation for the transport equation. Relations have been derived between Kubelka-Munk coefficients (K) and (S) and the transport parameters σs, σa and g = . The problem of collimated source is linked to the solution of the source-free problem. The reflectance and transmittance of surfaces with arbitrary roughness are calculated and compared with the available data.

101-

BAND STRUCTURE CALCULATIONS OF SI1-XGEX ALLOY UNDER TEMPERATURE AND PRESSURE

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The electronic structure of Si1-xGex binary alloy is calculated in the virtual crystal approximation using the empirical pseudo-potential method which incorporates compositional disorder as an effective potential. Some physical quantities as energy band gaps, bowing parameters, refractive indices, and dielectric constants of the considered alloy with different Ge concentration are calculated under the effects of temperature and pressure. The results obtained are found in good agreement with the experimental and published data.

102-

PERIODIC NONLINEAR WAVEFORMS AND DIVERGENT PULSES FOR KADOMSTEV-PETVIASHVILI EQUATION IN WARM PLASMA

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The reductive perturbation method has been employed to derive the Kadomstev-Petviashvili equation for small but finite amplitud electrostatic ion-acoustic waves. An algebraic method with computerized symbolic computation, which greatly exceeds the applicability of the existing tanh, extended tanh methods in obtaining a series of exact solutions of the KP equation. numerical studies have been made using plasma parameters reveals different solutions i.e., bell-shaped solitary pulses, rational pulses and solutions with singularity at a finite points which called blowup solutions in addition to the propagation of an explosive pulses. The result of the present investigation may be applicable to some plasma environments, such as ionosphere.

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THE RADIATION DOSE THROUGH THE HUMAN LUNG BASED ON THE INHALATION OF SHORT-LIVED RADON PROGENY

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Direct measurements of an effective dose due to the inhalation of short lived radon progeny through the human lung is rarely, if ever, possible. Therefore, one must rely on dosimetric models to evaluate doses at different depths in bronchial epithelium. These models always require information about the parameters of activity size distributions and the activity concentration of short lived radon progeny (218Po, 214Pb, and 214Bi/214Po). In the present work, the attached and unattached activity size distributions of radon progeny were measured by using a low pressure cascade impactor and a wire screen diffusion battery, respectively. The mean activity concentrations of (218Po, 214Pb, and 214Bi/214Po) are found to be 7.5 ą 0.64, 6.3 ą 0.5 and 4.4 ą 0.42 Bq/m^3, respectively. An analytical method has been applied to estimate the local energy deposition of radon progeny alpha particles in a target volume of 1 amp;#318;m spheres located at different depths in bronchial epithelium. In order to reach the target, alpha particles travel either through tissue alone or through air and tissue. While the depth-dose distributions (for 218Po uniformly distributed within the epithelium) were practically constant with depth, they decreased in an almost linear fashion with increasing depth for 218Po on the airway surface.

Keywords: Rn progeny, activity size distribution, Dosimeter, deposition.

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CRUCIAL PARAMETERS IN DOSE ASSESSMENT OF SHORT LIVED RADON PROGENY

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Different measurements of equilibrium equivalent concentration of radon progeny (EECRn) were taken over a period of one year in indoor air of physics department at Minia University, located in the Upper Egypt. A method based on an alpha spectroscopy subsequent to the samples which were collected on a membrane filters (Sartorius membrane filters type SM, 1.2 瘦 pore size, 25 mm diameter and its efficiency about 100%) were used. The alpha activities were detected during and after air sampling by a surface barrier detector. EECRn varied between 1.26 and 18.98 Bq m-3 with an average value of 5.21 Bq m-3. The unattached fraction was measured using a single stainless steel-wire-mesh screen (50% penetration for 4 nm equivalent diameter). A mean unattached fraction (fb) of 0.08 was obtained. Based on the obtained measured data values (fb and EECRn), dose conversion factors were compared to epidemiology based value of 4 mSv/WLM for indoor air.

105-

CROSS SECTION MEASUREMENTS AND THEORETICAL CALCULATIONS OF PROTON INDUCED NUCLEAR REACTIONS ON NATURAL TELLURIUM - RELEVANCE TO THE PRODUCTION OF ^{124}I

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Excitation functions of the reactions ^{nat}Te(p,xn)^{123,124,126,130}I were measured for proton energies from their respective thresholds up to 18 MeV, with particular emphasis on data for the production of the medically important radionuclide,^{124}I. The conventional stacked-foil technique was used where the samples for irradiation were prepared by a sedimentation process. The measured excitation curves were compared with both the data available in the literature and data obtained from TALYS and ALICE-IPPE codes. From the experimental data the theoretical yields of the investigated radionuclides were calculated as a function of the proton energy. The calculated yield of ^{124}I from the ^{nat}Te(p,xn)^{124}I process over the energy range E_p = 418 MeV amounts to 7 MBq/μA.h. The radionuclidic impurity levels are discussed. Use of ^{nat}Te as target material would not lead to high-purity ^{124}I.

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ASSESSMENT OF CANCER RISK FOR PLUME RELEASE FROM TEHRAN RESEARCH REACTOR

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The released radioactive materials from reactors stack producing the dose to the body. In this study, effects of plume release of Tehran's research reactor stack have been studied using CAP88 computer code. The code CAP88 is the Last Modified version of AIRDOS and approved by United States Environmental Protection Agency (EPA).

CAP88 uses a modified Gaussian plume equation to estimate the average dispersion of plume released from reactor stack. The Gaussian plume model produces results that agree with experimental data as well as any model.

Assessments are done for a circular grid of distances and directions for a radius of up to 80 kilometers around the TRR site. Results of simulation for Tehran research reactor showed that the cancer risk is below the regulatory limit.

Keywords: Cancer risk assessment, CAP88 code, Gaussian plume model, Tehran research reactor.

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RECENT APPROACH FOR URANIUM ISOTOPIC RATIO VERIFICATION OF ORES SOURCE NUCLEAR MATERIAL

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This paper deals with a recent approach for verification of isotopic activity ratio $^{235}U/^{238}U$ in source nuclear materials (ores), based on the γ-lines 185.7 keV of ^{235}U and 186 keV of Ra-226. This work was carried out by HPGe detector with using simple equation to calculate $^{235}U/^{238}U$ ratio in the samples. The results show that the activity ratios are in the range from 0.043% to 0.0497%. All the results are depicted, presented and discussed.

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THEORETICAL CALCULATIONS OF THE REACTION CROSS-SECTIONS FOR PROTON INDUCED REACTIONS ON NATURAL COPPER USING THE ALICE-IPPE CODE

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A theoretical study of the nuclear reaction cross sections for proton induced reactions on each of the Cu isotopes ^{63}Cu and ^{65}Cu have been performed in the proton energy ranges from some threshold values up to 50 MeV. The produced nuclei were different isotopes of ln, Cu, Ni, Co and Mn, some of which have found important applications. The reaction cross section calculations were performed using the ALICE-IPPE code which depends on

the pre-equilibrium compound nucleus model. This code is suitable for the studied energy and isotopic mass ranges. About 14 excitation functions for the different reactions have been constructed from the calculated cross section values. The excitation function curves for the proton reactions with natural copper targets have been constructed from those for enriched targets using the natural abundances of the copper isotopes. Comparisons between the calculated excitation functions with those previously experimentally measured were given whenever experimental values were available. Some statistical parameters were introduced to control the quality of the fitting between both experimental and theoretical calculated cross section values.

Keywords: Natural copper / Excitation function / ALiCE-IPPE / Activation technique / Proton reactions / Cross-sections.

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NUCLEAR MEDIUM EFFECTS ON PRE-EQUILIBRIUM NUCLEON-EMISSION REACTIONS

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In this paper the nucleon emission spectra was calculated statistically using PHASEOTI code using bases of pre-equilibrium reaction model (Hybrid model). The code is modified to incorporate nuclear medium effects and use of empirical value of total nucleon emission cross section. Several models of the in-medium nucleon-nucleon total cross sections are used in the calculation of the neutron emission spectra for proton with energy range $10 \leq E \leq 200$ induced reactions on some nuclei with $26 \leq A \leq 208$. The effects of these modifications on the emission spectra have been studied. The obtained results have been discussed and compared with the available experimental data in the literature. The modified value of the cross section has its own impact on the pre-equilibrium emission spectrum. Such effect increases or decreases the tendency on neutron emission in comparative with proton emission. Results showed that as the mass of the target nucleus increases, the nuclear medium produces lesser influence than it does for

smaller mass nuclei. In general, we obtained a plausible agreement by introducing the in-medium *NN* total cross sections in the emission spectra.

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"TOMOGRAPHY" OF NUCLEAR STRUCTURE IN DISSOCIATION OF RELATIVISTIC NUCLEI

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The use of accelerated nuclei, including radioactive ones, qualitatively diversifies the spectroscopy of cluster systems. Configuration overlap of a fragmenting nucleus with finite cluster states manifested most fully in the dissociation at the periphery of the target nucleus with the excitation transfer near the cluster binding thresholds. The definition of interactions as peripheral ones is simplified at energy above 1A GeV due to the collimation of the incident nucleus fragments. The detection thresholds disappear and the fragment energy loses in detector material are minimal. Thus, qualitatively new opportunities appear in the relativistic region for the study of cluster systems as compared with the low energy region.

Already it is established that final states of relativistic He fragments effectively correlate with the clustering in the nuclei ^{12}C, ^{6}Li, and ^{9}Be. The described approach is used in the BECQUEREL Project [http://becquerel.jinr.ru] to study the light dripline nuclei.

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IMAGING OF NUCLEAR FRAGMENTATION IN NUCLEAR TRACK EMULSION RELATIVISTIC NUCLEI

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The method of nuclear track emulsion provides a uniquely complete observation of multiple fragment systems produced in dissociation of relativistic nuclei. The most valuable events of coherent dissociation of nuclei in narrow jets of light and the lightest nuclei with a net charge as in the initial nucleus, occurring without the production of fragments of the target nuclei and mesons (the so-called "white" stars), comprise a few percent among the observed interactions. The data on this phenomenon are fragmented, and the interpretation is not offered. The dissociation degree of light O, Ne, Mg and Si, and as well as heavy Au, Pb and U nuclei may reach a complete destruction to light and the lightest nuclei and nucleons, resulting

in cluster systems of an unprecedented complexity. Studies with relativistic neutron-deficient nuclei have special advantages due to more complete observations. An extensive collection of macrovideos of such interactions in nuclear track emulsion gathered by the BECQUEREL collaboration is presented [http://becquerel.jinr.ru/movies/movies.html].

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STUDY THE VARIATION OF ALPHA-PARTICLE TRACK DENSITY IN CR-39 AS A FUNCTION OF ETCHING TIME AND TIME EXPOSURE

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The present work results of the measurements of alpha particle tracks in CR-39 at different conditions (etching time from 2-16 h each two hour) and time exposure (from 1-13 h for each one hour) using uranium oxide alpha source and study the change of the sensitivity of CR-39 about the number of tracks registration in etch case after exposure, CR-39 were etched using two type of etching solution NaOH and KOH at 70° C in a water bath. The track density was read in an optical microscope model M6N - 11, and the results show that the etching at times 6, 8 and 10 h and the maximum number of the tack density can be read is (451.67×10^3) and the high sensitivity of the detector are 95% and show that the results as the same when using NaOH or KOH solution in etching process.

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SHELL CORRECTIONS FOR HEAVY AND SUPERHEAVY NUCLEI

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The shell and pairing correction energies are calculated for heavy and superheavy nuclei by means of the Strutinsky's method. The single particle (s.p.) energy levels are obtained from the diagonalization of the Woods-Saxon s.p. Hamiltonian in the deformed harmonic oscillator basis for both

neutrons and protons. The residual pairing interaction is calculated by means of the usual Bardeen-Cooper-Schrieffer (BCS) approximation. A two-dimensional deformation space describing axially and reflection-symmetric shapes of nuclei has been used. Based on the shell and pairing correction energies, the signatures of the magic numbers appear at the spherical shell closures Z = 82, 114; N = 126 and 184. There are also signatures for some other shell closures at, e.g., Z = 108 and N = 162 which appear only when the deformation degrees of freedom is taken into account .

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COULOMB BARRIER PARAMETERS FOR DEFORMED NUCLEI DERIVED FROM DOUBLE-FOLDING MODEL AND PROXIMITY APPROACH

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In the present paper we discuss the differences between the fusion barrier parameters (the height of Coulomb barrier VB and its radius RB) computed by two methods namely; the proximity and double folding models. We found that, for the interaction systems $^{48}Ar+^{238}Pu$, $^{150}Nd+^{150}Nd$ and $^{86}Kr+^{180}Hf$, the approach produces too strong dependence of both VB and RB.

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Notes

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